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Facilitating Digital Trade for Inclusive Growth
Key Issues in Promoting Digital Trade in APEC

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1. INTRODUCTION

The internet and digital revolution, like the industrial revolution, has radically changed the world. It has spurred many innovations that have made life easier for many. New businesses have emerged that in some cases have displaced traditional ones or have made them more competitive in the global environment. Many businesses enter and (often) succeed in the marketplace without the need for huge capital unlike in the past. Anybody who is willing to pay can get almost any product they want from anywhere in the world almost instantaneously. People unhinged from the formal economy became empowered with access to finance and enabled to sell to a larger market. Still more innovations built on the internet are in the offing awaiting large scale deployment that can exacerbate business disruptions for better or worse for different types of businesses and people.

Without being exhaustive, this paper surveys some of the key issues in the digital economy. The topic is still relatively new and understanding the internet ecosystem that supports it requires a deeper dive that, unfortunately, entails more time and resources. Nevertheless, the paper attempts to highlight emerging policy issues which can undermine the usefulness of the internet and set back its growth, and hence warrant attention especially from APEC policymakers. The paper also discusses the opportunities and challenges that digital trade presents, as well as the enablers of growth of the digital economy. These enablers, ultimately, can be summarized in one: infrastructure, which can be physical, human, and regulatory. The interplay of the three is useful for economies, especially developing ones, which aspire to take advantage of the economic promises from the digital revolution.

The paper is organized as follows. Section 2 lays out an understanding of the internet value chain, providing a useful taxonomy of the different business models which the internet supports. Where does the 'sharing economy' or social networks fit in? How do payment systems support e-commerce? What is the role of the telecommunications provider? These questions are answered by looking at the internet with a value chain perspective. Section 3 presents the opportunities and challenges in digital trade. The opportunities are well-known and the chosen examples do not do justice to a whole gamut of internet applications that have helped millions of businesses and people. At the same time, the free and open internet has spurred concerns over personal privacy, personal and public security, jobs displacement, as well as increasing dominance of certain technology firms even as the industry remains contestable. Section 4 tackles the enablers of growth in digital trade including physical infrastructure, regulations, and skilled human resources. The last section, Section 5 shifts discussion to the international trade rules that govern e-commerce, starting from the limitations in multilateral trade rules affecting e-commerce and trade in 'new services' to emerging trade rules in preferential trade agreements.

2. UNDERSTANDING THE DIGITAL MARKET

Alibaba, Airbnb, Disney, Google, Facebook, Microsoft, Netflix, Rakuten, Samsung, Sony, Tencent, Twitter, Uber, and others – how do all these diverse businesses fit into the digital economy picture? One way to begin to understand the taxonomy of the different businesses underpinned by the internet is to examine them from a value chain perspective.

2.1 THE INTERNET VALUE CHAIN

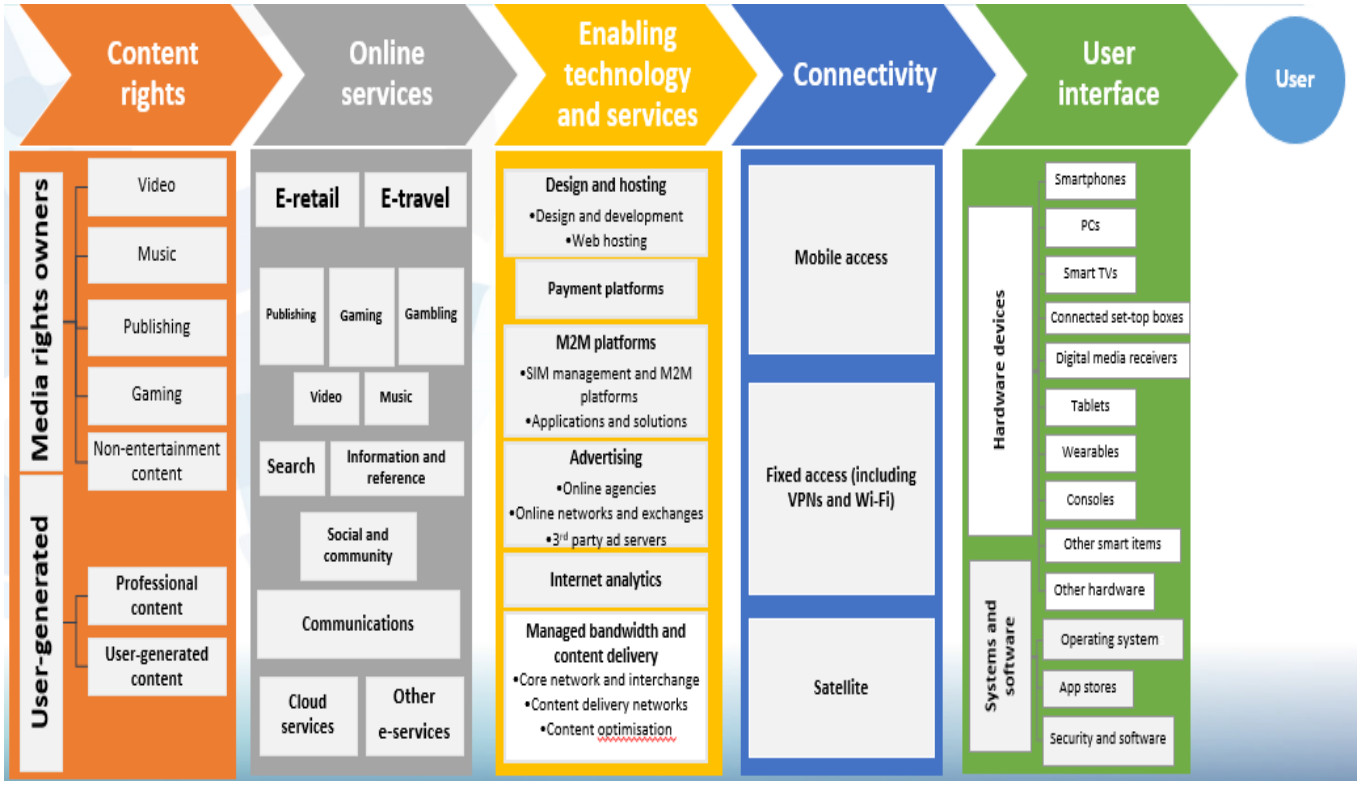
The internet ecosystem is complex and involves multiple activities and players. From one end of the spectrum are the users, at the other end are the content creators. In between are various algorithms, applications and connectivity infrastructure that allow content to reach end-users. AT Kearney (2010) broke down the internet value chain into five main segments: 1) creation of content rights, 2) online services, 3) enabling technology-services, 4) connectivity, and 5) user interface (see Figure 1).[1] This paper uses the AT Kearney model as a framework to describe the internet value chain.

Content Rights

This segment covers the rights for distribution of digital content such as eBooks, music, videos/films, games, as well as non-entertainment content. Big television and film studios, for example, BBC, Disney, Bloomberg, Time-Warner, as well as music recording companies dominate the global digital entertainment content but local companies like Lazada[2] likewise dominate respective home markets for digital content. In addition, start-ups as well as individuals also contribute in generating content for the internet. Professional content creation, blogs, and other internet postings – all user-generated – have become part of the democratization of internet content. For example, every tweet or Instagram picture shared on social media, every video uploaded on Facebook or YouTube, and every time someone updates his or her blog, digital content is created. Much user-generated content is accessed for free, while premium content by media companies is provided on license.

[1] The subsequent discussion of internet value chain draws heavily from GSMA/AT Kearney (2016) and AT Kearney (2010) and follows their categorization of internet businesses.
[2] Lazada is a popular e-commerce platform in Southeast Asia.

Figure 1. The Internet Value Chain



Source: AT Kearney (2010).

Online Services

Online services cover much of what most consumers see as the actual internet as they interact with internet services as websites or email software or search engines every day. Online services have five main clusters.

1. E-commerce

E-commerce is divided into e-retail and e-travel. **E-retail** includes all companies that sell goods and services online either to consumers (B2C) or businesses (B2B). For many, e-retail is more commonly known as 'e-commerce'. Any service where a sales transaction can be made online is included, even if the payment or fulfilment takes place offline. Well known e-retail companies include Amazon, eBay and Alibaba, but local retail websites, including those of department and retail stores, are included in this cluster. This category also includes social buying services including Groupon and Meituan in China and Carousell in Singapore. Dedicated B2B retail exchanges are also part of the category.

E-travel covers websites or applications that are dedicated to travel. The site can be focused on travel reviews, trip fares, hotels or a combination of offerings related to travel. Notable examples include online booking and travel agency services, for instance, Expedia, Agoda and Kayak, as well as newer online ride-hailing or ride-sharing services such as Uber, Didi and Grab, and other sharing economy sites such as Airbnb, as well as airline webpages. Thus, under

the typology of internet businesses used in this paper, the sharing economy is a category of e-commerce.

2. Entertainment

The internet provides a new and enhanced distribution channel for services that would have also been enjoyed offline. Internet-based services enable a broader choice of video, music, and gaming services, together with instant availability that was not previously possible pre-internet. The entertainment online services can be divided into five groups: publishing, gaming, gambling, video, and music.

Publishing: Though printed books still dominate publishing sales, digitally delivered content is increasingly important to the book publishing industry. E-books are expected to eventually surpass sales of printed consumer books (excluding professional and educational books) by as early as 2018 in the US and the UK (PwC 2015). Electronic consumer books, in particular, will see strongest sales growth in economies with high tablet penetration, for instance the United States (US), Singapore and Korea. A factor in online publishing's success is the rich experience of multimedia content, with embedded video, links to supporting materials, and other valuable features.

Gaming: Internet-based delivery of game content has grown across the video game industry. It has also given rise to internet-oriented games, such as those played on social networks, mobile applications (apps) for portable devices, and other games where communicating with and playing against other users is a central feature of the game (USITC 2014). This category includes platform-based video gaming with an internet connection (for instance, Xbox Live), casual online games (such as Candy Crush), and massive multiplayer online games (such as World of Warcraft) that use the internet to connect thousands of users around the world simultaneously in a single game (GSMA/AT Kearney 2016).

Gambling: Online gambling is a segment that continues to grow, despite restrictions in some economies.[3] As well as a new channel for the traditional bookmakers, the internet has enabled a new form of gambling with exchange platforms allowing customers to offer odds as well as place bets with one another. Betfair is an example of such a platform.

Video: Online videos are increasingly popular because people, especially young ones, want to watch their favorite shows anytime, anywhere and on any device. The 'linear' viewing of a succession of programs chosen by a television station is gradually reserved for the older generations (Accenture 2015). As a result, business models are shifting rapidly to capture value through these new channels.

These services are essentially platforms to host and distribute video content – a well-known example is YouTube - although players, such as Netflix, and even YouTube, are now investing

[3] For example, see *US – Gambling* dispute settlement case in the WTO.

to generate their own content. Videos are often accessed on the website or else streamed, either for free, pay-per-view or by subscription. In addition, this category includes the sale and rental of digital video content.

Music: The internet has disrupted the global music industry because instead of buying and owning records, the internet allows more people to purchase music by downloading or streaming music to their smartphones or computers. The increasing ubiquity of internet access and the improved reliability and quality of connections facilitated the buy-and-download consumer preference.

3. Search, information, and reference services

Search: Web search engines such as Yahoo, Google, or Safari are the world's digital entryway for consumers and businesses. They let users navigate the internet by organizing and making searchable content such as web sites, images, or other digital files. Search engines are intermediaries in the sense that they connect users with third-party content, as opposed to hosting the content themselves or making decisions to disseminate the content (OECD 2010). These services are almost entirely advertising funded, although some also derive commercial revenues from providing similar services to private companies to search their own internal information systems (GSMA/AT Kearney 2016).

Information and Reference Services: Google Maps and Wikipedia are quintessential examples of this category. These services are typically funded by donations or advertising revenues.

4. Social, community, and communications

Social and community services: Social networking sites have become very popular as their functions expand from merely social use to become integrated with content providers, becoming a venue for discovering and sharing music and video content, as well as a platform for playing games. Their roles in businesses have grown alongside its popularity surge. Although the distinctions among them are blurring, they include casual networks such as Facebook and Google+, professional networks such as LinkedIn, traditional blogging networks such as Blogger and WordPress, and microblogging networks such as Tumblr and Twitter.

Communication services: Internet-based communication services are becoming a popular choice for direct communications, replacing phone calls and text messages offered by the traditional telecoms companies (GSMA/AT Kearney, 2016). Prominent examples include internet protocol-based services including WhatsApp,[4] WeChat and Skype, which use the internet to send text messages, documents, images, video, user location and audio messages to other users using standard cellular mobile numbers. The fast users' uptake of these services is due to the fact that they are free and convenient which also means that this segment, to date,

[4] As of January 2017, WhatsApp had a user base of 1.2 billion, making it the most popular messaging application. See https://www.statista.com/statistics/260819/number-of-monthly-active-whatsapp-users/ accessed 4 April 2017

generates a lot less revenue compared to other online services. Advertising revenues help support the business as well as the sale of data generated by users.

5. Cloud and other e-services

Cloud services: Cloud computing are networks of data centers that use the internet to supply all kinds of services, from e-mail and social networks to data storage and analysis. It is a model for enabling ubiquitous, on-demand access to a shared pool of configurable computing resources (for example, networks, servers, applications and services) (NIST 2011). Compared with older IT systems, cloud computing is often much cheaper. It adds tremendous flexibility: firms that need more computing capacity no longer have to spend huge capital adding new servers and installing and maintaining software. In the cloud, they can get hold of it in minutes. Their applications can be updated continually, rather than just every few months. Individual users can reach their e-mails, files, and photos from any device. And cloud services also tend to be more secure, since providers often have better resources than their customers to protect their computing systems against hackers (The Economist 2015).

Other e-services: Other online services, including user-paid services such as e-learning, e-brokerage, paid apps, and advertising-based web services and apps belong to this category. It also includes the front end (that is, web design and user interface) of various 'internet of things' services (GSMA/AT Kearney 2016). For example, massive open online courses (MOOCs) attract millions of students around the world by providing quality education that is digitally delivered.

Enabling Technology/Services

For business sustainability, online services rely on the availability and efficiency of enabling technology and services. This third segment of the internet value chain can be divided into three groups: support technology, billing and payments, and advertising services.

1. Support technology

The enabling technologies and services cover the essential tools for the efficient operation of the overall internet infrastructure and the websites, platforms, and services that use it, but they are not generally visible to the user. These include basic website design/development and hosting; bandwidth management and content delivery; and machine-to-machine (M2M) platforms.

Web design, hosting, development: These services help users build basic websites, provide design and development services.

Content delivery network: This service has increasingly become important as large data volume demand (e.g. for video) in the internet grew. The service stores data from content providers and

prioritizes and manages the traffic as it connects and distributes content to end-users of broadband internet service providers (ISP) (Greenstein, Peitz and Valleti 2016). Arguably, this is part of the connectivity segment of the internet value chain rather than a support technology, because content delivery networks (CDNs) operate and maintain infrastructure (servers) located close to the broadband ISP users. Examples of third party CDN companies are Akamai Technologies and Limelight, but more recently internet backbone providers are also entering the CDN market by connecting content providers directly with broadband service providers. Other CDN competitors include data hosting service providers. Box 1 gives a typical structure of internet connections and terminologies that are widely used in the internet market.

Box 1. Internet Traffic: Basic Architecture and Terminology

Data traffic movement

How do content providers move data over the internet? One way is to move data from content provider over a 'backbone service provider' and then to local broadband data carriers. Here, the challenge is the point of interconnection. A second way is to move traffic to content delivery network (CDN) service providers that usually locate servers close to the users of broadband internet service providers (ISP). CDNs store the content on their servers and prioritize the delivery of the data to the 'last mile' service provider. A third way is where content providers co-locate their own servers inside the local ISP network. Content providers with large volumes of data usually choose this last option.

Kinds of data

While electronic mail dominated the traffic on the internet in the early 1990s and peer-to-peer traffic in the middle of 2000s, streaming traffic for video applications makes up the largest share of traffic in recent years. With electronic mail, the direction of traffic was symmetrical, i.e., from all locations to all locations; with video streaming, the traffic is unidirectional – from content providers to users. This unidirectional traffic is a source of conflict – particularly on revenue sharing – between network infrastructure (traffic recipient) and media content providers (source).

One- and two-sided pricing and net neutrality

In the three ways of data delivery above, who pays what to whom? Broadband ISPs or mobile broadband providers may charge a subscription fee only to end-users, and regulatory restrictions may rule out charging a fee to content providers. This arrangement called one-sided pricing leads to an active content creation sector. Treating all (legal) content the same in the one-sided pricing model is the essence of net neutrality. In a two-sided pricing market, the ISP charges end-users a subscription fee and content providers a termination fee (a fee for delivering their content). The termination fee may help reduce subscription fees of users but by how much is an empirical question. It can also induce the exit of some content providers who cannot pay the termination fee. From a broader policy standpoint, the net neutrality policy which had facilitated the growth of many online services, is being debated in some quarters because of the exponential growth in demand for high volume bandwidth consuming data like videos. Those opposed to net neutrality argue that underinvestment in internet infrastructure can result due to an ISP's inability to extract some of the rents that content providers enjoy.

Source: Greenstein, Peitz, and Valleti (2016).

Machine-to-machine (M2M) platforms: M2M refers to direct communication between devices using any communications channel, including wired and wireless. It can include industrial instrumentation, enabling a sensor or meter to communicate the data it records (such as temperature and inventory level) to application software that can use it.

2. Advertising

Advertising is an important segment supporting many free services and content on the internet. The players in this segment are advertising agencies, dedicated online advertising networks and exchanges, third party ad serving providers, and ratings and data analytics (AT Kearney 2010). One potential threat to the segment's growth, however, is ad-blocking services. On this issue, internet companies are taking different positions and approaches. Apple has made ad-blocking a core feature of its operating system to improve its customers' mobile phone experience. Yahoo, on the other hand, prevents access to certain services if ad-blocking software is present (GSMA/AT Kearney 2016).

3. Payment platforms

Paypal and Alipay are examples of payment platforms that provide processing of end-user online payments, acting as extensions of traditional credit card or debit card platforms. More recently, fintechs, technology startups that provide financial services like mobile payments, money transfers, loans, fundraising or asset management, have also entered the payment space. The rapid adoption of smartphones and tablets and the emergence of the 'smart wallet' is leading to a convergence of the offline and online world.

Connectivity

The main players in connectivity are the ISPs, telecommunications network operators, and core network and interchange operators. Core network operators connect service providers to the super-exchanges of internet traffic. Some players in the segment may be integrated with a large telecommunications company, while others are specialized in specific network services. For example, Level 3 is a company that specializes in backbone services provision; others are solely access providers or ISPs.

User Interface

The final segment of the value chain is the most tangible for end users and includes the devices, systems, and software they use to access the internet and the services in other segments (GSMA/AT Kearney 2016). It is broadly divided into the hardware segment and software or applications segment. Hardware consists of personal computers, laptops, mobile phone and tablets, smart TVs, and more recently, certain wearable technology (wearables, for example, smart watches and fitness trackers). Software includes operating systems, apps and security software. In some cases, the same manufacturer is responsible for producing both the devices and the software they contain as in the case, for instance, of Apple which has both the hardware

and its own proprietary operating systems. In most cases, however, device manufacturers incorporate a customized version of an open operating system developed by others, such as devices running on the Android system by Google, or computers running on Microsoft software.

The strongest growth is expected to come from wearables and other smart items. The internet of things (IoT) is predicted to play a fundamental role in economic and social development and it could soon be as commonplace as electricity in the everyday lives of people in developed economies (OECD 2016). Technology research group Gartner predicts that there will be 20.8 billion IoT devices in use by 2020 (Gartner 2015).

2.2 SCOPING THE DIGITAL MARKET

The rapid evolution of internet technologies and the ways they are used make it difficult to establish a standard definition of digital trade. Different organizations or governments capture different parts of the internet with terms such as 'e-commerce', 'internet economy' or 'information economy'.[5] The internet value chain discussed above precludes the equation of digital trade with e-commerce because the latter, under the above categorization, constitutes a narrower scope of internet transactions. There are definitely more types of businesses in the internet other than e-commerce.[6]

Moreover, there are digital products which, because of their size, may not use the internet in the exchange. For example, most 3D printing designs will likely not use the public internet but instead use private networks for greater intellectual property (IP) protection. They may also be transferred via disks or any external hard drives. Hence the digital market is bigger than the internet market because it includes digital products that may not use the internet in the process of exchange.

This paper ventures to include in digital trade all segments of the internet value chain except the connectivity segment and the hardware group of the user interface segment.[7] One may,

[5] UNCTAD defines e-commerce as 'purchases and sales conducted over computer networks, using multiple formats and devices, including the web and electronic data interchange, using personal computers, laptops, tablets and mobile phones of varying levels of sophistication'. E-commerce may involve physical goods as well as intangible (digital) products and services that can be delivered digitally (UNCTAD 2015).

[6] In the remaining part of the paper, 'e-commerce' is at times used interchangeably with 'digital trade'. In those cases, for the purpose of the paper, e-commerce is taken to mean business exchanges that take place via the internet, not just e-retail or e-travel businesses as in Figure 1. In discussions on trade agreements, the paper uses 'e-commerce' because the trade agreements explicitly refer to the term.

[7] Recent free trade agreements (FTAs) have defined the term 'digital product'. For example, the US–Chile FTA defines it as 'computer programs, text, video, images, sound recordings, and other products that are digitally encoded and transmitted electronically'. Notably, in succeeding treaties (e.g. US–Singapore, US–Australia, and Korea–Singapore), the term is expanded to include digitally-encoded products that are fixed on physical carriers. Ultimately, the definition and scope of digital trade or trade in digital products in APEC, as suggested by one economy, is going to be a result of negotiation, based on economies' experiences and the evolution of technology. Currently, there is no generally accepted industry definition of digital trade used by people and firms in the industry.

arguably, also exclude the content distribution network (CDN) in the sense that this has closer semblance to infrastructure (that is, servers and their location) and thus to the connectivity segment. On the other hand, CDN provides a service – for example, routing, delivery and prioritization – which are much like the other categories in the various segments, thus can be characterized as an infrastructure-as-a-service business.

Value Chain Segment Interdependencies and Market Characteristics

The different segments in the internet value chain are highly interdependent so that major players are present across several or all segments. Facebook, for example, is into content provision as well as various online services such as social and community, communications, entertainment (video, games), and retail. It is also into data analytics, payments, and web hosting. It purchased a connectivity business (satellite) and is now also into user interface such as wearables and other smart items like drones and 360-degree cameras. Google, too, is all across the internet value chain, with its YouTube channels competing with media companies and Netflix in content creation. It is, of course, the biggest search engine, a big player in cloud services and also into support technology (data analytics and data hosting). It is positioning itself for the explosion of the IoT with the purchase of Nest (producer of Nest Learning Thermostat and smart smoke detector). In China, Baidu acquired a television and advertising service provider, thus venturing into other internet segments. In addition, there are trends toward the purchase of innovative start-ups and technology small and medium enterprises (SMEs) by larger established companies as a way of expanding their business presence across the entire value chain.

Table 1 summarizes some salient market characteristics of segments of the value chain. In e-retail, while Amazon, e-Bay or Alibaba may be recognizable e-commerce platforms, in fact, the market is not concentrated because local online stores and sites compete effectively with large global players because of their geographic proximity to customers. For example, in Southeast Asia, until Amazon has a local presence in the domestic market, it is easier and cheaper to buy or order online from local or regional online retail platforms like Lazada or Carousell, as well as from local department stores that have online channels. The concentrated market segments are those that exhibit powerful network effects such as social and community and search segments, or those with strong and globally recognized brands (especially for video and music), or the segment with a high entry barrier such as the hardware category of user interface. Acquisitions of start-ups and competitors are also contributing to the increasing concentration in the gaming category.

Table 1. Market Characteristics of Selected Segments of the Internet Value Chain

Category	Characteristics	Notes
E-retail	Fragmented	Local retailers with own online sales have majority share of national market
Social and community, search	Very concentrated	Powerful network effects
Video and music	Concentrated	Small numbers of players with global scale and strong brands are able to monetize online content
Online video	Competitive	Big operators (e.g., Netflix) are expanding globally, but local online video players are following its model capitalizing on local knowledge and language. Content owners are also competing by bypassing third party platforms and providing streaming/subscription video on demand
Gaming	Increasing concentration	Due to acquisition of competitors
Connectivity	Globally fragmented; locally very concentrated	IP-based communication however it is concentrated e.g., WhatsApp
User interface	Concentrated	High barrier to entry (especially hardware)

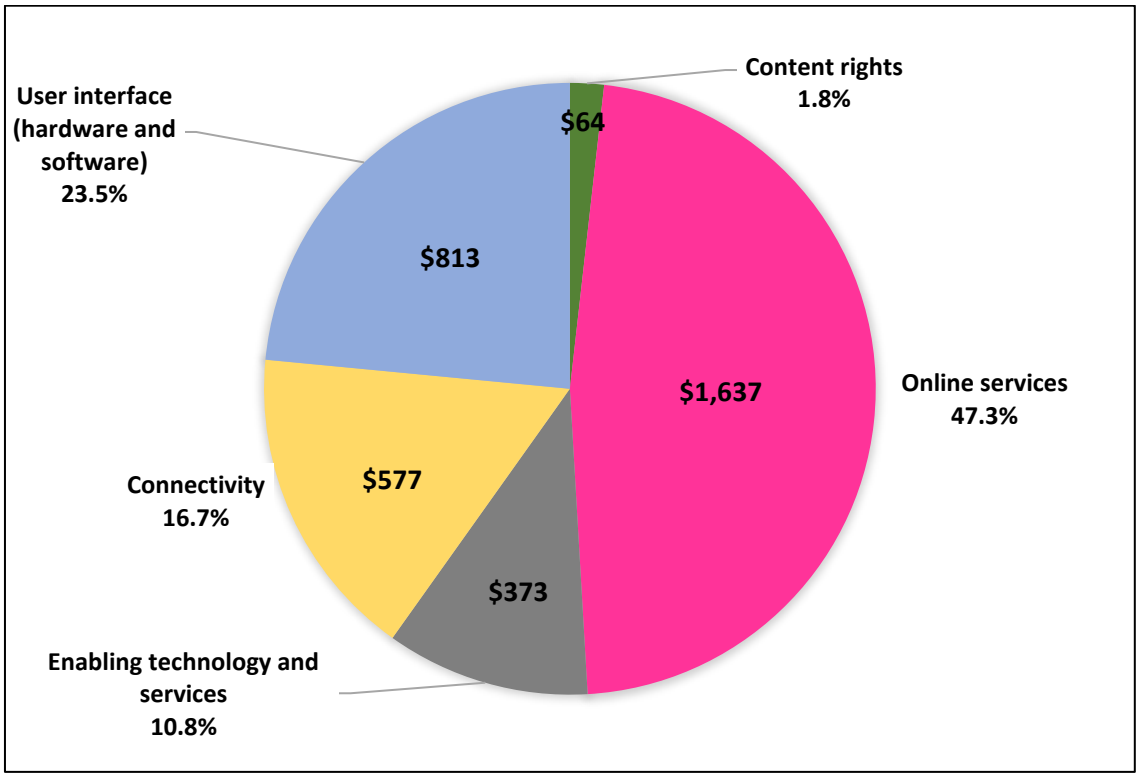
Sources: Authors, GSMA/AT Kearney (2016).

Market Size and Trends

Of the various segments in the value chain, online services have the largest share of the total market. Figure 2 shows that in 2015, online services had sales of USD 1.6 trillion, or close to 50 percent of the total internet value chain business, of which, 66 percent is from e-retail and e-travel. In second place is the segment on user interface (hardware, wearables and software) with close to a 25 percent share, and the rest is divided among the other three segments. The total estimated size of the entire market is USD 3.5 trillion, or 4.7 percent of world gross product.[8]

[8] These estimates were derived by counting the proportion of spending attributable to internet provision of a product or service, for example the commission earned (not the entire value of the product sold) by online platforms for e-retail. It is also based on various brokers' reports and financial statements, where available (GSMA/AT Kearney 2016).

Figure 2. Market Size by Segment and Category, 2015
(USD billion; % of total market)



Source: GSMA/AT Kearney (2016).

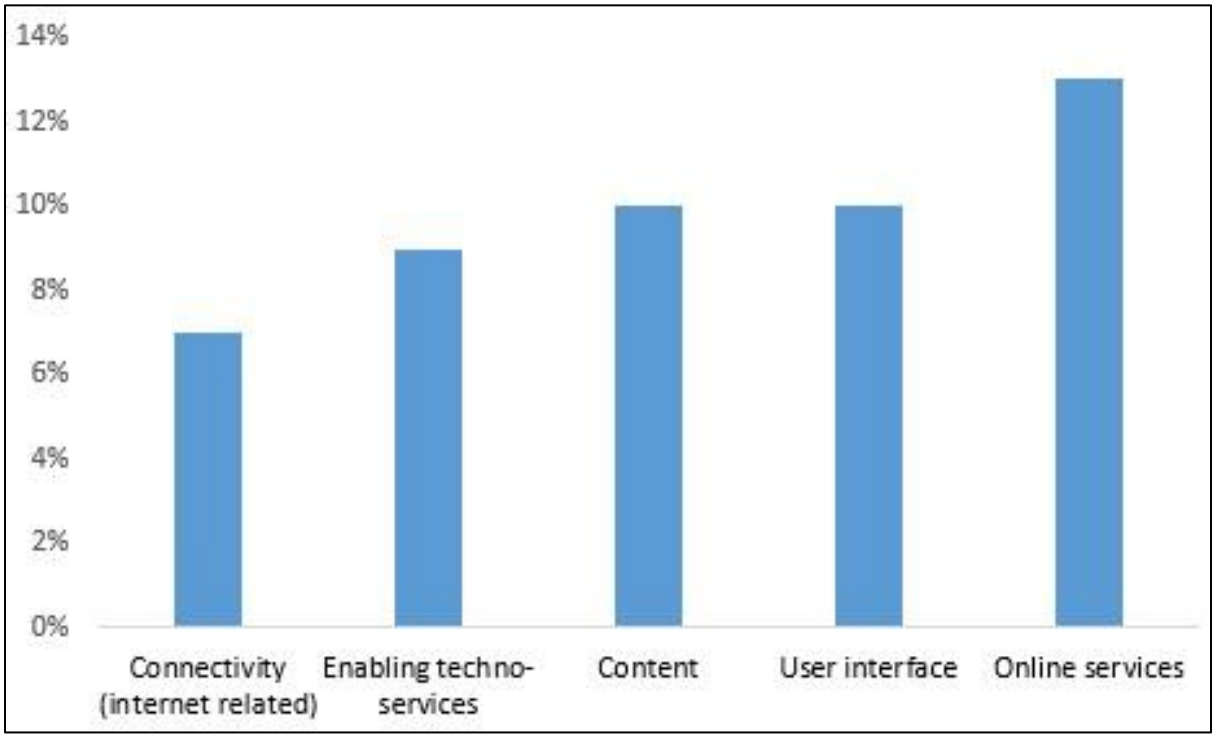
In terms of growth, as users spend more time online, the proportion of economic activities shifting online is also rising. For example, in 2008, global music online revenue was less than 10 percent; in 2015 it rose close to 20 percent. Gaming and gambling share grew from 4 percent to 23 percent. The same increasing trend is also observed for other products like advertising, publishing, video and retail. Online advertising, in particular, tripled its share from 5 percent to 15 percent between 2008 and 2015 as the various online advertising channels (including search, display ads, video advertising and in-app advertising) have increased in sophistication and become mainstream.

With increasing internet use, the entire digital market is expected to grow at 11 percent over the next 5 years to 2020 with online services expected to expand the fastest with 13 percent growth, followed by user interface and content at 10 percent. Connectivity will likewise grow as a result of the overall demand and growth of the internet but with the lowest rate of 7 percent (Figure 3). This is partly due to the fact that net neutrality restriction has restrained network operators from taking some of the gains enjoyed by the other segments, particularly online services. [9] Such unrealized potential gains by connectivity providers may have future

[9] There is an active debate in the literature on the welfare implications of net neutrality. Some argue that net neutrality has helped spawn the development of online content and thus the overall usefulness of the internet. Others contend against simplistic declarations in favor or against net neutrality. Indeed, the research question is still open in 'two-sided platforms markets', a setting where market participants have complementary economic relationships and share the costs and benefits of actions (Greenstein, Peitz and Valleti 2016)

implications on network infrastructure investment, and may dampen the future growth of digital trade.

Figure 3. Revenue Forecast, 2015–2020



Source: GSMA/AT Kearney (2016).

3. OPPORTUNITIES AND CHALLENGES IN THE DIGITAL MARKET

The internet and digital revolution has unlocked previously unknown opportunities. It has made the world 'smaller' by allowing people to cheaply communicate with others anywhere in the world. It has allowed access to a wider variety of products, services and information, created many efficiencies (for example, in coordinating supply chains, facilitating traffic flows, reducing search costs), and facilitated the creation of new products that were once thought mere fiction and figment of the imagination (for example, IoT devices and artificial intelligence).

The internet has spawned many new businesses, created wealth for a myriad of entrepreneurs and technology geeks but it has also caused digital disruptions of long-established business models. For example, traditional book store businesses have shrunk with the advent of e-commerce and e-books. The taxi industry is besieged by ride-hailing applications like Uber and Didi (in China) and Grab (in Southeast Asia) even though according to a McKinsey report for every job that the internet destroys, it also helps create 2.6 jobs (MGI 2011).

3.1 OPPORTUNITIES SPAWNED BY THE INTERNET

Digital Trade, Small and Medium-sized Enterprises (SMEs) and Inclusion

Many entrepreneurial business ideas have become realities thanks to the internet. The thousands of mobile applications that are available in app stores are examples of how the internet empowered not only apps developers but also small businesses. Surveys show that SMEs that use the internet for their business grow at a faster rate than those that do not (MGI 2011). Examples of many success stories abound of how these businesses thrived using the internet to do business. Box 2 presents three examples of small businesses that thrived using the internet: a mobile application for buying movie theater tickets that started in Lima and now operates out of 26 markets; a mobile market place based in Singapore started by students who wanted to unload tech gear they no longer needed; and a micro-multinational technology executive search business registered in Sydney comprising five persons operating from four different economies.

The internet expands the market for SME products, provides market intelligence and improves efficiency. Through the internet, enterprising individuals and SMEs can use e-commerce platforms like Amazon or Alibaba as sales channels to facilitate international economic exchange and enter overseas markets.[10]

The internet helps in reducing costs for SMEs. Through cloud technology, SMEs do not have to invest in large assets or bloated overheads and can, instead, rely on a skeletal workforce. They can scale up without the need to invest in additional infrastructure. Security and

[10] Mobile applications for expanding businesses are, today, among the most popular digital trend. For example, '91APP', a mobile business entrepreneur app launched in Chinese Taipei, allows SMEs to easily launch a mobile store which can be accessed from anywhere.

protection of data are also better handled using advanced cloud technology without having to hire a technology or data security expert.

Besides helping SMEs, the internet also facilitates the inclusion of the elderly, helping them remain active in their communities, not to become isolated and to continue to develop social networks. This, however, depends on whether the elderly have access to the internet and telecommunications as well as on their willingness to learn how to use it.

Digital trade also benefits people to have control over their own time or not to be confined to a specific location. This is especially important for women who often shoulder the primary responsibility of family care. Digital technologies empower caregivers to stay at home and work from home.[11]

Digital democracy is another benefit from the internet. In many economies, anybody can make themselves heard on any political and social issue. The days when institutional media monopolized the dissemination of information are over. From Facebook to blogs to Twitter to YouTube, citizens can engage in the democratic process at all levels – from community or district levels to national or even international audiences.

Economic Efficiency and Services Transformation

Global supply chains operate efficiently because of modern internet communications and services. Products like airplanes or cars require hundreds of components sourced from scores of locations, underpinned by internet-based efficient systems of real-time monitoring of schedules, inventories, quality control and product standards. Post-sales, companies can remotely monitor the performance of its products for maintenance purposes and future product modifications.[12]

Scientists from developing economies do not need to migrate to developed economies to participate in important research. The internet facilitates networked labor or virtual teams that enable the skills available globally to be tapped. It helps minimize the relocation cost of international experts when they can collaborate through digital means with local counterparts.

[11] This perhaps partly explains the rising number of women staying at home compared to the number in the 1990s. See Pew Research Center (2014) on the rise of stay-at-home mothers.
[12] See Low and Pasadilla (2016) for case studies on how large multinationals use internet services in their value chain operations.

Box 2. Small and medium-sized enterprises (SMEs) and the Internet

Below are three examples of small businesses in APEC that have thrived through the internet.

Cinepapaya (Peru)

Cinepapaya is a mobile app developed in Peru that uses geo-location to allow users to find movie theaters nearby, check prices of movie tickets across theaters, buy cinema tickets online, access exact show times and upcoming releases and other information. An important milestone for Cinepapaya was when it was one of the winners in the Intel APEC Challenge in Chinese Taipei in 2013. Since then, Cinepapaya has expanded its service and now serves users in 29 economies, including 7 in APEC. Currently, it generates USD 2.5 million in ticket sales every month.

Carousell (Singapore)

Carousell is a peer-to-peer (P2P) mobile marketplace that started in 2012 in Singapore. It was founded by three students who wanted to sell superfluous gadgets they had purchased from Amazon. After trying to sell on eBay and Yahoo auctions, they decided that a mobile platform for buying and selling things would be more convenient. From an idea, it became a start-up that eventually attracted capital from global investors including Rakuten (e-commerce Japan) and Sequoia Capital, the firm that supported the start-ups Google and Apple. The mobile platform is like a neighborhood bazaar or garage sale, allowing users to sell products they do not need or buy items they want at bargain prices. Today, Carousell is the number one lifestyle application in Singapore with 26 million listings. It has a commercial presence in Malaysia, Indonesia, and Chinese Taipei.

Franklin Phillips (Australia)

An executive search and consulting firm, Franklin Phillips finds technology executives to head up regional operations or headquarters within the Asia–Pacific region. To be competitive, top firms need top talent for continued success but Franklin Phillips faces visa challenges to move executives from one economy to another which, it says, could constrain companies' growth. Though it deals with the movers and shakers in the technology field, Franklin Phillips is a multinational team of five persons with 'operations' that are located in different economies. The CEO and her co-founder work from home in Sydney, Australia; their executive assistant works from the south of Manila, the Philippines; their head analyst does her job from home in Pune, India; and a project manager works from the beach in Thailand. Staff operate with differing internet speeds ranging from 8 megabytes to 100 megabytes per second. They all share a virtual office using cloud technology where they access office files from wherever they are located.

Source: Authors' compilation.

The adoption of digital technologies in the public sector has also transformed government services. Health and education services, for example, can reach more remote villages with the help of technology. Even simple government services, such as access to birth certificates records or granting licenses or collecting taxes, are more efficiently provided with the use of the internet. Box 3 provides corporate examples of efficiency gains from using digital technology.

Box 3. Examples of Data-driven Innovations

3D Printing

3D printing is a technology that builds physical objects directly from 3D computer-aided design data and adds different materials, layer-by-layer, with the help of a 3D printer. Nuts and bolts, cars, shoes, meat, body parts and many others can now be 3D printed. Originally used by companies for prototyping, the technology is increasingly being deployed for more commercial applications in a larger number of sectors. Its use can lead to more nearshoring of production, potentially reversing the offshoring trends in the last century.

Remote Monitoring of Machines

Hitachi Construction Machinery, Co. Ltd, collects real-time information on its construction machines sold all over the world. As well as helping modify its own products, the analysis of the machines' performance data also aids productivity, signals timely maintenance interventions that help reduce repair costs and minimize work accidents.

Offsite Support for Strawberry Farming

NEC Corporation supports greenhouse strawberry cultivation in India. Local cultivators send information on the greenhouse environment (humidity, temperature, solar insulation, acidity levels in the soil or water, among others). Cultivation experts analyze the data and provide recommendations and advice to the local workforce, enhancing productivity and increasing harvest and strawberry quality.

Entertainment Platforms

The collection of information on customer preferences (play status, viewing data and other user-generated content) improves individuals' 'wow' experience of the entertainment product, helps companies refine their product recommendations and sometimes facilitates the creation of an online community of 'like' tastes.

Sources: Kommerskollegium (2016), Yokozawa (2016).

3.2 CHALLENGES IN THE DIGITAL ECONOMY

While the internet has spurred countless innovations and benefits, it has also raised concerns, particularly on the loss of privacy, the lack of security (both personal and on public infrastructure), or the potential displacement of many jobs either through artificial intelligence (AI) or nearshoring and emerging onshoring strategies of multinational firms. The emergence of powerful and dominant technology businesses, the loss of tax revenues due to greater ease in profit shifting especially by multinational technology firms, and increased difficulty in authenticating where the real value originated or was generated (for example, in the case of data collection from one jurisdiction and analytics done in another) are additional reasons for some economies' unease. As a result, the digital economy itself, thus far open and free, faces enormous challenges to maintain the characteristics that enabled all the innovations and benefits in the first place. There are emerging social, technological, commercial or government policy-related developments that can imperil the digital economy's usefulness. Nevertheless, there remains a role for well-designed and legitimate public policy to provide protections for users of the digital economy because such protections can enhance confidence, encourage use and support growth in the digital economy.

Multilayered Challenges to the Internet Ecosystem

To understand the multiple challenges in the digital economy, it is important to understand the multilayered structure of the internet ecosystem. Although organized differently, these layers complement the internet value chain discussed in Section 1. The five layers are infrastructure, logical, application, content, economic and social layers, as well as governance layer that affects the other five. The **infrastructure layer** consists of routers, switches, internet exchanges, transmission facilities including fiber optic cable, cellular systems, internet of things (IoT) structures and systems, and various hardware. The **logical layer** comprised the virtual resources and technical standards, internet protocol (IP) addresses and domain names. Software and apps, voice over internet protocol, and platforms comprise the **applications** layer, while the **content** layer is what is most visible to end-users such as text, web content, books, audio, pictures and videos. Grouped in the **economics and social layer** is the business and economic environment that affect the internet such as investment or tax regimes (CIGI 2016).

Policies, both of governments and commercial entities, affecting each layer have an impact on the digital ecosystem and, in turn, affect the risks and benefits from digital trade. Table 2 groups the different risks and challenges that have emerged according to the affected layers. The challenges go beyond the issues of data localization and include policies related to interoperability, access and inclusion as well as content censorship, intellectual property protection and enforcement, free speech, and cybersecurity. However, while these challenges are representative of policies affecting the digital economy, some may have less relevance to commercial activities than others.

In the infrastructure layer, the risks and challenges include the interoperability of hardware and telecommunication facilities, commitment to multi-stakeholder internet governance arrangements, the risk of cyber-attacks on critical infrastructure and others. The logical layer

challenges include data flow restrictions, encryption standards and the requirement of some governments for certain firms to surrender 'back-door' keys to encryption, lack of understanding of the purpose and outcomes of algorithms, AI or ledger technologies. Censorship, geo-blocking, filtering, unauthorized surveillance and data flows restrictions are among the challenges in the content layer. Additionally, for the internet to attract more people, an increase in relevant local content, for example, in local languages as well as government services, requires a more determined effort and support. Finally, in the economic and social layer, the ease of doing business and investment incentives help attract investments in the sector, but there are investment restrictions in different economies for technology firms. Other challenges include the lack of skilled ICT engineers, increasing digital literacy and inclusion, and how to make access to the internet more affordable. In the light of new business models, for example driverless cars or the sharing economy, the issue of liability attribution is unclear. An additional area of concern, especially for developing economies, is how the nearshoring strategies that are urged by emerging polity in some developed economies and are supported by new technologies would affect the growth trajectories of many developing economies which rely on foreign investment for jobs and growth.[13]

The whole gamut of challenges and risks in the internet and digital ecosystem listed in Table 2 cannot be discussed adequately in one survey paper. A deeper dive into its nature, causes, impact and alternative solutions is required. It could be the topic of public and private sector dialogue on digital trade in APEC.

[13] These types of discussions are the focus of the meetings of the World Economic Forum's Global Future Councils, particularly the Digital Economy and Society group.

Table 2. A Taxonomy of Risks and Challenges

Cyber sovereignty, data nationalism vs. global nature of internet	Economic and Social Layer	Investment restrictions, different tax policies (profit shifting), competition policy, ease of doing business, inadequate approaches to intermediary liability, IP/copyright policies and frameworks, cross-border law enforcement, inadequate protection of children online, cyber-attacks, unclear liability attribution (e.g., in sharing economy, AI), affordability of access, digital literacy in the population, lack of investments in schools/libraries, job losses, lack of investment in ICT education, de-globalization and consequence for growth trajectories of emerging economies
Governance Layer	Content Layer	Censorship, geo-blocking, filtering, privacy, data security, unauthorized and indiscriminate personal data collection and analysis, data flows restrictions, dearth of locally relevant content (language) including government e-services
	Application Layer	System not designed with security and resilience at their core, walled gardens, lack of accountability of vendors for vulnerabilities
Lack of framework to facilitate sharing and reporting of cyber incidents	Logical Layer	Data flow restrictions, compromises on encryption standards, domain name system vulnerabilities, slow deployment of IPv6 (security and privacy features in IoT applications), lack of understanding of the purpose and outcome of algorithms and AI or ledger technologies, handing over source code or encryption back doors, net neutrality
	Infrastructure Layer	Loss of interoperability, lack of openness of protocols and platforms, lack of commitment to distributed, multi-stakeholder internet governance, propensity to systemic risk due to interconnected/dependent systems and applications, cyber-attacks on critical infrastructure, localization requirement, carbon footprint of data centers

AI = artificial intelligence, ICT = information and communications technology, IP = intellectual property, IPv6 = internet protocol version 6, IoT = internet of things.
Source: Authors' compilation based on CIGI (2016) and discussions at the World Economic Forum's Global Future Council for Digital Economy and Society, Dubai, November 2016.

Data Privacy and Security

Along with the benefits, the digital economy may also cast a threat to data privacy and security, which concerns governments and their citizens. This partly explains the increasing number of governments that have adopted laws on privacy and cyber security to help protect the internet ecosystem and to safeguard domestic security and individual privacy (Figure 4). However, it also stirs questions as to the extent of government regulation, for some government measures not only raise business costs but also threaten to impede the growth of digital businesses. Whether some of the policy responses go beyond legitimate public policy goals needs to be

discussed and a balance should be made between protecting privacy and security as well as facilitating digital businesses.

Challenges related to cross-border data flows are critical for many of the services in the internet (Box 4). The issues that come to the fore with data flows concern privacy, data security, the increasing power of government surveillance, and also a new form of protectionist policy which relies on the view that having data centers is necessary to partake of the competitive opportunities from the internet.

Box 4. Data Flows and the Internet Value Chain

Data flows underpin digital services. In some segments such as advertising, data themselves, are at times, the 'products' that are traded. In most segments and categories, data are not the product but are an important component of the digital business model. In entertainment platforms, for example, data collection helps improve individual user experiences. In applications such as maps and traffic information services, real time information of individual locations is a crucial input. E-commerce requires personal data of the buyer and seller for the validity of the economic exchange. The purchase of any digital service, whether cloud service or music or videos or others, requires the provision of personal information. Multinational corporations also use data of their employees all over the world to match skills and deploy them where needed. Even for the monitoring of global value chains, data of names of employees who were in a particular warehouse at a particular time, for example, are invariably necessary.

Will digital trade be possible without data flows? Some say no. For example, Kommerskollegium (2014) argues that international trade, even of physical goods, would be virtually impossible without cross-border data flows. Now, physical products are sold abroad 'encased with a digital wrapper service' (MGI 2014) that includes information about the product, the importer, the exporter, and other pertinent information necessary for tracking purposes.

Government measures can impose huge compliance costs, partly due to the difficulty in interpreting privacy laws. For example, implementing an apparently benign requirement to obtain consent from data subjects to transfer data cross-border can become arduous for AI technologies. Ahmed and Chander (2015) ask 'Will a self-driving car need the consent of every other inhabitant of a vehicle it encounters if the self-driving car processes information about road conditions remotely?' The requirement to store data locally, imposes additional significant costs that may be superfluous if companies already have existing data centers elsewhere with excess capacity. According to Chander and Le (2014), establishing data centers to house data in Brazil costs USD 60.9 million, in Chile USD 51.2 million and in the USD 43 million on average. Another cost is in terms of lost efficiencies. For example, aggregation of data from all

over the world, say, of clinical trials, increases the data information's accuracy and predictive use for different races and age groups, among others. Another lost efficiency comes from the inability of SMEs to access state-of-the-art productivity tools for their businesses, if left with no other choice but to work only with local cloud service providers due to data restrictions.

Notwithstanding the cost to businesses, some economies argue that effective enforcement of domestic laws should be given priority. To some, the difficulty and complexity of ensuring domestic compliance from overseas data centers and of ensuring that data operators bear the liability of any misuse of information justify the imposition of localization rules. For example, if international communication cables are damaged by natural disasters, wars, or other causes, some economies hold that localization requirements reduce the risk of business losses, or even economic paralysis.[14]

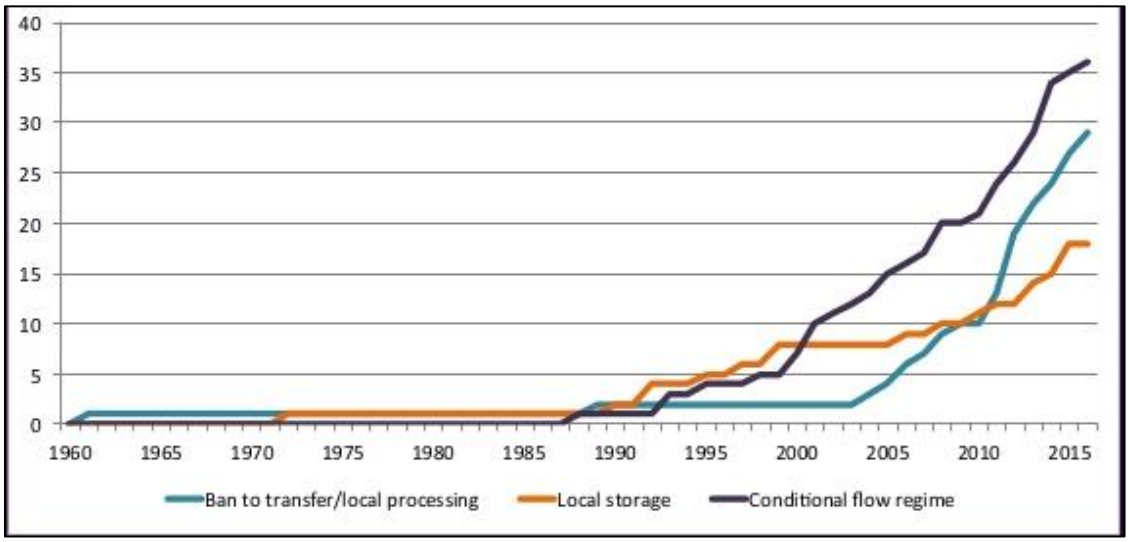
Current and Emerging Regulations in Cross-border Data Flows

Data flow policies can take a variety of forms and stringencies. The mildest is putting conditions on data transfer such as consumer consent requirement. Other policies require local data storage even though data could still be sent offshore for processing. The most stringent is the complete prohibition of cross-border flows of personal data, which means that the storage and processing could only be done within the territory. In the latter two, the result is that firms are forced to establish local data centers to store information which are deemed 'sensitive' by the economy. The scope of such sensitive data varies per economy; some consider only national security information while others consider personal information as sensitive. However, the additional cost needed to establish data centers is becoming an entry barrier for firms and ultimately affects the capacity of domestic firms, especially SMEs, to engage actively in digital trade.

Figure 4 shows the increasing number of policies globally that restrict cross-border data flows. Since the 1980s, consumer privacy regimes have required conditions, that is, the data subject's consent, for transferring consumer information. But more recent laws have become increasingly stringent. The steep rise in the number of data localization rules, particularly laws that prohibit data transfer, is evident starting around 2004 and 2010.

[14] Other concerns raised by economies include the possibility that 'concentrated data centers' or hubs could be abused for political purposes, such as sanctions and political interference.

Figure 4. Rise of Cross-border Data Restrictions (by degree of restrictiveness)



Source: Ferracane, M.F. (2016). Digital Trade Estimates Project. Geneva: World Trade Organization. https://www.slideshare.net/MartinaFerracane/digital-trade-estimates-project (accessed 10 March 2017).

In APEC, 13 out of 21 economies have comprehensive data protection laws but the definition of personal data differs.[15] Some economies distinguish between personal data and sensitive personal data, where the former can be transferred with the subject's consent while the latter cannot (APCC and ACCA 2014).

Data flow regulations in Table 3 show the varied scope and requirements of restrictions across APEC economies. Some regulations outlaw the exportation of data in any circumstances, while some allow data to be transferred if certain conditions are met, usually with the consent of the data subject or equivalent data protection measures in the receiving economies. Some economies require a copy of the information to be stored locally, which implies the establishment of local data centers. In almost all economies, national security interest trumps the necessity for cross-border data flows.

[15] The International Association of Privacy Professionals collected the different definition of personal data across economies. See https://iapp.org/resources/article/compendium-the-changing-meaning-of-personal-data/

Table 3. Examples of Regulations Restricting Cross-border Data Flows in Selected APEC Economies

Economy	Examples of Regulations Restricting Cross-border Data Flows	Type of Restriction Generally
Australia	The My Health Records Act was passed in 2012. Section 77 of the act prohibits transfer of health records with certain exceptions outside Australia.	Prohibition; sectoral
Canada	British Columbia and Nova Scotia have enacted laws that require personal information held by public bodies, such as a government ministry or a designated agency, educational or health case body, to be stored and accessed in Canada only, unless it falls under certain limited exceptions.	Conditional; provincial
China	Notice to Urge Banking Financial Institutions to Protect Personal Information prohibits Chinese personal financial information from being analyzed, processed or stored overseas.	Prohibition; sectoral
	Cyber-security Law necessitates that important data pertaining to Chinese citizens and critical information infrastructure be locally processed and stored.	Storage
Indonesia	Regulation 82 on the Operation of Electronic System and Transaction Operation requires service providers providing public services to place their data centers in Indonesia.	Storage
Korea	The Personal Information Protection Act was enacted in 2011 whereby data exporters are required to provide the data subject with information about the transfer.	Conditional
	The Act on the Establishment and Management of Spatial Information restricts the cross-border transfer of mapping data.	Storage
Malaysia	The Personal Data Protection Act was passed in 2010. It requires data pertaining to Malaysians to be stored on local servers but the transfer of data abroad may be allowed under certain conditions.	Storage; conditional
Russia	Federal Law 242-FZ requires that all data collected on Russian citizens be stored within the economy.	Storage
	Blogger's Law requires that all bloggers with more than 3,000 followers to store all internet-related data within Russia for up to 6 months and allow law enforcement agencies to access them.	Storage
Chinese Taipei	Article 21 of the Personal Data Protection Act gives authority to government agencies to restrict international transfers in the industries they regulate. While the government generally does not restrict the international transmission of personal information, the relevant authority may limit transmission if it concerns certain issues including national interests, and lack of proper regulations to ensure data protection by the receiving economy.	Conditional; sectoral

United States	The Department of Defense Interim Rule on Network Penetration Reporting and Contracting for Cloud Services requires all cloud computing service providers that work with the department to store relevant data within the economy.	Storage; sectoral
Viet Nam	The Decree on Management, Provision, and Use of Internet Services and Information Content Online was enacted in 2013. It requires various internet service providers to maintain a copy of any information they hold domestically so as to facilitate inspection by authorities. A circular released in 2013 provides additional implementing details including the requirements that local data servers must meet.	Storage

Sources: Chander and Le (2014), Information Technology Industry Council (2016) (accessed 9 January 2017), government information supplied to authors.

There are likewise currently drafted measures that may have an impact on cross-border data transfer. For example, China's draft Supervision Rules on Insurance Institutions Adopting Digitized Operations contains requirements for data servers of any insurance institution processing the personal data of its citizens to be localized. In Indonesia, there is a draft regulation which, although is still unclear, would require over-the-top service providers to place part of their data centers in the economy. In Viet Nam, the requirement is for all over-the-top service providers to have at least one server in the economy. In Korea, the Standards for Cloud Computing Services would oblige all cloud computing providers to locate servers handling public data within the economy.

Are There Alternative Solutions?

Data protection and security may be served by other means such as through improved encryption technology, the adoption of better security features in ICT devices,[16] an improved trust environment for data handling, or the establishment of bilateral and international cooperation framework agreements for ensuring compliance.

Encryption

Data security experts assert that the geographic location of data hosting servers does not matter for security because criminal hackers respect no national borders. What does matter is the encryption technology that prevents theft and data hack. Arguably, companies that operate cloud technology and internet multinational corporations have greater capacity than national data centers to secure and protect data.[17] They have the required resources and expertise to

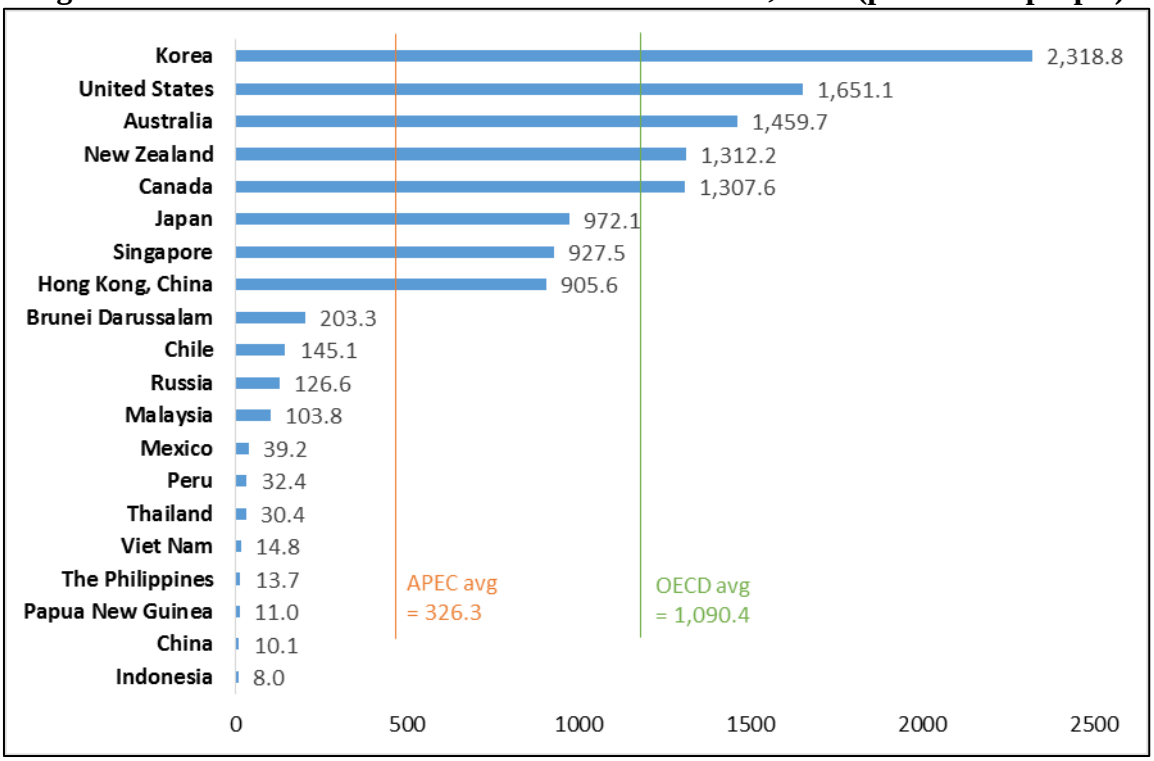
[16] For example, through wider adoption of internet protocol version 6 (IPv6) which has better security features than IPv4.

[17] Some finance multinational corporations hold that, if forced to establish local data centers, the degree of data security in their national data centers would be inferior to that in their regional hubs, let alone their global centers. For one thing, their regional or global data centers would house an agglomeration of experts that national data centers, particularly in developing economies, would not be able to match. For another, the national data centers would also be unlikely to replicate all the security and encryption technology used in their advanced data centers due to cost consideration. Thus, data stored locally may become even more vulnerable to cyber attacks. Offshore

produce sophisticated encryption technology. Their in-house standards on securing data privacy could even be more stringent than the requirements of local economies.

Data protection may also be achieved through secure servers with advanced encryption technology. The APEC data on the number of secure internet servers weighted by population highlights the significant difference between developed and developing economies. Figure 5 shows that 12 out of 20 economies are below the APEC average of 326 secure internet servers per million population, and 15 are below the OECD average of 1090.

Figure 5. Number of Secure Internet Servers in APEC, 2015 (per million people)



Notes: APEC and OECD data are weighted average based on population size in 2015 obtained from World Bank World Development Indicators. Data for Chinese Taipei is not available. OECD data excludes Latvia.
Source: APEC PSU compilations from World Bank World Development Indicators (accessed 20 June 2016).

Trust enablers

Regulatory divergence across economies increases the cost of business compliance and this holds true with divergent privacy rules. Privacy regimes are hard to harmonize because each economy's privacy standards are closely bound with cultural factors that differ across economies. One remedy is through a system that facilitates the interoperability of regulatory regimes. The APEC Cross-border Privacy Rules (CBPR) system developed under the Electronic Commerce Steering Group (ECSG) is one solution that facilitates the interoperability of privacy regimes (APEC 2016). The CBPR is a voluntary accountability-based system that aims to facilitate cross-border flows of personal information by requiring participating economies and businesses to develop and implement data privacy policies that

data centers also parcel out encrypted data in different territories as an additional data protection measure because concentrating data in one geographic territory is a 'sweet spot' for cyber attackers.

are consistent with the nine principles indicated in the APEC Privacy Framework (2004). Box 5 describes the APEC CBPR and the roles of the four main stakeholders in the system.

Currently, there are only two accountability agents, TRUSTe (US) and JIPDEC (Japan).[18] Accountability agents certify privacy policies of participating companies as achieving the high standards of protection approved by APEC economies, review them annually, and resolve non-compliance disputes. There are, so far, four participating economies: Canada; Japan; Mexico and the US, while Korea submitted its application for participation in December 2016. Under the CBPR system, the enforcement authorities in these economies cooperate under the APEC Cross-border Privacy Enforcement Arrangement (CPEA) and enforce CBPR pursuant to domestic laws and commitments made by companies.[19] Among businesses, companies (personal information controllers) in the US and Japan including Apple, IBM, HP, Cisco, Merck and Intasect, have been certified under the CBPR system. Once certified, companies benefit by being able to operate in multiple jurisdictions seamlessly.

The CBPR system has also been useful for developing a common referential document with the European Union (EU) that aims to facilitate interoperability between the APEC CBPR and the EU Binding Corporate Rules (BCR) systems. The common referential document serves as an informal pragmatic checklist for companies applying for authorization under the EU BCR and the APEC CBPR systems. It outlines compliance and certification requirements in both systems as well as identifies common elements and additional requirements.[20]

The challenge for the CBPR system is to have more APEC economies participating in the system and for more companies, especially SMEs, to be CBPR-certified. The system, while facilitating operations of multinational corporations that deal with cross-border data, should address affordability concerns for SMEs. This could be done through capacity building and promotion of the system to encourage uptake in SME participation.

Competition, Profit Shifting, Business Disruptions and Job Displacements

Besides the data privacy and security challenges in the digital economy, other issues worth highlighting are competition policy concerns in network industries such as those based on internet technologies; the ease with which the internet facilitates profit shifting and its corresponding impact on tax revenues; the oft-cited angst over business disruptions as well as job displacements due to AI and other technologies.

[18] Approved in 2013 and 2016, respectively.

[19] CPEA was endorsed by APEC Ministers in November 2009 to facilitate information sharing and cooperation among privacy enforcement agencies (PEAs). Currently, there are 25 PEAs from nine APEC economies (Australia; Canada; Hong Kong, China; Japan; Korea; Mexico; New Zealand; Singapore; and the US) but only PEAs from the four participating economies in the CBPR are responsible for CBPR enforcement.

[20] See APEC Committee on Trade and Investment. http://www.apec.org/Groups/Committee-on-Trade-and-Investment/Electronic-Commerce-Steering-Group.aspx

Box 5. APEC Cross-border Privacy Rules System

The APEC Cross-border Privacy Rules (CBPR) system is a voluntary accountability-based system endorsed by APEC Leaders in 2011. Its aim is to reduce barriers to information flows, enhance consumer privacy, and promote interoperability across regional data privacy regimes.

The Joint Oversight Panel under the Electronic Commerce Steering Group, which administers the system comprises of four main stakeholders (i.e., businesses, consumers, accountability agents and governments/privacy enforcement authorities of the participating APEC economies). Their respective roles are described as follows:

Stakeholder	Roles
Accountability agents	• Recognized public or private sector entities that certify that the privacy policies and practices of participating businesses are compliant with the CBPR system and therefore APEC Privacy Framework requirements. • Resolve any disputes including those pertaining to non-compliance.
Businesses	• Apply for certification (qualified to apply if it is subject to the laws of CBPR participating economies) • Develop and implement data privacy policies which are consistent with the updated APEC Privacy Framework (2016).
Consumers	• Benefit from enhanced privacy protection and coordinated government enforcement. • Report a complaint about CBPR certified businesses or recognized accountability agents if they violate the principles indicated in the APEC Privacy Framework.
Governments/privacy enforcement authorities of the participating APEC economies	• Enforce CBPR according to domestic laws. • Cooperate under the APEC Cross-border Privacy Enforcement Arrangement (CPEA), which creates a framework for regional cooperation in the enforcement of privacy laws.

Source: Cross-border Privacy Rules System. http://www.cbprs.org/default.aspx (accessed 3 October 2016)

Contestability, innovation pressure and competition policy framework

Network effects characterize many businesses in the digital economy. In network markets, the use of more persons generates positive externalities to others. For example, in a social network service, the more people join it, the greater its usefulness to its users. Or, when more people use a particular operating system or search engine, the better the user experience becomes. Thus, network industries tend to grow big, often toward monopoly or oligopoly (OECD 2015) as they compete for market share dominance, often with 'winner-takes-all' outcomes.

The highly competitive environment of network markets that characterize certain categories of the internet value chain has created few very dominant market players. For example, in the

search engine segment, Google is unquestionably the dominant player with 77 percent of the market share.[21] Arguably, market dominance is in itself, not a problem, but it becomes one when there is abuse of the dominant position. For example, Google was found to have illegally restricted advertisers' ability to run campaigns on rival search engines although it has since made voluntary changes to its practice and has given advertisers greater control (Wall Street Journal 2015).

There is the danger that network industries would seek to make themselves indispensable and that once they reach a 'gatekeeper' position, they could try to hamper competition and innovation to lock in end-users and leverage their market power. However, to the extent that the digital economy is contestable, such market power rests on shifting sands. The digital economy can be described as a 'complex structure of platforms stacked on each other allowing multiple routes to reach end-users' (Van Gorp and Batura 2015) which make it difficult to maintain gatekeeper positions for long. The pressure to innovate is intense in the digital industry because dominant firms are constantly challenged by innovations from both new challengers and incumbents. Such competition helps the industry to continuously develop new business models and shift the boundaries of the market.

Still, there is need for economies to have robust competition policies to be able to address competition abuses in general, be it from digital firms or from other industries. What is important is that competition policy should be able to non-discriminately discipline the tendency to abuse dominant positions, regardless of whether the monopolist in question is a local or a foreign one.

How to Tax Digital Businesses

The more difficult issue is the taxation of digital businesses. On the one hand, internet companies offer many free services, for example, geo-location services, and have introduced many efficiencies and innovations. On the other hand, many of them have raked in huge profits in different economies but only paid a minuscule proportion of it in tax in those jurisdictions. Digital technologies can enable economic actors to operate in ways that easily avoid, remove or significantly reduce tax liabilities (OECD 2015). The problem stems from various causes. First, digital firms can sell goods and services without a 'physical presence' in the taxing economy,[22] while tax laws have been built based on a 'manufacturing' economy foundation where a 'physical presence' is used for tax purposes. Second, for business models using data, there is the knotty question of their characterization, proper valuation or value attribution. For example, data may be collected from one place, processed and analyzed in another, and used for advertising aimed at the consumer in the first jurisdiction but with the advertiser located in a third economy (Ahmed and Chander 2015). In cases like this, it is hard to pin down value creation or generation which may be helpful for tax purposes.

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[21] Desktop Search Engine Market Share. https://www.netmarketshare.com/search-engine-market-share.aspx?qprid=4&qpcustomd=0 accessed 05 April 2017.

[22] The OECD has proposed using 'significant economic presence' to apply to digital firms instead of the traditional use of 'permanent establishment' (OECD 2015).

Besides the conceptual tax policy issues, other problems include: i) the administrative challenge of collecting taxes from non-resident entities, and ii) whether different methods of levying tax on the digital economy could run into conflict with existing trade treaty obligations (particularly, national treatment).[23] For example, the proposal of imposing a withholding tax on certain types of digital transactions may inadvertently target foreign non-resident companies while sparing domestic ones, triggering questions about potential national treatment violations.

Business and Employment Disruptions

On technology disruptions, there are concerns about how the internet is replacing or disrupting traditional business models (see for example, Box 6 on the business disruption of the music industry). While long-term productivity and wealth creation benefits are expected, the short-term disruption is causing concern. For example, a taxi operator in New York pays for a taxi medallion worth no less than USD 500,000, a high value associated with some degree of exclusivity owing to a limited number that is made available. If online services like Uber enter the market and offer a service similar to taxis, the exclusivity accorded by the taxi medallion is removed and the value of this upfront investment by incumbent taxi operators is thus diminished.[24]

The internet's impact on employment is another issue to watch. While some types of employment may be destined for disruption by automation and robotics, new types of jobs will emerge such that total employment is expected to be positive from the internet. This again might call for some policy responses on re-training and on re-examination of education curricula to focus on the type of skills that will be needed in the digital economy.

[23] Trade obligations may differ substantially depending on whether a particular digital transaction is characterized as a trade in goods or services. GATT will apply to the former, and GATS to the latter. GATT has a general national treatment obligation, while GATS national treatment obligation applies only to committed sectors.

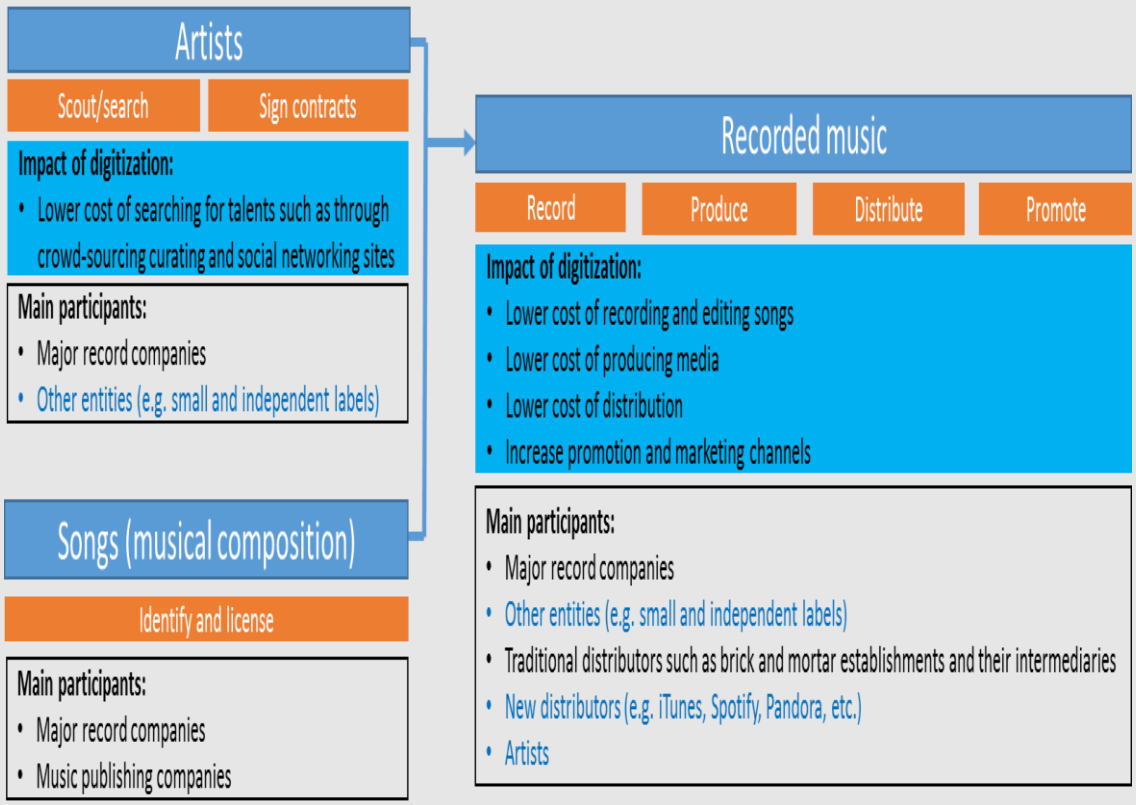
[24] In the case of the taxi medallion operators where upfront investment is paid in return for access to a limited market, Hoekman and Pasadilla (2016) suggest some form of compensation mechanism or a return of the upfront investment for the license.

Box 6. Digital Disruption in the Music Industry

Traditionally, the music industry was controlled by the major record companies that have the advantage and resources to accumulate different industry assets, namely artists, songs (musical compositions) and recorded music. They have the resources to hire talent scouts and the physical capital for recording and editing songs. Copyright in the sound recording is typically assigned to the record company for it to recoup the various costs associated with finding artists, recording songs, promoting, marketing and distributing music products. The artist earns royalties on the sales of his/her music only after the record company has fully recouped its costs.

With the internet, producing music has become less costly. The cost of a talent search is no longer high because of the availability of crowd-sourced curating and social networking sites such as FreshScouts and MySpace. Major record companies no longer enjoy an advantage over independent labels (or the artists themselves) in finding artists, nor in recording, producing and distributing songs because of the increased number of promotion and marketing channels. As a result of this transformation, the original revenue structure of the industry changed. Record companies are no longer the major recipients of revenues from music sales. Artists no longer need to assign their copyright to record companies and therefore can earn royalties sooner. At the same time, the introduction of innovative business models in music distribution such as digital music stores and music subscription or streaming services means that traditional distributors and their intermediaries may be eclipsed by new internet players such as iTunes and Pandora.

Digitized music supply chain



Source: Authors based on Cameron and Bazelon (2011).

3.3 SUMMARY

This paper is not an exhaustive discussion of the issues in the internet and digital economy but it highlights the need for further dialogue, especially between policymakers, the private sector as well as other stakeholders that influence the governance across the complex layers of the internet. There is a host of issues, some technical and others policy-related, that need to be better understood, especially by policymakers to arrive at a more balanced regulation of the industry that allows for innovation and growth as well as address concerns over data privacy and security and other challenges. There is a need to provide data security and privacy, but how best to do it, in cooperation with the private sector, is the question. Economies need to have robust competition policy to be able to prevent abuses by dominant players, while allowing for a market-based competitive environment. Fair taxation will be for the good of all, including the internet companies whose business would also suffer from the populist backlash that could ensue from the tax base erosion and the perception of lack of fairness. Likewise, there are national security considerations, along with trade interests, that should be weighed in the search for balanced solutions.

APEC needs to discuss and to continue to learn from the experience of multiple economies and to work with other international organizations that are trying to grapple with many of the digital economy issues such as privacy and taxation. Importantly, APEC should engage the business community as well as the research community in dialogue to maintain the innovation from and dynamism of the digital economy while minimizing the disruptions and possible harm from data misuse. There is a need to better understand the economic value of data, of how firms use data for their value chain and ordinary operations. There is also a need to understand the factors that influence firms' decisions where to locate data centers. There is a need for a deep dive on the various risks and their impact on the layers of the internet – some of which may have technical solutions, while others may require a framework for enhanced international cooperation or trade agreements. Sustained work on this topic would help paint a better picture of the risks and their impact and cost, and hopefully avert the fragmentation of the internet.

4. ENABLERS OF GROWTH IN DIGITAL TRADE

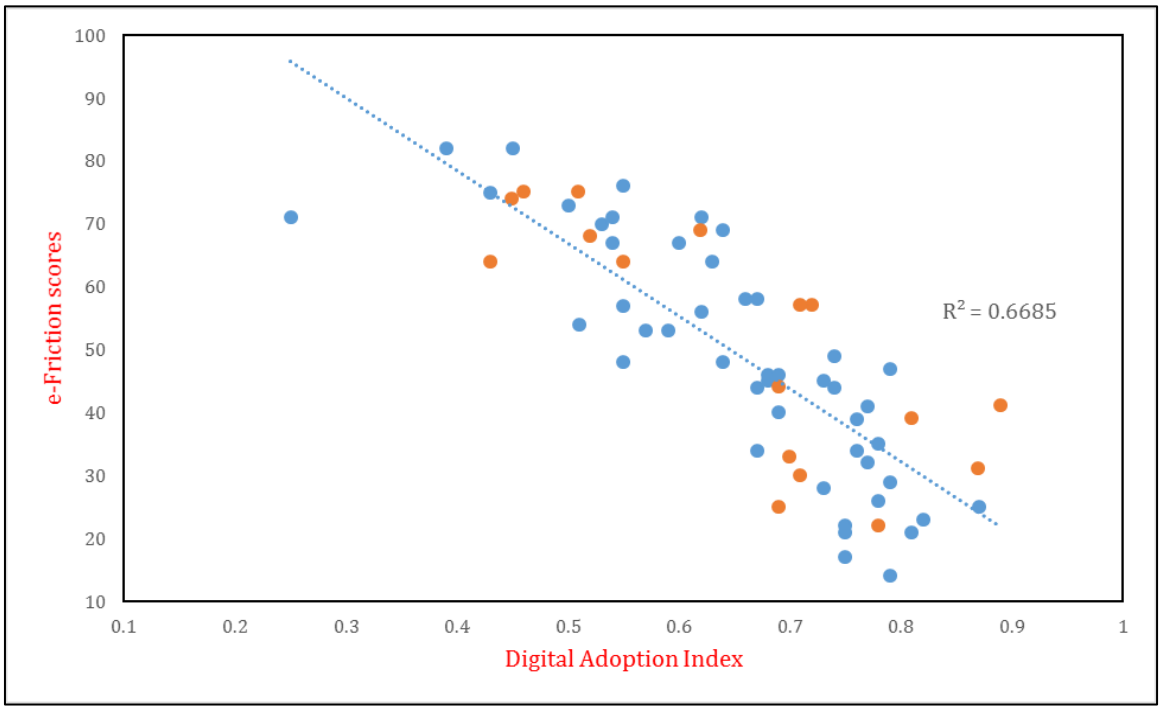
There are many factors that influence the ability of economies to fully participate in digital trade. These factors can be categorized into three broad areas, namely those pertaining to: i) infrastructure, ii) factors including regulations and availability of ICT skills that facilitate the supply of internet and/or digital services, and iii) factors that facilitate the access or demand of internet services. Based on these factors, this section builds an 'enablers' ranking index which can be correlated with indicators of the size of the digital economy such as internet penetration and digital intensity.[25] The implication of the result is that progress in improving 'enablers' can translate to a greater participation in the digital economy and economic growth.

The Boston Consulting Group (BCG) constructed a similar index for 65 economies based on a slightly different set of indicators, called it 'e-friction', and found that the size of e-friction is negatively correlated with the size of the digital economy (Zwillenberg, Field and Dean 2014). Their study shows that economies that have large e-friction have lower growth in its digital economy than those with low e-friction. Considering that SMEs that heavily use the internet are more likely to sell products and services to a bigger market and source products from further afield than those that use the internet less, then e-friction also likely limits SMEs sales reach and product sourcing (Zwillenberg, Field and Dean 2014).

Figures 6 and 7 show how the BCG e-friction scores correlate negatively with the adoption of digital technology by businesses, people and government indicated by the digital adoption index. It also correlates negatively with the number of people that access the internet (internet penetration rate). Both figures support the view that reducing e-friction would help economies grow their digital economy and participate in the benefits derived from it. They also show the diversity of e-friction scores among APEC economies, with three of them in the top quintile (lowest e-friction score), and four in the bottom quintile (highest e-friction score). The BCG result is largely a function of levels of development with the more developed APEC economies having lower e-friction scores and the developing economies having higher scores.

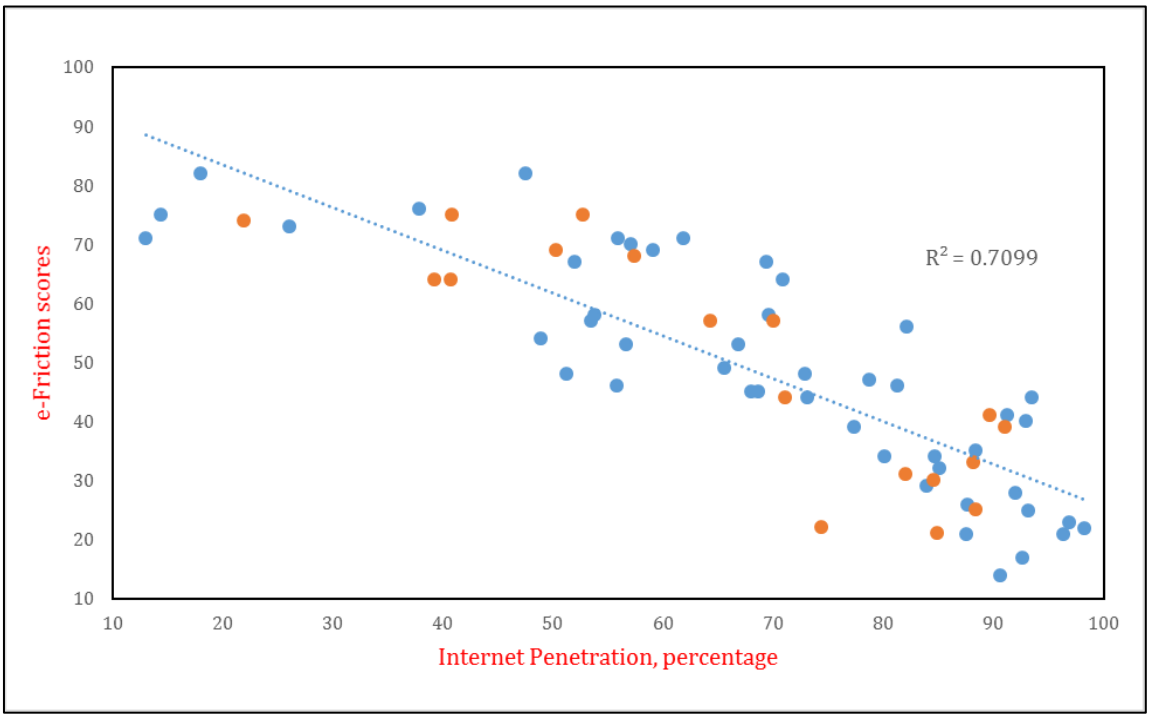
[25] The authors patterned the methodology to that used in Zwillenberg, Field and Dean (2014) of the Boston Consulting Group (BCG) but with a slightly different set of indicators depending on what is generally available for most APEC economies. The paper also makes use of simple rank average rather than scores as was done in the BCG article. The results and insights are, however, widely similar.

Figure 6. E-friction Scores and Digital Adoption Index



Notes: e-Friction scores = 0 (best)-100 (worst); Digital Adoption Index points = 0-1
Sources: Zwillenberg, Field and Dean (2014), World Bank. Digital Adoption Index Orange dots represent APEC economies.

Figure 7. E-friction Scores and Internet Penetration



Note: e-Friction scores = 0 (best)-100 (worst)
Sources: Zwillenberg, Field, and Dean (2014), World Bank Digital Adoption Index. Orange dots represent APEC economies.

4.1 INDICATORS OF DIGITAL ENABLERS

Instead of e-friction, this study uses a summary measure for digital growth enablers. There are many indicators that can be used as indicators of enablers for the digital economy but for the purpose of getting a 'summary picture' of where APEC economies stand, the paper uses only a few representatives. As mentioned, there are three broad areas where various enablers can be categorized. For the infrastructure group, ten indicators (Table 4) were chosen that represent those that facilitate: i) **access**, for example, number of secure servers, quality and cost of electricity production; ii) **speed**, for example, bandwidth, average connection speed for both mobile and internet; iii) **cost**, represented by tariff price for mobile and internet adjusted for levels of income; and iv) **architecture**, for example, available country code top level domain (cc-TLD) sites located onshore. For factors that facilitate the supply of internet services, the indicators include those pertaining to: i) **labor**, for example, quality adjusted average years of education or availability of scientists and engineers; ii) **capital** for example, ease in accessing loans; and iii) the economic and regulatory **environment**, proxied by a few ease of doing business indicators or intellectual property protection. Finally, for factors that facilitate use of the internet, indicators include those that represent digital literacy, availability and use of digital payments, as well as indicators that capture the network externality benefit that encourages the use of the internet, for example, the number of users of social networks. Table 4 provides the detailed list of indicators used for the index while Tables A1 to A3 provide the detailed values of the selected indicators.

Table 4. Indicators of Digital Enablers

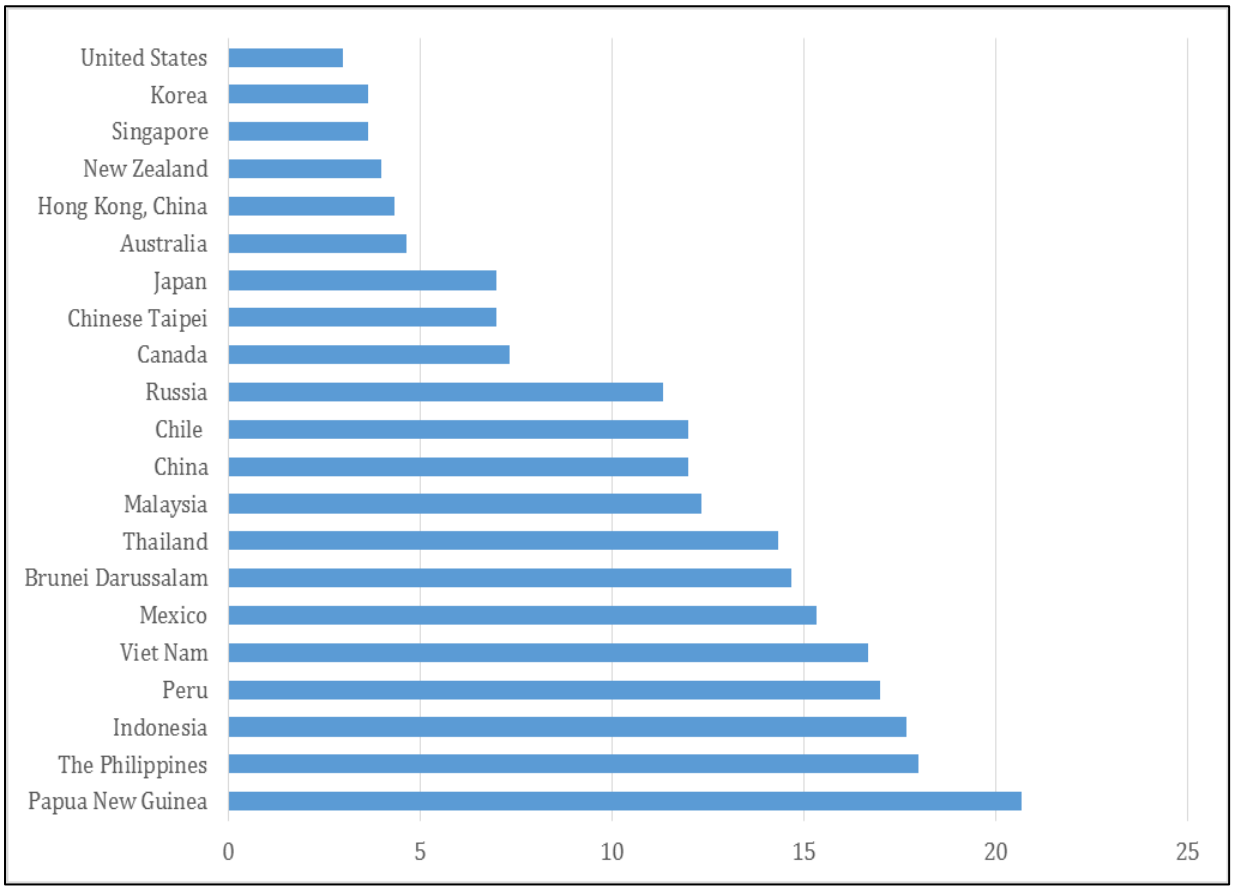
Infrastructure	Facilitating Supply	Facilitating Demand
Access • Number of secure internet servers (per million people) (WB WDI) • International internet bandwidth (kb/s per user) (ITU) • Electricity production (kWh/capita) (WEF NRI) • Cost of electricity (USD/kWh) (Deutsche Bank) • Quality of electricity supply (1 = poor 7= excellent) (WEF GCI) **Speed** • Average Connection Speeds (IPv4) for Mobile Connections (Mbps) (Akamai) • Average Connection Speed (Ipv4) (Mbps) (Akamai) **Price** • Mobile tariff (PPP$/min)/per capita GDP, PPP (current international $) (WEF NRI and WB WDI) • Fixed broadband tariffs (PPP$/month)/per capita GDP, PPP (current international $) (WEF NRI and WB WDI) **Architecture** • Share of ccTLD-sites hosted on shore (%) (Pingdom)	**Labor** • Quality-adjusted years of education (WB World Development Report 2016) • Tertiary gross enrolment ratio (%) (UNESCO Institute for Statistics) • Quality of math and science education (1=poor, 7=excellent) (WEF GCI) • Availability of scientist and engineers (1=poor, 7=excellent) (WEF GCI) **Capital** • Ease of access to loans (1=poor, 7=excellent) (WEF GCI) **Economic Environment** • Time to export: Border compliance (hours) (WB EDBD) • Time to enforce contract (no. of days) (WB EDBD) • Cost to export: Border compliance (USD) (WB EDBD) • Intellectual Property Protection (1=poor, 7=excellent) (WEF GCI)	**Ability** • ICT development index (ITU) **Access** • Applicable *de minimis* value for e-commerce tax (USD) (Global Express Association) • Adults who own smartphone (%) (Pew Research Center; Spring 2015 Global Attitudes Survey) • Fixed broadband subscriptions per 100 inhabitants (ITU) • Mobile broadband subscriptions per 100 inhabitants (ITU) • Online population using social networking (%) (comScore) • Freedom on the net (0=best, 100=worst) (Freedom House) **Banking** • Population with financial account (%) (WB GFD) **Payments** • Adult population with credit card (%) (WB GFD) • Population using internet to make payments and buy (%) (WB GFD)

Notes: ccTLD = country code top-level domain, EDBD = Ease of Doing Business Database, GCI = Global Competitiveness Index, GFD = Global Findex Database, ICT = information and communications technology, IPv4 = internet protocol version 4, ITU = International Telecommunication Union, NRI = Networked Readiness Index, UNESCO = United Nations Educational, Scientific and Cultural Organization, WB = World Bank, WDI = World Development Indicators, WEF = World Economic Forum.

Source: Authors' compilation.

The easiest way to make comparable the various indicators that use different metrics is by constructing an index which comes from the ranking of the indicators' values. A simple average of these various rank indices is taken to represent the overall rank of economies in each category, that is, infrastructure, supply environment and demand environment. The average of the rank indices of these three category indicators is further computed to get the overall index of digital enablers. The result of this computation is shown in Figure 8 where lower average values represent more favorable 'enabler' indicators overall. The graph shows that the US; Korea and Singapore have favorably ranked digital enabler indicators overall, while the opposite goes for Peru; Indonesia and the Philippines. Figure 9 also shows that the digital enabler indicator has a negative correlation with internet penetration in APEC,[26] which means that economies that have favorable digital enabler indicators (that is, with low average rank) tend to have a wider adoption of the internet in their economies. Economies with the most favorable digital enabler indicators have internet penetration rates exceeding 80 percent of the population.

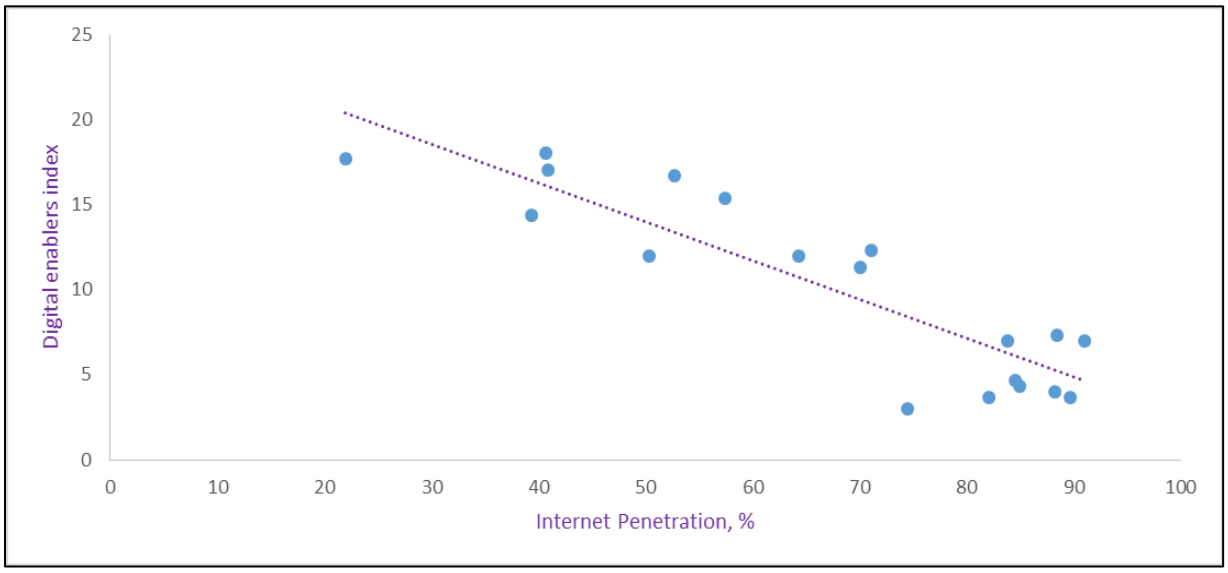
Figure 8. Overall Rank Index of Digital Enablers



Source: Please see Annex A and B for data notes and sources.

[26] The correlation coefficient is –79 percent and highly significant.

Figure 9. Digital Enablers and Internet Penetration



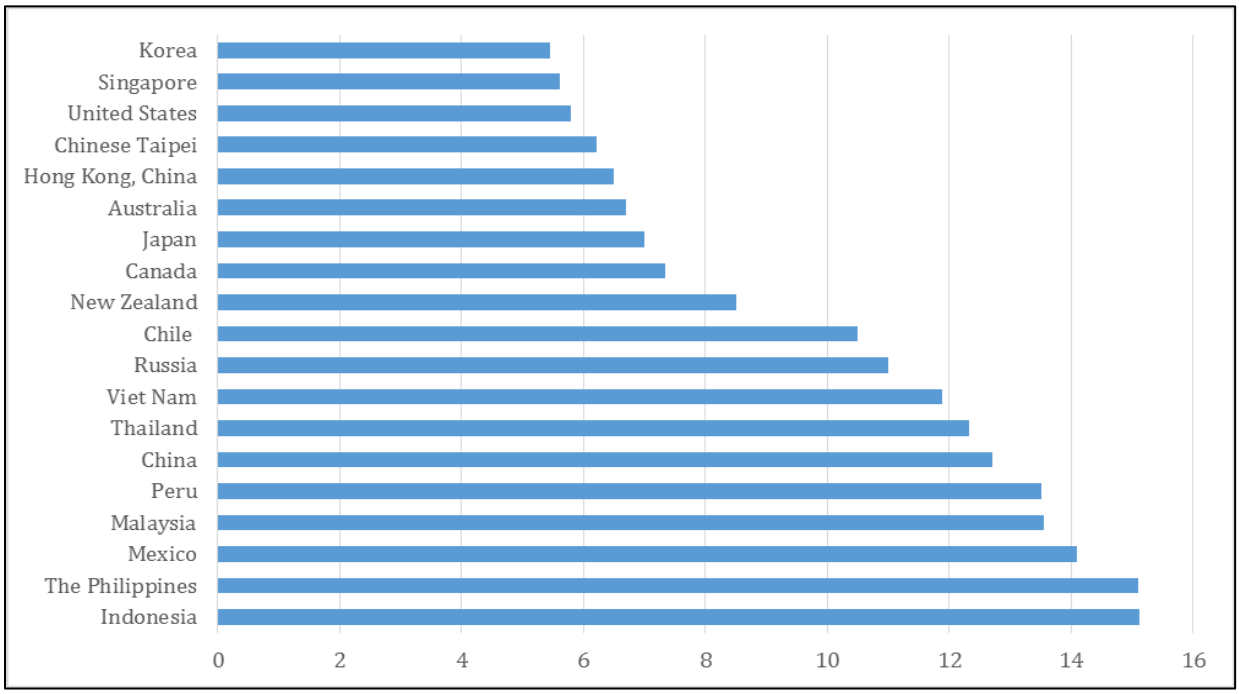
Source: Internet penetration data ITU (2015).Chinese Taipei, ITU (2014).
For digital enablers please see Annex A and B for data notes and sources.

4.2 DIGITAL ENABLERS INDEX AND POLICY PRIORITY

The simple rank index of various digital enablers indicators can also show where the more important bottlenecks in individual economies are possibly located and thus help guide policy priorities. Figures 10 to 12 show the digital enablers index for infrastructure, supply facilitators and demand facilitators. This index along with a detailed examination of data in Tables A1 to A3 (Annex A) show the strengths and areas for improvement for different economies. For example, it shows that the Philippines' main constraint is in infrastructure, specifically in the low number of secure servers, the quality and cost of electricity, and connectivity speed. In terms of indicators that facilitate the supply of internet services, the Philippines has a slightly better ranking based on the availability of labor and/or skill indicators and the ease of doing business indicators. For indicators that facilitate the use of the internet, its ranking is brought down by its low *de minimis* value for e-commerce and low use of digital payments even though it ranks highly in the use of social networking sites. Similarly, Singapore has an excellent average ranking for the environment that facilitates supply due to its top rank in the ease of doing business indicators, is second best for infrastructure, but the category where it lies somewhere in the middle is in the one that facilitates the use (demand) of internet services. New Zealand, in contrast, tops this broad category. Japan has good infrastructure but is hobbled by the price of mobile tariffs. Similar examination for each individual economy will lead to different conclusions and possible policy priorities if applicable.

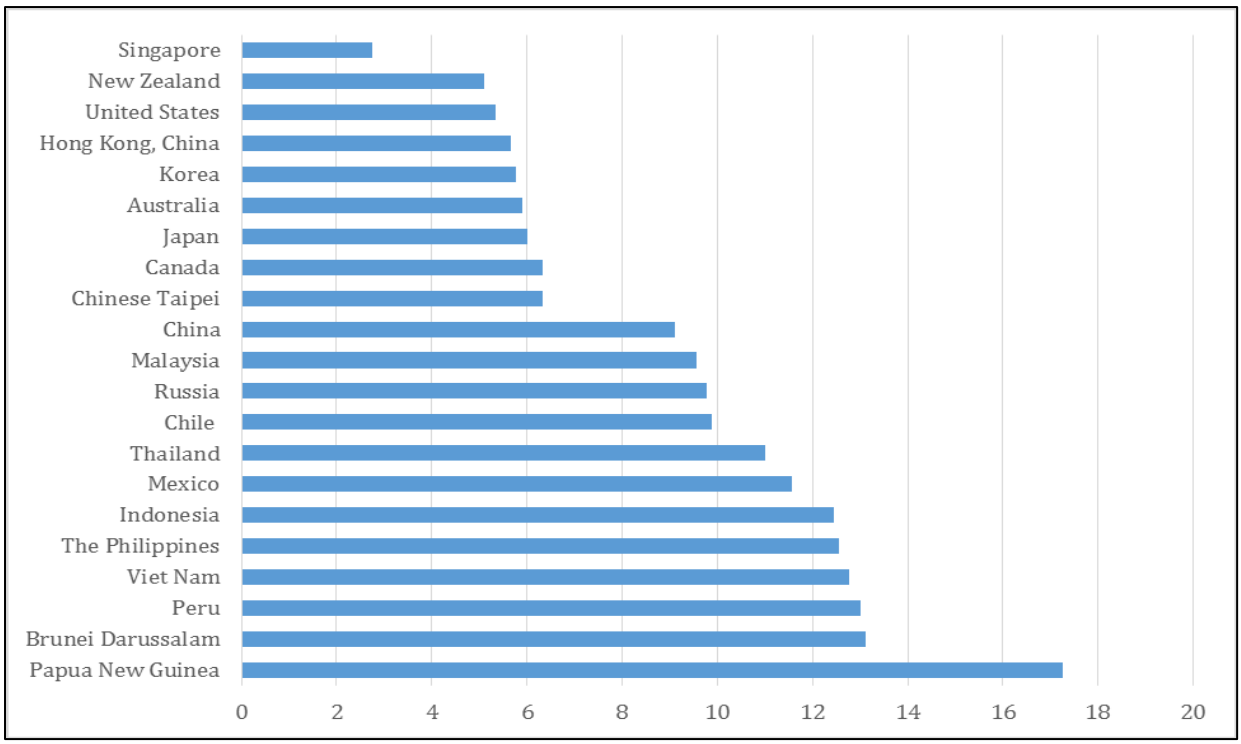
Economies may decide in their own domestic policymaking and prioritization to focus on other sets of indicators, but this exercise is useful for categorizing the sets of policy indicators into different 'baskets', whether infrastructure or regulatory or human capital requirements that ultimately affect the use or supply of internet services, thus helping pinpoint possible priority areas.

Figure 10. Rank Index of Infrastructure Indicators



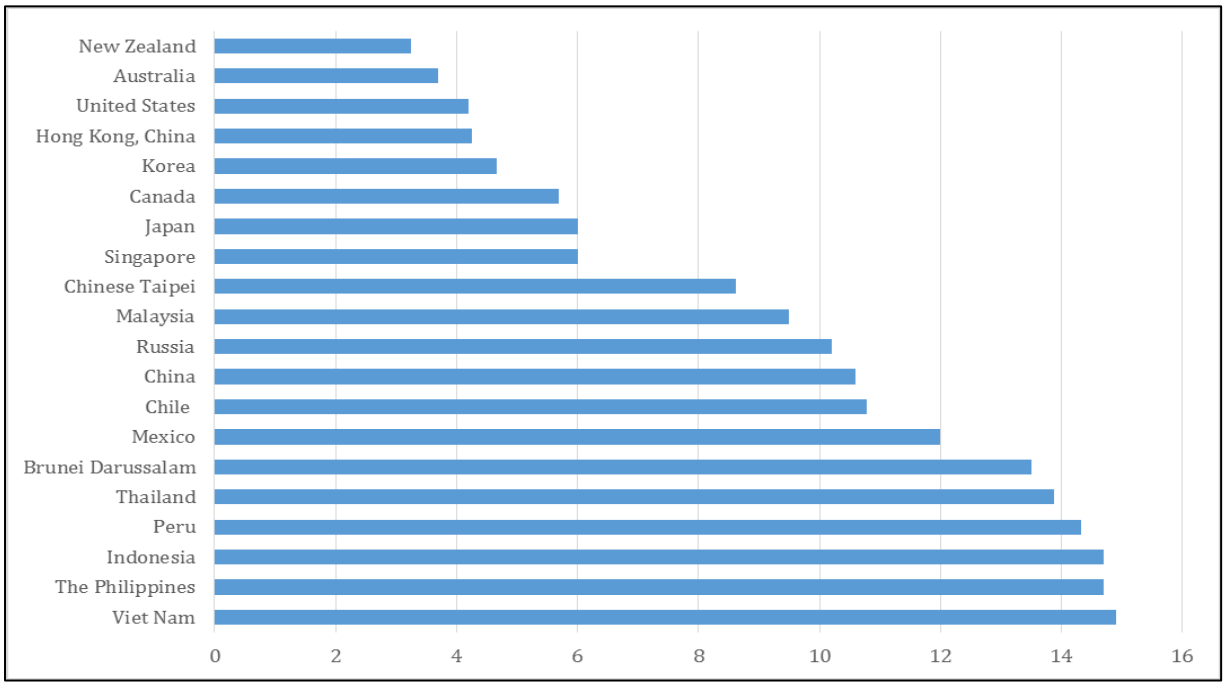
Source: Please see Annex A and B for data notes and sources.
Note: Brunei Darussalam and Papua New Guinea are excluded for lack of available data.

Figure 11. Rank Index of Indicators Enabling 'Supply'



Source: Please see Annex A and B for data notes and sources.
Note: Index for Papua New Guinea is based on the average of only 4 out of 9 indicators.

Figure 12. Rank Index of Indicators Enabling 'Demand'



Source: Please see Annex A and B for data notes and sources.
Note: Papua New Guinea is excluded for lack of available data.

4.3 FACTORS AFFECTING DIGITAL ENABLER INDEX

Identifying strengths and weaknesses relevant to the digital economy is one thing, effectively doing something about them is another. There are major factors that affect the 'favorability' result of the digital enabler index. One is the wealth factor. Higher per capita gross domestic product means that its citizens can afford to buy smartphones and other devices, the government can build advanced ICT infrastructure, and pay for good education in science and technology. This explains why developed economies are also those with a favorable digital enabler index and why emerging markets have the most number of unconnected consumers (Zwillenberg and Dean 2015).

Another factor is population density and urbanization. This explains why internet and digital infrastructure tends to be built around cities where it is possible to recoup the cost of infrastructure deployment. Archipelagos like Indonesia or the Philippines have villages with uneven distances from fiber connection points depending on how close they are to urban centers.

Literacy and basic English language skills are other factors that affect the digital enabler index. Economies with a favorable index tend to have high literacy rates. Furthermore, without English language skills, most people would not find the internet useful if it contains little content in the local language. Zwillenberg and Dean (2015) state that 55 percent of all websites use English, while the percentage of people speaking English is estimated at 20 percent to 25 percent of the global population. Languages like Arabic, Hindi, Mandarin, and Spanish are used on fewer than 10 percent of websites globally.

4.4 POSSIBLE AREAS FOR CAPACITY BUILDING

This section and Section 3 have shown that APEC economies are at different stages of development based on various indicators of identified building blocks for digital trade growth. The digital divide between developed and developing APEC economies is evident particularly with regard to infrastructure and human resources, as well as in their capacity in privacy legislation and enforcement. Under the surveyed scenario, how can APEC's capacity building activities help promote digital trade in the APEC region?

APEC should continue trade policy dialogue with policymakers, the research community, other international organizations and the private sector that carry the burden of compliance as well as reap the benefits from digital trade. Along with topics suggested for future dialogue in Sections 2 and 6, APEC should also continue allocating capacity building resources for its work in trade facilitation and other complementary trade policies to e-commerce.

Likewise, capacity building on improving the investment environment to accelerate bridging the digital infrastructure divide is another key area of work. For example, in the electricity market or the information and telecommunications market, how open are the APEC economies to foreign investment in this critical infrastructure? The capacity of the crucial backbone infrastructure would greatly affect the capacity to deliver or consume online services but foreign investment is needed for its constant upgrade.

Finance is another crucial infrastructure. Access to international online payment systems is integral for digital trade participation but such a facility may not be available to potential participants for many reasons including the absence of bank accounts and/or credit cards. APEC could try to understand why payments' infrastructure and people's access to it differ across economies. What factors help in the use of bank accounts or credit cards? How can APEC improve financial inclusion?

A critical prerequisite for participation in digital trade is information technology literacy. Despite the ubiquitous presence of devices that allow people access to the internet, a significant share of the population remains unaware of what it is and what it can do to their lives. The APEC digital opportunity centers, initiated by Chinese Taipei, have been successful in providing basic computer and internet access training and APEC should build on this initiative by establishing more digital opportunity centers. Member economies should also look at ways to enhance digital literacy at an early age, especially in rural areas, as well as creating clubs that can help upgrade the coding skills of local talent (Box 7).

Box 7. APEC Digital Opportunity Centers

Chinese Taipei proposed in 2003 the establishment of the APEC Digital Opportunity Center (ADOC) project. Its main objective is to transform digital divides in the Asia-Pacific region into digital opportunities by providing training to various segments of society regardless of age, gender, physical, social or educational status. Participants including the visually impaired, women, children and micro, small and medium enterprises are provided training in topics such as basic computer skills, internet access, e-commerce and e-marketing.

Since its inception, the project has evolved and introduced many innovative ways to better realize its objective. These include establishing mobile digital opportunity centers, providing standardized training material in multiple languages as well as organizing ADOC clubs and workshops to facilitate sharing of good practices.

To date, Chinese Taipei has established more than 100 centers across APEC economies. These centers are found in both urban and rural areas and are set up in collaboration with local authorities, universities, secondary schools and non-profit or non-government organizations.

Ten partner member economies have participated in the project: Chile; Indonesia; Malaysia; Mexico; Papua New Guinea; Peru; the Philippines; Russia; Thailand; and Viet Nam.

Source: APEC Digital Opportunity Center. http://www.apecdoc.org/site/ accessed: 3 October 2016

5. EVOLUTION OF E-COMMERCE RULES IN TRADE AGREEMENTS

While Sections 2 to 4 of this paper discuss industry-related issues, this section focuses on trade rules that affect e-commerce and digital trade.[27] A hypothetical legal case of a smart object that sends personal data to an offshore server begins the discussion to highlight some emerging issues associated with digital technology and privacy regulations, and to underscore the limitations of existing rules in the WTO. In contrast, preferential trade agreements have made considerable progress on e-commerce rules and are discussed in the last part of this section.

5.1 TECHNOLOGY, THE INTERTWINING OF GOODS AND SERVICES, AND TRADE RULES

Through technology, many goods are now imbedded with services. Watches do not only tell the time but also function as internet devices, air conditioning units smartly adjust room temperature according to the number of people in the room and the amount of humidity, and many cars are not just vehicles but also data transmitters. Some goods, like books or films, no longer come in print or reels but in digital shape. Goods and services have increasingly become so intertwined that without the latter, goods are often less saleable.

Smart products

Box 8 considers a hypothetical case of a smart object – a fitness tracker that transmits information to an offshore server – but is imported into an economy that prohibits the transfer abroad of identifiable personal health data. The scenario lays out a case in which data flow regulations could act as a non-tariff barrier. It shows that in many cases, both the General Agreement on Tariffs and Trade (GATT) and General Agreement on Trade in Services (GATS) would increasingly be invoked together in trade dispute resolutions. More significantly, it highlights the problems associated with using GATS. Rules on trade in services at the World Trade Organization (WTO) are governed by a positive list approach to committing service sectors for liberalization but the sectors listed, in some cases, do not reinforce each other but rather provide ample scope for various interpretations. In the example in Box 8, the importing economy may have a liberal commitment in the computer and related services sectors (which presumably governs measures on data flows) but it has a very restrictive commitment in health services. It is uncertain in this case whether the data flow restrictions would be vitiated by the economy's liberal commitment in computer services, or would be supported by the non-liberal health services commitment. Considering the growth of IoT and smart objects, it is highly likely that the WTO dispute settlement body could soon face actual cases similar to the hypothetical example, grapple with the ontology of smart objects and, possibly, stretch the interpretation of WTO laws.

[27] Without prejudice to the interpretation of either term by APEC economies, 'e-commerce' is understood in this paper as business exchanges that take place via the internet and 'digital trade' as trade in digital products that are either transmitted electronically or are fixed on physical carriers.

What does this imply for the architecture of the multilateral trade rules? There is work to be done to improve the WTO rules. Services rules or GATS, in particular, were written prior to the wide use of digital products, smart objects and IoT and a host of new but now common online services such as social networking or search engines or sharing economy. It was written at a time when the delineation between goods and services was more clear-cut.

Box 8. Hypothetical Case: Fitness Tracker Import and Privacy Regulations

Economy A produces fitness trackers. Economy B would like to export similar fitness trackers to Economy A but its products send health data to servers in Economy B where they are stored, processed and analyzed. Economy A bars the offshoring of personally identifiable health information. In addition, Economy A has a liberal GATS commitment in computer and related services, including data processing, information and data retrieval services, but no liberalizing commitment in health services.

Can Economy A use its data flow restriction regulation to bar the importation of the fitness tracker that sends health information offshore? What legal challenges to WTO law might Economy B bring against Economy A?

The issue highlights the intertwining of goods and services where both GATT and GATS would likely be invoked in a dispute. Is the fitness tracker a good or a service or both? In a case like this, the economy defending a policy would likely prefer that the issue be focused on services, i.e., GATS whose disciplines leave more elbow room, for instance in the interpretation of the scope of the economy's services sector commitment. The complainant, i.e., Economy B in this case, would likely focus on invoking GATT because it has stricter disciplines and consistent case law that contribute to greater liberalizing effect. In particular, 'national treatment' which is relevant in the hypothetical case is a general obligation in GATT but only depends on the economy's schedule of commitments in GATS.

GATT = General Agreement on Tariffs and Trade, GATS = General Agreement on Trade in Services, WTO = World Trade Organization.

Source: Adapted by authors from Chander (2015).

Are Digital Products Goods or Services?

One of the perennial issues that has stymied progress in e-commerce discussion at the WTO is the classification of digital products. Most WTO members agree that services delivered electronically such as professional services are to be governed by GATS. But what about digital products that have traditionally been traded on a physical carrier medium but are now traded electronically? Should GATT continue to apply to these electronically delivered products? Should GATS apply? Or should it be governed by a different set of trade rules?

The issue is difficult because neither the Harmonized System (HS) classification used in GATT nor the Services Sector Classification List W/120 used in GATS provide a way to classify digital products (Wunsch-Vincent and McIntosh 2005). For example, movies may be classified under GATT's HS classification under the medium or physical carrier on which it is distributed – not the content of the movie itself.[28] On the other hand, under GATS, movies may be classified under W/120 as 'motion picture and video tape production and distribution services' (Prov CPC 9611) or 'motion picture projection services, etc' (Prov CPC 9612) but as with the HS classification, it does not tackle the actual content of the movie. This issue becomes important because of the differing levels of trade liberalization accorded by GATT and GATS.[29] Unlike GATT where national treatment is a general obligation for all, the GATS positive list approach only guarantees market access and national treatment for foreign services and service suppliers in sectors specified in the Schedules of each WTO Member. Furthermore, under GATS, economies can introduce and/or maintain cultural protection laws that restrict available 'shelf space' or air time to nondomestic cultural products which, under GATT would be a violation of the national treatment principle (Porges and Enders 2016).

The salience of this issue becomes clearer when considering duties in offline and online transactions. Table 5 shows that levying tariffs on products when they are sold offline remains possible but that the 1995 Decision on Customs Valuation required the choice of levying tariffs on the value of the carrier medium or content and most members chose the former. Furthermore, the Information Technology Agreement obliged signatories to bind the tariff on the carrier medium to zero. The complexity is when the same product is delivered electronically. If it is a good, then a tariff levy is, in principle possible, but technically difficult to impose. If it is a service, then usually no duties are imposed on services but whether the service would enjoy national treatment would depend on whether the economy committed the service in question for liberalization. Classifying digital products as a service provides more regulatory leeway to the importing economy.

[28] In this case, HS 37.06 cinematographic film, 85.24 Records, tapes and other recorded media for sound or other similarly recorded phenomena (Wunsch-Vincent and McIntosh 2005).

[29] Wunsch-Vincent and McIntosh (2005) provide a clear explanation on the implications of different levels of trade liberalization from GATT and GATS. For example, border measures that subject good imports are limited by GATT obligations on national treatment, tariff bindings, quotas, subsidies, safeguards, customs valuation decision and the International Technology Agreement. In contrast, GATS has fewer limitations and market access and national treatment are accorded only pursuant to specific sector commitments. The 'culture' debate exacerbates the limitations of GATS if it is invoked to extend discriminatory limitations and subsidies to audiovisual services that are delivered electronically. See also Wunsch-Vincent (2006, 2008).

Table 5. Duties in Offline and Online Transactions

Transactions Involving a Digital Product	Offline (e.g., software product delivered on a disc)	Online (e.g., software product delivered electronically)	
Classification	Good	Good	Service
General ability to levy duties	Yes	Yes, but technically difficult	Maybe. WTO members do not generally levy duties on services; depends on whether they have a national treatment commitment on the service in question; technically difficult to do
Impact of duty-free moratorium on ability to levy duties	Not applicable	Maybe, depends on interpretation of 'electronic transmission'[a]	Maybe, depends on interpretation of 'electronic transmission'
Impact of 1995 Decision on Customs Valuation	Members may elect to levy duties on the basis of the value of the physical carrier medium or content. Most members have elected to use the carrier medium	To be consistent, members should make the same election for online transactions as they make for offline transactions.	Members would have more leeway to levy the duty on the basis of the content.
Information Technology Agreement (ITA)	ITA signatories bind tariffs on the basis of the physical carrier medium at zero.	To be consistent, ITA signatories bind tariffs to zero	Same as above, i.e., more leeway

Notes: [a]. Duty moratorium on electronic transmission may mean duties not imposed on the transport service that support e-commerce, or on the content of the transmission, or that products that are duty-free offline would remain so in the online world. WTO = World Trade Organization.
Source: Wunsch-Vincent and McIntosh (2005).

5.2 MULTILATERAL AND PREFERENTIAL TRADE RULES AND DIGITAL TRADE

As early as 1998, the WTO established a dedicated work program on e-commerce to address identified limitations in multilateral trade rules. Not much had been achieved under the work program, unfortunately, but cases heard by the WTO appellate body had helped clarify some legal applications (Table 6). Meanwhile, some preferential trade agreements, particularly those led by the US, have advanced and leapfrogged stalemated discussions at the WTO on duties of digital products, problems of definition of digital products, intellectual property protection and others. Table 6 provides a summary of the status of various issues identified in the WTO work program and the state of play, including in preferential trade agreements. We discuss some of these issues.

Table 6. WTO, Preferential Trade Deals and Digital Trade

Issues Suggested by WTO Work Program on E-commerce	State of Play at the WTO Based on Work Program	State of Play Based on Dispute Settlement Case Law	Overall WTO Results	Preferential Trade Agreements
Instauration and applicability of a clear, permanent duty-free moratorium on electronic transmission and their content	No binding decision	Not subject to dispute	Pending	Addressed in some FTAs, practice for making the moratorium permanent varies
Applicability of general GATS obligations (e.g., MFN and transparency) to the electronic delivery of services	No binding decision	Not subject to dispute	Pending	Clearly in force
Applicability of specific commitments to the electronic delivery of services	No binding decision	Affirmed (*US – Gambling*)	Dealt with	Clearly in force
Classification of electronically trade services as mode 1 or mode 2	No binding decision	Potentially: classify as mode 1	Pending?	Not an issue under negative list approach
Classification and scheduling of **new services**	No binding decision	Not subject to dispute	Pending	Not an issue if no relevant limitations listed to market access
Classification of digital products	No binding decision	Not subject to dispute	Pending	US-style e-commerce chapters provide for non-discriminatory trade treatment for digital products, but subject to services chapter commitments
Determining 'likeness' for application of MFN obligations and national treatment commitments	No binding decision	No decision	Pending	Pending but less necessary in negative list context
Application of GATS Article VI (domestic regulations) to digital trade	Yes, but only in principle	Yes, applies to electronic transaction	Dealt with in theory	Later FTAs have specific provisions on data flows, localization, data privacy, etc.
TRIPS Council: Examining the 'protection and enforcement of copyright and related rights; protection and enforcement of trademarks; [and] new technologies and access to technology'[a]	Only discussion	Not subject to dispute	Pending	TRIPS-plus provision for protection of online content

Notes: [a.] WTO work program on electronic commerce (WT/L/274). Para. 4.1; FTA = free trade agreement, GATS = General Agreement on Trade in Services, MFN = most favored nation, TRIPS = Trade-Related Aspects of Intellectual Property Rights, US = United States, WTO = World Trade Organization.
Source: Wunsch-Vincent and Hold (2012) with **P**referential **T**rade **A**greements updates from authors, WTO (1998).

Definition of Digital Products and Non-discrimination Treatment

While the debate on whether digital products should be classified as goods or services at the WTO continues, FTAs moved forward by: i) defining digital products, first as 'products that are digitally encoded and transmitted electronically' (for example, US–Chile), and later expanding the definition to include 'digitally-encoded products that are fixed on physical carriers' (US–Singapore, US–Australia, Korea–Singapore),[30] and ii) deciding to limit duties on and discrimination against digital products.[31] Products such as computer programs, text, video, images and sound recordings fall under this definition. By limiting discrimination against digital products, many FTAs adopted the principle of technological neutrality (that is, a product is the same regardless if delivered offline or electronically) whether expressly or not.[32] The negative list approach in many US-led FTAs has also made the issue of whether electronically traded services should be classified as mode 1 or mode 2[33] superfluous. It also mitigated the general problem of services classification under GATS even though parties could still exclude certain industries through the list of non-conforming measures. For example, in the EU–Canada Comprehensive Economic and Trade Agreement (CETA), audio-visual services in the EU and cultural industries in Canada are not subject to their commitments in the trade in services chapter.

Applicability of Trade Rules to Electronic Supply of Services

Most FTAs recognize that services delivered or performed electronically are subject to the relevant provisions of the chapters on investment, trade in services and financial services, including any obligations, exceptions or non-conforming measures contained therein. In the WTO, two major dispute settlement cases also helped clarify the applicability of GATS to electronic delivery of services. In *US – Gambling* (2005), the appellate body found that cross-border supply of online gambling and betting services fall within the scope of the GATS. In *China – Audiovisuals* (2010), the appellate body ruled that China's commitment on 'sound recording distribution services' include the distribution of sound recordings through electronic means thus affirming technological neutrality in the delivery of the service. The panel and the appellate body in *US – Gambling* (2005) and *China – Audiovisuals* (2010) reaffirmed that mode 1 is applicable to the delivery of electronic services, but did not examine the differences between the two modes in detail.

[30] See also Annex A, Table A4 which indicates the rule-making milestones in e-commerce.
[31] However, FTAs usually provide that the definition of digital product in the agreement does not reflect parties' views on the classification issue of GATT or GATS, and thus keep the issue open for discussion at the WTO.
[32] Japan–Australia FTA Article 13.1.3 expressly recognizes this principle ('The Parties recognize the principle of technological neutrality in electronic commerce').
[33] Mode 1 (cross-border supply) covers services flow from one territory of a member to the territory of another; Mode 2 (consumption abroad) is when a consumer moves into the territory of another member to consume a service. There are more liberalization commitments for mode 2 than mode 1, hence the interest in having trade in digital services under mode 2.

Duty-free Moratorium for Digital Products

WTO members have, so far, maintained their political commitment of not imposing customs duties on electronic transmissions. This commitment, however, is temporary and cannot be legally enforced through dispute settlement. It is also, arguably, effective only because it is not clear how duties on electronic transactions could practically be imposed. It is also uncertain whether the duty-free moratorium applies to the transmitted content (for example, professional services). In contrast, some FTAs provide a clear and permanent duty-free environment on electronic transmissions of 'digital products' as defined in the agreement (for example, FTAs between US–Singapore, US–Chile, Korea–Singapore and EU–Korea).

Cross-border Data Flows

The digital economy is driven by massive cross-border information flows. Sharing data across borders allows business to access global market, interact with customers, communicate with suppliers and affiliates around the globe, and thereby increase efficiency and productivity. However, as discussed in Section 2, some economies impose regulations that restrict the free flow of information for various reasons, including for privacy protection or security.

GATS does not explicitly mention regulations on data flows but more recent FTAs have started to address this increasingly prevalent issue. For example, the US–Korea FTA stipulated that parties 'endeavor to refrain from imposing or maintaining unnecessary barriers to electronic information flows across borders.' The 'weak' language in this FTA does not prohibit restrictions to data flows or data localization measures which the Trans-Pacific Partnership (TPP) sought to address (Box 9). Other localization measures, particularly the requirement to establish a local data center for service supply, are prohibited in the US FTAs with Chile; Singapore and Korea as well as in the Japan–Australia FTA.

Box 9. E-commerce in the Trans-Pacific Partnership Agreement

Despite the current uncertain status of the Trans-Pacific Partnership **(**TPP) agreement, it is worthwhile highlighting its contribution to e-commerce regulations. Many US-led FTAs have increasingly tightened discipline on regulations restricting cross-border data flows (e.g., US–Korea) but the TPP went beyond its previous FTAs by imposing necessity conditions (akin to conditions for sanitary and phytosanitary and non-tariff measures) for data flow restrictions (Article 14.11). It also prohibits a data and server localization requirement as a condition for market access (Article 14.13), likewise with a strict necessity test for public interest regulations. Worth noting, however, is the exclusion of financial services from the e-commerce chapter disciplines, particularly data localization.

Cross-border Transfer of Information by Electronic Means

Under the TPP, parties shall allow the cross-border transfer of information (including personal information) if it is for the 'conduct of the business of covered persons' in the agreement. At the same time, the agreement permits the restrictions on the transfer when the measures are (i) to achieve a legitimate public policy objective; (ii) not applied in a manner that constitute arbitrary or unjustifiable discrimination or a disguised restriction on trade; and (iii) not greater than those required to achieve the objective.

Localization of Computing Facilities, Source Code Transfers or Access

The TPP explicitly bans the requirements to use or locate computing facilities in a party's territory as a market access condition. Likewise, Article 14.17 prohibits the requirement to transfer or provide access to source codes as a condition for import, distribution or sale of the software. The prohibition of localization and source code transfer requirements prevents forced transfer of know-how while allowing the possibility of source code transfers and access, not as a trade requirement, but as part of commercially negotiated arrangements.

Carve-Out of Financial Services Chapter

The e-commerce chapter expressly states that a 'covered person' does not include a 'financial institution' or a 'financial service provider' defined in the financial services chapter. In addition, the term 'digital product' does not include a 'digitized representation of a financial instrument, including money'. Likewise, in the financial services chapter, e-commerce chapter provisions addressing requirements on local presence of computing facilities are not mentioned. Arguably, the financial services carve-out creates a loophole for localization requirement.

Expansion of Intellectual Property Rights Protection

The intellectual property (IP) chapter of the TPP establishes strong enforcement systems for IP infringements.

Source: Based on published text of the TPP agreement.

Financial Services

Financial services, electronic payments in particular, are involved in e-commerce transaction and is an enabler of the digital economy (Box 10). In almost all FTAs, financial services are covered by a separate chapter with its own set of obligations under the trade agreement. With regard to financial services' obligations on data flows, in FTAs such as US–Korea, obligations on data flows include the 'transfer of information in electronic or other form, into and out of its territory, for data processing where such processing is required in the financial institution's ordinary course of business.'[34] The definition of 'financial institution' in recent FTAs (for example, EU–Korea) is expanded to include all financial service suppliers to be allowed to transfer data across national borders. The obligation to allow data transfer, however, does not preclude regulations requiring that copies be stored in local data centers which has the same effect as mandating data localization.

Box 10. Electronic Payment Systems

The rapid development of internet, mobile device and cloud technology has fundamentally transformed the financial industry. In the past, ATM and card payment instruments were the top two innovations in financial services. Recently, companies from a variety of sectors are launching electronic payment services and products including e-check, e-cash (bitcoin) and e-wallet (PayPal, Alipay, Apple Pay, Google Wallet) that can be used and exchanged on social networks or mobile devices. Distributed technologies such as blockchain is expected to revolutionize the financial industry due to its efficiency, relative security, transparency and low transaction costs.

But the arrival of new players also brings regulatory challenges. First, financial services regulations, especially regarding the new payments technology, vary across economies. The varied regulatory regimes can impede the global adoption of financial innovation. Second, regulators need to balance the promotion of competition and financial innovation with the reduction of fraud, money laundering and illegal disclosure of financial information.

Monetary authorities are seeking to understand the ramifications of a wider adoption of the new financial technologies. For example, the United Kingdom's Financial Conduct Authority introduced Project Innovate in 2014 to provide support and explore policies regarding blockchain and other financial technologies (UK Government 2015). The European Commission also adopted the revised Directive on Payment Services (DPS2) in 2015 focusing on electronic and third party payments. International regulatory cooperation is important more than ever to address systemic risks and other issues such as financial crime and data breaches.

Source: Authors' compilation.

[34] Under the US–Korea FTA, a financial institution is a 'financial intermediary or other enterprise that is authorized to do business and regulated or supervised as a financial institution under the law of the Party in whose territory it is located.' This definition is narrower than the term 'financial services supplier' in the WTO.

Intellectual Property Protection

The WTO agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) is technologically neutral and the basic principles 'remain valid in cyberspace' (WTO Council for TRIPS 1999). However, for digital trade purposes, TRIPS does not address certain digital intellectual property (IP) issues such as on the liability of internet service providers (ISPs)[35] in copyright infringement, as well as on internet domain names. Some IP-related issues in the digital environment have been addressed by the World Intellectual Property Organization (WIPO) that shepherded the negotiation of the WIPO Copyright Treaty and the WIPO Performances and Phonograms Treaty dealing with online distribution of copyrighted materials.[36] Many WTO members have acceded to and are also members of WIPO.

Limitations on Liability of Internet Service Providers (ISPs)

ISPs contribute to the digital economy by enabling the spread of information without the gatekeepers' function and limitations, for example, editorial censorship of traditional media. ISPs have traditionally been considered merely as infrastructure providers or internet access facilitators. With the evolution of new online services, internet giants like Amazon, Alibaba, Facebook and YouTube may meet the definition of ISPs as they provide services for users to upload images, videos and documents that might involve copyright or trademark infringements (Edwards 2011).

FTAs led by the US and the EU seek to impose liability on ISPs. Most of them include a so-called 'notice and takedown' mechanism, providing limited liability protection for ISPs after they take down or block access to potentially infringing materials upon copyright owners' notice.

Dispute Resolution for Internet Domain Name

A domain name is an online address that enables internet users to locate a company. When someone falsely registers names of well-known, trademarked brands or entities, consumers may be misled and the value of trademarks diluted. The Uniform Domain Name Dispute Resolution Policy (UDRP), adopted by the Internet Corporation on Assigned Names and Numbers in 1999, has set out a legal framework for domain names in the generic top level

[35] According to Article 18.81 of the Trans-Pacific Partnership (TPP) agreement, an ISP means: (a) a provider of online services for the transmission, routing, or providing of connections for digital online communications, between or among points specified by a user, of material of the user's choosing, undertaking the function in Article 18.82.2(a) (transmitting, routing or providing connections for material without modification of its content (which does not include a modification made as part of a technical process or for solely technical reasons such as division into packets) or the intermediate and transient storage of that material done automatically in the course of such a technical process); or (b) a provider of online services undertaking the functions in Article 18.82.2(c) (storage (or 'hosting'), at the direction of a user, of material residing on a system or network controlled or operated by or for the ISP i.e. include e-mails and their attachments stored in the Internet Service Provider's server and web pages residing on the Internet Service Provider's server) or Article 18.82.2(d) (referring or linking users to an online location by using information location tools, including hyperlinks and directories). For greater certainty, ISP includes a provider of the services listed above that engages in caching carried out through an automated process.

[36] See WIPO Internet Treaties, http://www.wipo.int/copyright/en/activities/internet_treaties.html. See also WIPO (2004).

domains (gTLDs), and some 'country code top level domains' (ccTLDs).[37] US-led FTAs contain provisions that oblige each party to provide an appropriate settlement procedure and remedies for domain name dispute in its own ccTLD, based on the principles of the UDRP.

Enforcement: Civil, Administrative and Criminal Proceedings

To tackle online IP infringements, all listed FTAs in Table A4 (Annex A) (other than the Korea–Singapore FTA) include provisions regarding civil, administrative or criminal procedures and remedies. Specifically, they provide criminal penalties in cases of: (i) willful trademark or copyright infringement on a commercial scale; (ii) knowingly circumventing technological protection measures; and (iii) removing or altering rights management information for commercial purposes. The exceptions are the US–Jordan FTA and the EU Canada CETA that do not require parties to adopt any criminal penalty in IP enforcement, as well as the ASEAN–Australia–New Zealand FTA (AANZFTA) that includes criminal penalties only for willful copyright infringements.

[37] WIPO Arbitration and Meditation Center provide domain name dispute resolution services for 75 ccTLDs, see http://www.wipo.int/amc/en/domains/cctld/. Another dispute resolution mechanism for domain name is the Uniform Rapid Suspension System (URS) that applies to new gTLDs, i.e., not to .com, .net, .org and other traditional top-level domains. It is envisioned as a cheaper and faster approach for settling dispute, but unlike the UDRP which allows for the transfer of the domain name to itself (i.e., to the complainant), the URS only provides for a temporary suspension of the problematic domain name (www.gigalaw.com). Dispute resolutions will be facilitated by the Trademark Clearinghouse, a global repository for trademark data. The Trademark Clearinghouse informs trademark holders if someone has registered a matching domain name to theirs (http:www.newgtlds.icann.org).

6. SUMMARY AND RECOMMENDATIONS

This paper discusses a framework for understanding the digital economy using a value chain approach. It discusses the opportunities spawned by digital technologies, particularly on inclusion, as well as the challenges and risks to various layers of the internet ecosystem. In particular, it discusses those challenges related to privacy and security, international taxation, and competition issues derived from the network characteristics of most digital industries. The paper also tackles the enablers of growth in digital economy, particularly the physical, human and regulatory infrastructure that facilitates the growth of the digital economy. Finally, the paper discusses the limitations of existing WTO rules for trade in digital products and the emerging rules on e-commerce from various preferential trade agreements.

Where should APEC go from here? Acknowledging that the myriad and complex issues surrounding the internet cannot be exhaustively discussed in one quick survey, further dialogue needs to take place, particularly involving stakeholders from the private sector as well as other organizations that either have established thought leadership in digital economy discussions or are intimately connected with the development of multilateral rules affecting the internet ecosystem. Examples are the World Economic Forum, the International Telecommunications Union, the International Engineering Task Force, the Internet Society and the OECD, to name a few. The issues on digital trade go beyond the capacity and mandate of APEC because of the complexity of the internet ecosystem but to understand how digital trade is ultimately affected, it is important to get an enhanced appreciation of other challenges and multilateral efforts that seek to protect the openness, security, trustworthiness and inclusiveness of the internet by working on specific aspects related to various layers of the internet ecosystem. Put another way, regular dialogue needs to take place with various internet actors and stakeholders, not just with users, that is, business enterprises, but importantly, with policymakers and technical experts that impact the ultimate structure of the internet system.

Additionally, for capacity building activities or public–private sector dialogues, discussion can include the following topics.

- **Opportunities and Risks in the Digital Economy**

A dialogue on the various emerging developments in the digital economy such as artificial intelligence (AI), robotics, 3D printing, blockchains, biotechnology, neuroscience and computing, to name a few, and how they can improve quality of life. The dialogue can discuss how these technologies could disrupt business models as well as their potential social impact. This topic alone will need several rounds of policy dialogue to be able to cover as many emerging technologies and their potential advantages and risks.

- **Emerging Data Regulations and Rules in Trade Agreements**

Capacity building or policy dialogue on understanding data privacy and security regulations, company responses to strengthen data security, and the emerging rules on e-commerce and the

internet would be another useful topic for discussion. For example, it would be useful to discuss frameworks on how to assess when policies are appropriate or least trade restrictive for achieving a legitimate policy objective.

- **Net Neutrality**

APEC officials should be able to understand the debate over net neutrality, its advantages and disadvantages, as well as the short- and long-term impact on the digital industry.

- **Platform Economics, Competition Policy, Systemic Risks**

How best to regulate industries that generate innovations and efficiencies through networks but which tend to morph into dominant market players is another topic for discussion. Likewise, with the digital industry tending toward concentration or dependency on a few digital service providers, how should economies address systemic risks if problems arise in any one of these providers? The APEC Economic Committee has started to examine the competition policy aspects of platforms and internet innovations, which it should continue.

- **Fiscal Taxation of Digital Businesses**

Economies need to understand ongoing discussions on the limitations of existing made-for-manufacturing international tax frameworks for digital businesses where 'established presence' is not necessary to do business in any jurisdiction. APEC economies too would need to address the potential loss of revenues from profit shifting even as digital trade grows.

- **Mutual Legal Assistance Treaties**

How to access data across jurisdictions for law enforcement purposes is another big topic. How should new international conventions for cooperation be drafted and how will this impact data privacy regimes in each economy?

- **Walled Gardens, Geo-blocking, Standards and Interoperability**

How will the naming and numbering systems enable the blocking of content and arguably, affect freedom of expression even as it may also be sometimes used for intellectual property rights protection. How do proprietary technical standards endanger interoperability, especially in the internet of things.

- **Impact of Digital Transformation on Jobs and Work**

This discussion dovetails with the topic of risks and opportunities in the digital economy. The question needs be asked what jobs are likely going to be replaced by AI or robots, and the necessary skills or training that economies, even now, should be providing its citizens. Capacity building activities are relevant in this area.

- **De-globalization and Growth Trajectories of Emerging Economies**

With digital technology, outsourcing could be rendered out of date and developed economies would have more near-shore or onshore production activities. How will this impact the growth trajectory of emerging economies that rely on low labor costs and what will be its social impact?

- **Digital Application for MSMEs which Enhance their Competitiveness and Resilience**

Micro, small and medium enterprises (MSMEs) that adopt new technologies and digital applications have the opportunity to access future markets. APEC should discuss ways to equip MSMEs with tools that ensure digital competitiveness and resilience to survive in a fast-changing digital age. This includes facilitating access to information on local e-commerce markets and relevant e-commerce policies to expand economic opportunities.

- **Allocation of Liabilities**

Much of the existing legal framework was not made for the digital age. Thus, for example, whose liability would it be if the AI or robot malfunctions or an autonomous vehicle causes an accident or, if patients are given a wrong diagnosis due to a wrong algorithm?

- **Building of More Digital Opportunity Centers across Developing Members of APEC**

Last but not least, if APEC wants to be easily understood by the ordinary person on the street and its inclusion objective is to yield an outcome that is tangible, establishing APEC-funded digital opportunity centers would be a worthwhile plan. The digital opportunity centers will be where out-of-school young people or low-income individuals can be taught the basics of the internet, learn to appreciate the benefits it brings and effectively participate in the opportunities that the internet offers.

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ANNEXES

Annex A

Table A1. Infrastructure Dataset

Economies	Number of Secure Internet Servers (per million people), 2015	International Internet Bandwidth (kb/s per user), 2016	Electricity Production (kWh/capita), 2016	Cost of Electricity (USD/kWh), 2015
Australia	1460.9	75.1	10765.5	0.5
Brunei Darussalam	203.2	NA	NA	NA
Canada	1308.8	129.2	18539.2	NA
Chile	145.1	73.1	4157.1	0.3
China	10.1	5.0	4005.2	0.1
Hong Kong, China	904.5	3721.8	5447.7	0.3
Indonesia	8.0	6.2	858.0	NA
Japan	971.0	48.6	8155.2	0.3
Korea	2319.6	45.2	10710.8	NA
Malaysia	103.8	27.2	4695.3	NA
Mexico	39.2	20.9	2400.8	0.2
New Zealand	1298.6	95.1	9737.7	0.2
Papua New Guinea	11.0	NA	NA	0.3
Peru	32.4	36.4	1419.0	0.1
The Philippines	13.7	27.7	771.4	0.3
Russia	126.4	29.9	7369.6	NA
Singapore	932.1	616.5	8883.5	0.2
Chinese Taipei	NA	60.4	10646.5	0.2
Thailand	30.4	54.8	2456.7	NA
United States	1649.9	71.0	13544.8	0.2
Viet Nam	14.8	20.7	1416.0	NA

Economies	Quality of Electricity Supply (1 = poor 7 = excellent), 2016–2017	Average Connection Speeds (IPv4) for Mobile Connections, Q4 2016	Average Connection Speed (Ipv4), Q4 2016	Mobile Tariff (PPP$/min)/per capita GDP, PPP (current international $), 2015
Australia	6.4	13.8	10.1	2.01206E-06
Brunei Darussalam	5.3	NA	NA	NA
Canada	6.5	10.3	14.9	5.16521E-06
Chile	5.9	5.9	8.6	1.2817E-05
China	5.3	7.4	6.3	3.90451E-06
Hong Kong, China	6.8	7.2	21.9	3.79207E-07
Indonesia	4.2	9.8	6.7	2.67567E-05
Japan	6.5	13.3	19.6	8.96379E-06
Korea	6.2	12.7	26.1	3.99534E-06
Malaysia	5.8	3.9	8.2	8.6088E-06
Mexico	4.9	7.6	7.2	7.21536E-06
New Zealand	6.3	12.5	12.9	8.95766E-06
Papua New Guinea	NA	NA	NA	NA
Peru	4.9	6.7	5.6	2.56012E-05
The Philippines	4.0	14.3	4.5	4.89942E-05
Russia	5.0	9.5	11.6	4.97712E-06
Singapore	6.8	9.9	20.2	2.13976E-06
Chinese Taipei	6.0	12.0	15.6	4.91107E-06
Thailand	5.1	7.1	13.3	6.29948E-06
United States	6.5	7.9	17.2	4.85047E-06
Viet Nam	4.4	4.3	8.3	2.00737E-05

Table A1. (cont.) Infrastructure Dataset

Economies	Fixed Broadband Tariffs (PPP$/month)/per capita GDP, PPP (current international $), latest year available	Share of ccTLD-Sites Hosted Onshore (%), 2017
Australia	0.000738	65
Brunei Darussalam	NA	74
Canada	0.000858	45
Chile	0.002285	58
China	0.002343	74
Hong Kong, China	0.000531	77
Indonesia	0.005102	66
Japan	0.000503	91
Korea	0.001009	97
Malaysia	0.001722	69
Mexico	0.001244	22
New Zealand	0.001371	66
Papua New Guinea	NA	33
Peru	0.003113	24
The Philippines	0.007530	26
Russia	0.000664	67
Singapore	0.000333	57
Chinese Taipei	0.000334	78
Thailand	0.003423	85
United States	0.000582	78
Viet Nam	0.000439	93

Table A2. Dataset of Factors Affecting 'Supply'

Economies	Quality-adjusted Years of Education, 2016	Tertiary Gross Enrolment Ratio (%), latest available year	Quality of Math and Science Education (1=poor 7=excellent), 2016–2017	Availability of Scientists and Engineers (1=poor 7=excellent), 2016–2017
Australia	8.8	86.6	4.9	5.0
Brunei Darussalam	5.9	31.7	4.7	3.8
Canada	10.8	58.9	5.3	5.4
Chile	5.6	86.6	3.2	4.7
China	4.3	39.4	4.5	4.7
Hong Kong, China	9.4	68.8	5.5	4.3
Indonesia	4.8	31.1	4.4	4.5
Japan	7.7	62.4	5.2	5.5
Korea	7.8	95.3	4.7	4.4
Malaysia	8.2	29.7	5.2	5.3
Mexico	2.7	29.9	2.9	4.1
New Zealand	9.2	80.9	5.3	4.7
Papua New Guinea	NA	1.9	NA	NA
Peru	2.3	40.5	2.5	3.4
The Philippines	4.9	35.8	3.9	3.8
Russia	5.9	78.7	4.5	4.1
Singapore	10.8	NA	6.4	5.2
Chinese Taipei	8.1	83.7	5.2	4.7
Thailand	3.8	52.5	3.9	4.1
United States	10.1	86.7	4.7	5.5
Viet Nam	3.2	30.5	3.9	3.8

Economies	Ease of Access to Loans (1=poor 7=excellent), 2016–2017	Time to Export: Border Compliance (hours), 2016	Time to Enforce Contract (no. of days), 2016	Cost to Enforce Contract (% of claim), 2016	Intellectual Property Protection (1=poor 7=excellent), 2016–2017
Australia	5.1	36	395	21.8	5.8
Brunei Darussalam	3.6	117	540	36.6	4.3
Canada	4.7	2	910	22.3	5.9
Chile	4.8	60	480	28.6	4.3
China	4.5	26	458	16.3	4.3
Hong Kong, China	4.5	19	360	21.2	6.0
Indonesia	4.7	53	485	112.7	4.3
Japan	5.3	23	360	23.4	5.9
Korea	3.5	13	290	12.7	4.4
Malaysia	4.7	48	425	37.3	5.3
Mexico	3.8	20	322.5	31.95	4.2
New Zealand	5.7	38	216	27.2	6.1
Papua New Guinea		42	591	110.3	
Peru	4.4	48	426	35.7	3.6
The Philippines	4.3	42	842	31	4.0
Russia	3.0	96	335	17.5	3.3
Singapore	5.5	12	164	25.8	6.3
Chinese Taipei	5.4	17	510	17.7	5.2
Thailand	4.5	51	440	19.5	3.3
United States	5.3	2	432.5	32.45	5.9
Viet Nam	3.6	58	400	29	3.7

Table A3. Dataset of Factors Affecting 'Demand'

Economies	ICT Development Index, 2016	Applicable de minimis Value (USD), 2016	Smartphone Ownership (adults) (%), 2015	Population with Financial Account (%), 2014
Australia	8.2	756	77	98.9
Brunei Darussalam	5.3	295	NA	NA
Canada	7.6	15	67	99.1
Chile	6.4	30	65	63.3
China	5.2	320	58	78.9
Hong Kong, China	8.5	NA	83	96.1
Indonesia	3.9	50	21	36.1
Japan	8.4	90	39	96.6
Korea	8.8	150	88	94.4
Malaysia	6.2	128	65	80.7
Mexico	4.9	50	35	39.1
New Zealand	8.3	272	NA	99.5
Papua New Guinea	NA	NA	NA	NA
Peru	4.4	200	25	29.0
The Philippines	4.3	0.33	22	31.3
Russia	7.0	119	45	67.4
Singapore	8.0	296	NA	96.4
Chinese Taipei	NA	93	57	91.4
Thailand	5.2	28	NA	78.1
United States	8.2	800	72	93.6
Viet Nam	4.3	40	35	31.0

Economies	Adult Population with Credit Card (%), 2014	Freedom on the Net (0=best, 100=worst), 2016	Population using Internet to make Payments and Buy (%), 2014	Fixed Broadband Subscriptions per 100 inhabitants, 2015
Australia	58.6	21	68.2	28.5
Brunei Darussalam	NA	NA	NA	8.0
Canada	77.1	16	65.7	36.3
Chile	28.1	NA	14.6	15.2
China	15.8	88	19.2	19.8
Hong Kong, China	64.3	NA	36.3	32.1
Indonesia	1.6	44	5.1	1.1
Japan	66.1	22	36.1	30.7
Korea	56.0	NA	52.5	40.2
Malaysia	20.2	45	18.8	10.0
Mexico	17.8	38	6.0	11.6
New Zealand	61.4	NA	71.7	31.6
Papua New Guinea	NA	NA	NA	0.2
Peru	11.7	NA	2.8	6.4
The Philippines	3.2	26	3.5	4.8
Russia	21.0	65	17.5	18.9
Singapore	35.4	41	27.6	26.4
Chinese Taipei	54.9	NA	36.0	24.3
Thailand	5.7	66	4.4	9.2
United States	60.1	18	64.7	31.0
Viet Nam	1.9	76	9.1	8.1

Table A3. (cont.) Dataset of Factors Affecting 'Demand'

Economies	Mobile Broadband Subscriptions per 100 Inhabitants, 2016	Online Population Using Social Networking (% reach of online population), 2011
Australia	112.9	96
Brunei Darussalam	4.5	NA
Canada	56.3	94
Chile	57.6	94
China	56.0	53
Hong Kong, China	107.0	93
Indonesia	42.1	94
Japan	126.4	58
Korea	109.7	87
Malaysia	89.9	94
Mexico	50.4	96
New Zealand	114.2	95
Papua New Guinea	NA	NA
Peru	36.7	96
The Philippines	41.6	96
Russia	71.3	88
Singapore	142.2	94
Chinese Taipei	66.9	94
Thailand	75.3	NA
United States	109.2	98
Viet Nam	39.0	85

Table A4. Evolution of Rule-making in Free Trade Agreements

Issues\FTAs		ASEAN–AUS–NZ FTA	US–JOR FTA	ROK–SGP FTA	EU–ROK FTA	EU–CDA CETA	JPN–AUS FTA	US–CHL FTA	US–SGP FTA	US–ROK FTA	TPP
Strength of rules on digital trade		Low ---------->				Medium	<----------				High
Date of signature/Entry into force		2009/ 2010	2000/ 2001	2005/ 2006	2010/ 2011	2014/ pending	2014/ 2015	2003	2003/ 2004	2007/2 012	2015/ pending
E-commerce and Services	Recognizing the applicability of WTO rules to e-commerce	-	✓	✓	✓	✓	-	-	✓	✓	-
	Applicability of trade rules to electronic supply of services	✓	-	✓	-	-	-	✓	✓	✓	✓
	Duty-free moratorium for digital products	-	✓	✓	✓	✓	✓	✓	✓	✓	electronic transmissions*
	Non-discrimination for digital products		-	✓	-	-	✓	✓	✓	✓	✓
	Free cross-border data flow (except for financial data)	-	-	-	-	-	-	-	-	Δ	✓
	Prohibition on local presence of computing facilities	-	-	-	-	-	-	-	-	-	✓
	Prohibition on local presence of offices and persons	-	-	✓	-	-	✓	✓	✓	✓	✓
Financial Services	Free cross-border financial data flow	✓	-	-	✓	✓	✓	-	-	✓	✓
	Prudential Exception for financial stability and integrity	✓	-	✓	✓	✓	✓	✓	✓	✓	✓
Intellectual Property	Limitations on liability of internet service providers	-	-	-	✓	✓	✓	✓	✓	✓	✓
	Dispute resolution for internet domain name	-	-	-	-	-	-	✓	✓	✓	✓
	Enforcement: civil, administrative and criminal	Δ	Δ	-	✓	Δ	✓	✓	✓	✓	✓

Notes: AUS = Australia; CDA= Canada; CHL= Chile; JPN = Japan; JOR = Jordan; ROK = Korea; NZ = New Zealand; SGP = Singapore; US = United States. FTA = free trade agreement, *Certainty that it includes content. '✓': addressed by the agreement; '-': silence on the issue; 'Δ': not addressed fully.

Annex B. Data Notes and Sources for Digital Enablers Index

Infrastructure

- *Number of secure internet servers* (per million people), 2015
  Data for Chinese Taipei is not available.
  Source: World Bank World Development Indicators

- *International internet bandwidth* (kb/s per user), 2016
  APEC data excludes Brunei Darussalam and Papua New Guinea.
  Chinese Taipei international internet bandwidth data is from World Economic Forum.
  Source: International Telecommunication Union

- *Electricity production* (kWh/capita), 2016
  APEC data excludes Brunei Darussalam and Papua New Guinea.
  Source: World Economic Forum Networked Readiness Index Historical Dataset 2012–2016

- *Cost of electricity* (USD/kWh), 2015
  APEC data covered Australia; Chile; China; Hong Kong, China; Japan; Mexico; New Zealand; Papua New Guinea; Peru; The Philippines; Singapore; Chinese Taipei; and United States.
  Source: Deutsche Bank, 2015

- *Quality of electricity supply* (1=poor 7=excellent), 2016–2017
  APEC data excludes Papua New Guinea.
  Source: World Economic Forum Global Competitiveness Index Historical Dataset 2006–2016

- *Average Connection Speeds* (IPv4) *for Mobile Connections*, Q4 2016
  APEC data excludes Brunei Darussalam and Papua New Guinea. IPv4 = Internet Protocol version 4
  Source: State of the Internet Report, Akamai

- *Average Connection Speed* (IPv4), Q4 2016
  APEC data excludes Brunei Darussalam and Papua New Guinea.
  Source: State of the Internet Report, Akamai

- *Mobile tariff* (PPP$/min)/*per capita GDP*, PPP (current international $), 2015
  APEC data excludes Brunei Darussalam and Papua New Guinea. Chinese Taipei GDP, PPP (current international $), 2015 data from Knoema.com.
  Source: World Economic Forum Networked Readiness Index Historical Dataset 2012–2016 and World Bank World Development Indicators

- *Fixed broadband tariffs* (PPP$/month)/*per capita GDP*, PPP (current international $), 2015
  APEC data excludes Brunei Darussalam and Papua New Guinea. Chinese Taipei GDP, PPP (current international $), 2015 data from Knoema.com.
  Source: World Economic Forum Networked Readiness Index Historical Dataset 2012–2016 and World Bank World Development Indicators

- *Share of ccTLD-sites hosted on shore* (%), 2017
  Source: Pingdom

Factors Facilitating 'Supply'

- *Quality-adjusted years of education*, 2016
  Source: World Bank World Development Report 2016

- *Tertiary gross enrolment ratio* (%), latest available year
  APEC data excludes Singapore.
  Source: UNESCO Institute for Statistics (accessed 28 March 2017).

- *Quality of math and science education* (1=poor 7=excellent), 2016-17
  APEC data excludes Papua New Guinea.
  Source: World Economic Forum Global Competitiveness Report 2016-17

- *Availability of scientist and engineers* (1=poor 7=excellent), 2016-17
  APEC data excludes Papua New Guinea.
  Source: World Economic Forum Global Competitiveness Report 2016-17

- *Ease of access to loans* (1=poor 7=excellent), 2016-17
  APEC data excludes Papua New Guinea.
  Source: World Economic Forum Global Competitiveness Report 2016-17

- *Time to export: Border compliance* (hours), 2016
  The most recent round of data collection for the project was completed in June 2016.
  Source: World Bank Ease of Doing Business Database 2016

- *Time to enforce contract* (# of days), 2016
  The most recent round of data collection was completed in June 2016.
  Source: World Bank Ease of Doing Business Database 2016

- *Cost to enforce contract* (% of claim), 2016
  The most recent round of data collection for the project was completed in June 2016.
  Source: World Bank Ease of Doing Business Database 2016

- *Intellectual Property Protection* (1=poor 7=excellent), 2016-17
  APEC data excludes Papua New Guinea.
  Source: World Economic Forum Global Competitiveness Report 2016-17

Factors Facilitating 'Demand'

- *ICT development index*, 2016
  APEC data excludes Papua New Guinea and Chinese Taipei.
  Source: International Telecommunication Union

- *Applicable de minimis value* (USD), 2016
  For economies with more than one value, the lowest value is regarded as the de minimis value. Specifically for China, although the de-minimis value is CNY 2000 (USD $320) per single cross-border transaction, there is a maximum of CNY20,000 per person per year. APEC data excludes Hong Kong, China and Papua New Guinea.
  Source: Global Express Association, 2016 and China Ministry of Finance

- *Adults who own smartphone* (%), 2015
  APEC data is only available for Australia; Canada; Chile; China; Indonesia; Japan; Korea; Malaysia; Mexico; Peru; Philippines; Russia; United States; and Viet Nam.
  Hong Kong, China data from the Thematic Household Survey conducted during May-Aug 2015. Chinese Taipei data from National Communications Commission, Q3 2016
  Source: Pew Research Center; Spring 2015 Global Attitudes Survey.

- *Population with financial account* (%) , 2014
  APEC data excludes Brunei Darussalam and Papua New Guinea. Share of population age 15+ with an account in 2014.
  Source: World Bank Global Findex Database

- *Adult population with credit card* (%), 2014
  APEC data excludes Brunei Darussalam and Papua New Guinea. Credit card ownerships in 2014 (% age 15+).
  Source: World Bank Global Findex Database

- *Freedom on the net* (0=best, 100=worst), 2016
  Source: Freedom House

- *Population using internet to make payments and buy* (%), 2014
  APEC data excludes Brunei Darussalam and Papua New Guinea. Share of population age 15+ that used internet to pay bills or buy things in 2014.
  Source: World Bank Global Findex Database

- *Fixed broadband subscriptions per 100 inhabitants*, 2015
  Source: International Telecommunication Union

- *Mobile broadband subscriptions per 100 inhabitants*, 2016
  Data for Chinese Taipei refers to latest available year and is obtained from World Economic Forum Networked Readiness Index Historical Dataset 2012-2016. Data for Papua New Guinea is not available.
  Source: International Telecommunication Union

- *Online Population Using Social Networking (% reach of online population),* 2011
  APEC data excludes Brunei Darussalam; Papua New Guinea; and Thailand.
  Source: comScore