

APEC Fintech E-payment Readiness Index

Ecosystem Assessment and Status Report

supported by PayPal

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Preface

The **APEC Fintech E-payment Readiness Index: Ecosystem Assessment and Status Report** is a joint study by the Australian APEC Study Centre at RMIT University and TRPC, a specialist technology research consultancy, based out of Singapore, with offices in Hong Kong, Beijing and Sydney. PayPal generously supported the development of the report for both the 2015 report and the 2016 report.

The study assesses the level of readiness and future potential of the 21 APEC economies to engage in, adopt and reap the broad range of economic and societal benefits that e-payments hold, and to which the role of Fintech is of critical importance. The report was undertaken with a view to testing the assumption that there is a strong and growing link between e-payment penetration and economic growth. And that, any such link was worth identifying and beginning to measure, along with a canvassing of the barriers to e-payment adoption across the various APEC economies.

APEC economies constitute an important regional economic bloc, representing over 40% of world trade and 50% of global GDP. As the study attests, these economies are undergoing a profound transition towards cashless societies, driven by the spread of mobile devices, increasing access to the Internet, and the emergence of digital payments. The study provides a timely snapshot of e-payment adoption, and serves as an early guide on accelerating digitization of payments in line with APEC's founding objectives of trade facilitation, regional integration and economic prosperity for all. More crucially, the report also helps policymakers assess to what extent their economies are e-payments ready, and identifies what areas are in need of improvement.

While e-payments have long been discussed within a few specific fora of the APEC system, their wide-ranging benefits are only beginning to be appreciated outside the technology sector. Not surprisingly therefore, a cross-sectoral approach within APEC to systematically measure the economic impact of the transition towards e-payments has been lacking. At the time of writing, however, the APEC Business Advisory Council (ABAC) Asia Pacific Financial Forum (APFF) has initiated the process of creating an e-payments sub-group. The study can, therefore, serve as a reference point to track the region's progress and invite collaboration from various members in the effort to improve on e-payments readiness and impact measurement.

To estimate the macro-economic impact of open access to e-payments on APEC economies, the report begins with a proof-of-concept econometric modelling using sample data from six APEC economies. The heart of the report is the APEC E-payment Readiness Index, comprising 44 indicators across four pillars making up the e-payment ecosystem that measure the attractiveness of their physical and regulatory environments, current and potential demand, and their capacity to innovate. This latest report is improved by fine-tuning the indicators used in order to better represent existing and potential demand of e-payments, as well as incorporating the use of the latest available data.

As the findings from the index show, smartphones and e-commerce are set to drive e-payment adoption in the future and in this context, the role of governments in developing economies is critical if e-payments are to forge ahead. Governments need to ensure their regulatory and business environments are conducive for innovation and seamless transactional flows with the region. The report also argues that governments need to show leadership, especially in emerging economies, by promoting a shift to digital within public finances, and to work with stakeholders from the private sector and the international development community.

This report illustrates key considerations and potential pathways for expanding e-payment adoption across APEC economies. The authors hope that the APEC E-payment Readiness Index 2016 will contribute to the development of seamless electronic payments, expanding the overall market, and increasing the shared prosperity of all APEC economies.

Executive Summary

E-payments hold a broad range of promises for individuals, communities and economies at large. Adaptation to digital transactions is already having a transformative impact on societies through a lowering of transaction costs, particularly for SMEs, and thereby adding to productivity, economic growth and social benefits. Constraining transaction flows, through restrictions on access to e-payments – whether intentional or not – can be shown to dampen economic growth, social equity and equality, and innovation. However, this study finds that Asia Pacific Economic Cooperation (APEC¹) economies' level of advancement and experience in the development of an e-payment ecosystem varies widely. Realising the full potential of e-payments will require more flexible regulatory and business climates along with coordinated and sustained efforts from governments, the private sector and the international development community to foster adoption.

This study set out to illustrate the linkages between e-payment penetration and economic growth, canvassing where barriers exist for each APEC economy. To estimate the macro-economic impact of open access to electronic payments on APEC economies, a proof-of-concept exercise was conducted at the outset of the study. Using sample data from six APEC economies, the study found that **a 1% change in online retail sales is associated with at least a 0.175% growth in Gross Domestic Product (GDP) per capita among these six APEC economies**. This is a substantive finding and calls for a follow up and more substantive and empirically based survey of e-payments access and opportunities across APEC economies.

Next, an **APEC E-payment Index**, comprising four pillars and 44 indicators, was constructed to gauge the readiness and capacity of each of the 21 APEC economies to engage in e-payment (including both e-payment and m-payment services), and to further develop their overall e-payment ecosystem. Building from this Index the study also uses a series of case studies of selected economies – Australia, Indonesia, Hong Kong China, and the Philippines – to illustrate key contributing factors to the prospects for e-payment adoption and development.

Key trends and insights that emerged from the Index and case studies are as follows:

- While economies can *generally* be seen to rank in accordance with their income bracket (GDP per capita), **the level of economic growth is not the sole determinant of e-payment readiness or adoption** in a given economy. Indeed, some middle-income economies, such as Malaysia, and China, with a favourable business climate and solid infrastructure, are punching above their weight, while some high-income economies, such as the Republic of Korea and Japan, fall below where they would otherwise be expected, due to a restrictive regulatory environment and a lack of certain consumer demand. *This suggests that, by focusing on e-payments, an economy can boost economic growth and effectively 'leapfrog' in its development trajectory.*
- Further developing this issue, the E-payment Index shows that **APEC economies are largely divided into three clusters according to readiness and capacity for e-payment usage and adoption**. The clusters can be summarised as follows:

¹ The 21 APEC economies are: Australia, Brunei Darussalam, Canada, Chile, China, Hong Kong China, Indonesia, Japan, Republic of Korea, Malaysia, Mexico, New Zealand, Papua New Guinea, Peru, Philippines, Russia, Singapore, Chinese Taipei, Thailand, United States of America and Vietnam.

- **Cluster 1: Economies with advanced e-payment ecosystems** (“Advanced”) – United States of America, Singapore, Canada, Australia, New Zealand, Republic of Korea, Hong Kong China, and Japan
- **Cluster 2: Economies with transitioning e-payment ecosystems** (“Transitioning”) – Chinese Taipei, Malaysia, Brunei Darussalam, China, Russian Federation, and Chile
- **Cluster 3: Economies with nascent e-payment ecosystems** (“Nascent”) – Thailand, Peru, Mexico, Indonesia, Philippines, Vietnam, and Papua New Guinea

- Notably, no single APEC economy trumps in all pillars of the Index. Of the four pillars that comprise the Index, Singapore comes first in Regulatory & Policy, Korea tops the list in Infrastructure, New Zealand scores highest in Demand, while the United States excels in Innovative Products & Services. This means that every economy has aspects it can improve in order to reap the benefits that e-payments can bring. Even more significantly, no single economy trumps in more than one pillar. This also implies that while sequencing of structural shifts that takes place may be important, there is no single pathway or a roadmap for those in the lower clusters to climb up the ranking. **Every economy will have a unique combination of focus areas to strategically and successfully shift to e-payments.**
- The results also show that while access to formal financial systems, such as banking including credit and debit card usage, is important today, **future growth will come disproportionately from emerging economies using affordable smartphones and other mobile devices.** Economies such as Indonesia and the Philippines, while still cash dependent, are showing not only a remarkably high propensity to go online, engage in social media and shop via smartphones, but a large proportion are entering the formal financial market because of these devices, and potentially bypassing traditional platforms such as credit cards. **Rapidly expanding e-commerce sectors in these economies will often lead and further drive the development and usage of e-payments in coming years.**
- No matter the stage of development of the e-payment ecosystem, **facilitating an attractive market (including business) climate, and investments into innovative e-money solutions is important.** Some developing economies, such as Indonesia and the Philippines, are forging ahead in innovations such as FinTech and cryptocurrencies to capitalise on their growing middle class’ propensity to spend and transact via mobile devices.
- Government, as a huge provider and consumer of payments, has an important role to play in accelerating the digital transition, especially in economies across the lower clusters. **Government efforts and initiatives to transition to electronic payments creates demand and new opportunities, including new needs for payment infrastructure and a change in consumers’ cash dependence.** As governments cease to accumulate, and produce, cash and increasingly move to electronically disbursing citizen funds – to bank branches, ATMs, or other cash-out points – recipients will be incentivized to participate.

In terms of specific areas of the APEC E-payment Index, the findings are as follows:

Regulatory and Policy Environment: Many economies need to focus on fostering a favourable regulatory and policy environment to enhance the confidence of businesses and consumers. Therefore, government's vision and efforts to make use of e-payments to improve transparency, efficiency and accountability in its own finances can kick-start a virtuous cycle of adoption.

Infrastructure: The gap or divide between high-income, upper-middle-income and lower-middle-income economies is most obvious in the infrastructure pillar and bridging the digital divide will be essential to fully leveraging the opportunities in e-payments. This includes increasing smartphone penetration and broadband access and affordability. Focusing on availability and affordability of basic financial services is key in driving e-payments.

Demand: Demand for e-payment to date is more prominent in advanced economies where the majority of the population are likely to have bank accounts – but that trend is likely to change soon. Rapid uptake of mobile phones, social media and e-commerce in developing economies will facilitate market growth for e-payment and m-payment.

Innovation: Innovations especially in mobile and virtual currencies in overcoming infrastructure challenges are contributing to higher uptake of e-payment and m-payment services, and are acting as gateways into the financial system for unbanked – or under-banked – consumer segments. Governments need to embrace cryptocurrency, while also providing much needed consumer protection and mitigating illicit activities, to be able to benefit from the potential to plug consumers to global payments systems. As the number of non-bank players in the e-payment system increases, particularly in developing m-payment solutions, there is a need for collaboration among banks and non-banks in order to accelerate innovation. There is also a need for regulatory coordination in the region to support this endorsement.

1. Introduction

Electronic payments, or e-payments, have been making ever-increasing inroads into transactions since the 1950s beginning with the advent of general-purpose payment cards. Technology developments, particularly the increasing pervasiveness of the Internet and mobile phones, have paved the way for the current proliferation of e-payment methods. E-payments now range from standard bank transfers and card payments, to Internet-based consumption and transactions, to mobile wallets, and on to virtual currency exchanges such as cryptocurrencies and distributed ledger technologies. Common use cases of digital payments have stretched beyond traditional retail and peer-to-peer (P2P) payments and now include government-to-people (G2P) payments, cross-border remittances, transportation, and in-app purchases on smart phones.

With such variety e-payments hold a broad range of promises for individuals, communities, and especially for developing economies and small and medium-sized enterprises (SMEs) that have typically been left behind by the brick-and-mortar model of financial services. Mobile money, for example, can extend financial access to the unbanked, enabling them to transfer funds conveniently and safely, while online and mobile payments enable SMEs to expand market reach and engage in cross border trade by offering fast, secure and predictable flows of funds. For governments, digitized payments enable far more effective disbursements of funds such as pensions, salaries and social welfare payments, increasing reach and transparency, reducing corruption, and ensuring accountability.

Despite its potential, the pace of e-payments adoption is still constrained in many parts of the world. Out of the two billion people without access to formal financial services, 1.12 billion are from Asia Pacific, where cash still remains the preferred medium of payment.² Moreover, differing regulatory frameworks across the region along with different definitions of what constitutes payments – or what is a payments *business* – constrain cross-border e-payments.

This paper is premised around a simple hypothesis: that by increasing open access to payments (i.e. removing constraints on payments access) there will be a corresponding growth in economic development (GDP).

The purpose of this study therefore is to look into the trends and differences, to examine the status of e-payment penetration across the APEC economies, and the level of advancement of each economy's e-payment ecosystem for supporting future development and adoption. In so doing, the study provides a roadmap of potential pathways and key considerations for expanding e-payment adoption across APEC economies, and thus being able to realise the socioeconomic benefits that adoption can bring.

The study is divided into two distinct components:

1. **The APEC E-payment Index**, gauging the readiness and capacity of each of the 21 economies that comprise APEC to engage in e-payment, to use both e-payment and m-payment services, and to further develop their overall e-payment ecosystem. The 2016 APEC E-payment Index has fine-tuned 19 indicators out of the 44 used with newer statistics or more relevant indicators that have become available since the publication of the 2015 APEC E-payment Index.

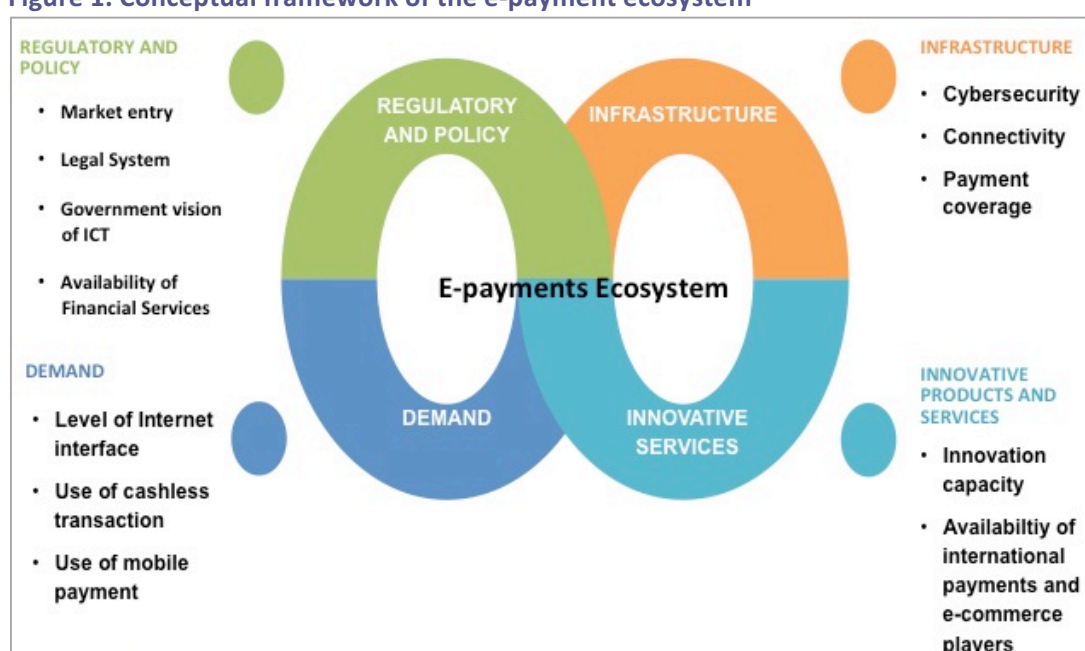
² Asia Pacific here refers to East Asia, South Asia and the Pacific according to the GSMA classification. For more information, see GSMA (2016) 2015 The State of the Industry Report: Mobile Money.

2. **Case studies** of selected economies – including both advanced and emerging economies – to illustrate key contributing factors, and the prospects of e-payment adoption and development.

Conceptual Framework

In order to estimate e-payment readiness this study developed an Index aggregating and then ranking a variety of factors contributing to a healthy e-payment ecosystem. The APEC E-payment Index is based on four ‘pillars’ of this ecosystem: i) the Regulatory and Policy Environment, ii) Infrastructure, iii) Demand and Use, and iv) Innovative Products and Services (or the supply-side of the e-payment ecosystem) (see Figure 1). Using these four pillars, the Index examines the readiness of APEC economies to adopt and utilise e-payments, as well as their future development potential (see Appendix 2 for the methodology used in developing the Index).

Figure 1. Conceptual framework of the e-payment ecosystem



Source: TRPC

The first pillar focuses on the regulatory and policy environment for both the information and communication technology (ICT) and business sectors. Business friendly regulations and policies need to be in place to be able to provide affordable and secure e-payment services. For service providers, regulations and policies can foster or hinder market entry, and thus, affect the development and uptake of e-payment solutions. This pillar therefore reflects on the presence of ICT-related regulations and policies (e.g., electronic commerce, digital signatures, consumer protection), and the extent to which government is using technology to enhance competitiveness. As there are no regional level datasets that comprehensively examine and compare regulations and policies specific to e-payments, the index uses more broad measures such as the time and costs required to start a business, the efficiency of the legal framework in settling disputes and challenging regulations, and the range of financial products and services available to businesses.

The second pillar focuses on e-payment infrastructure. Investments in building a reliable and secure physical network to deliver e-payments nationwide, particularly to rural areas, is essential to the expansion of e-payment services. This pillar looks at the level of penetration of the Internet, wireless

broadband, mobile phones and smartphones, as well as the number of ATMs and commercial bank branches in each economy. It also examines national capabilities in cybersecurity.

The third pillar focuses on the level of latent and actual demand for e-payments from businesses and consumers, as their acceptance and usage of e-payment services are key to a thriving e-payment ecosystem. The pillar gauges the economies' use of the various channels for e-payment, including credit and debit cards, online and mobile options, and through social media sites.

The fourth pillar focuses on the supply-side of e-payment and the economies' readiness to develop innovative e-payment solutions and business models by looking at the level of competitiveness, venture capital availability, and presence of international players in both e-commerce and online payments such as Alibaba, Alipay, Amazon, Bitcoin, eBay, PayPal, Taobao and Tenpay. In the updated 2016 report, this pillar received the most changes, with 4 out of the 9 indicators previously used from the World Economic Forum's Global Competitiveness Report replaced with more rigorous and relevant ones from the Global Innovation Index published in 2015 (See Appendix 2 for details).

The central premise of this study is that an increase in access to and usage of e-payments will lead, fairly directly, to an increase in economic growth. A corollary position is that the greater financial depth created by a transition to e-payments has a positive impact on socioeconomic development. There is already ample evidence establishing a concrete correlation between e-payments and economic growth to support this argument. Moody's Analytics, for example, conducted a study looking at electronic card usage in 70 countries. The study found that electronic card usage added USD296 billion to real GDP from 2011 to 2015, equivalent to a 0.1 cumulative increase in global GDP during the sample time period. Higher electronic cards usage also accounted for an average increase of 2.6 million jobs per year across the countries sampled during the same period.³ Similarly, Imperial College London estimates that moving 25% of paper-based transactions to digital in retail payments, G2P, e-commerce, cross-border remittances and SMEs, governments, businesses and consumers could unlock between USD350 to 400 in annual savings.⁴

Taking this a step further, Deloitte used an econometric modelling to quantify the effects of an increase in online retail as a proxy to e-payments on economic growth across Europe and found that the total contribution of online retail enabled by online payments, between 2009 and 2012, to be at least 1% of GDP per capita.⁵ As it is beyond the scope of this study to build a separate econometric model to quantify the economic impact of online payments across all 21 APEC economies, a proof-of-concept exercise was carried out using Deloitte's regression model to test the correlation.

Using sample data from six APEC economies over four years, from 2011 to 2014 (including a mix of advanced and emerging economies: see Appendix 1), a multi-regression analysis was carried out to estimate the elasticity between online retail sale and economic growth. **The results suggest that a 1% change in online retail sales enabled by e-payments is associated with 0.175 % change in GDP per capita among these economies**, a 57% increase compared to the previous study where a 1% change in online retail accounted for a 0.1% change in GDP per capita over 2011-2013.

³ Moody's Analytics (2016) The Impact of Electronic Payments on Economic Growth, <https://usa.visa.com/dam/VCOM/download/visa-everywhere/global-impact/impact-of-electronic-payments-on-economic-growth.pdf>

⁴ Imperial College London (2016) Releasing the Flow of Digital Money: Hitting the Tipping Point of Adoption, https://www.citibank.com/icg/sa/digital_symposium/digital_money_2016/pdf/releasing_the_flow_of_digital_money.pdf

⁵ The economic growth literature that Deloitte and this study drew the methodological approach from includes Barro (1992), Mankiw, Romer and Weil (1992) and Caselli, Esquivel and Lefort (1998).

When combined with the conclusions emerging from the E-payment Index, we believe that **this result merits further study utilizing panel data across all APEC economies and over a sustained period of time to better understand the economic impact of e-payment adoption.**

2. APEC E-payment Index

This section details the development of the APEC E-payment Index and summarises the key trends and insights that emerge from an analysis of the Index.

Table 1. The APEC E-payment Index: Overall Ranks

Rank	Economy	Scores	Changes in Ranking
1	United States of America	66.9	-
2	Singapore	62.9	-
3	Canada	62.4	(+2)
4	Australia	60.6	-
5	New Zealand	60.4	(-2)
6	Korea, Rep.	59.9	(+1)
7	Hong Kong, China	59.3	(-1)
8	Japan	55.5	-
9	Chinese Taipei	52.9	-
10	Malaysia	45.5	-
11	Brunei Darussalam	42.4	-
12	China	37.5	(+1)
13	Russian Federation	37.4	(+1)
14	Chile	36.2	(-2)
15	Thailand	33.2	-
16	Peru	29.5	(+3)
17	Mexico	29.1	(+1)
18	Indonesia	28.4	(-2)
19	Philippines	26.0	(-2)
20	Vietnam	25.6	-
21	Papua New Guinea	23.9	-

APEC is highly diversified in terms of readiness and advancement of e-payment ecosystems.

While intuitive, it is worth recognizing upfront that APEC economies' readiness to adopt and utilise e-payments varies widely. Overall, the United States retained its first position within the APEC E-payment Index with a score of 66.9 (out of a possible 100 – see below for details), while at the other end of the table Papua New Guinea came in last with a score of 23.9.

Between 2015 and 2016, 11 of the 21 APEC economies had a shift in rankings. Peru marked the biggest gain by moving up three places to 16th. Canada moved up two positions to 3rd, while the Republic of Korea, China, the Russian Federation, and Mexico all moved up one place to 6th, 12th, 13th, and 17th respectively. Chile, Indonesia and the Philippines fell two places to 14th, 18th, and 19th respectively, while New Zealand also fell 1 place down to 5th.

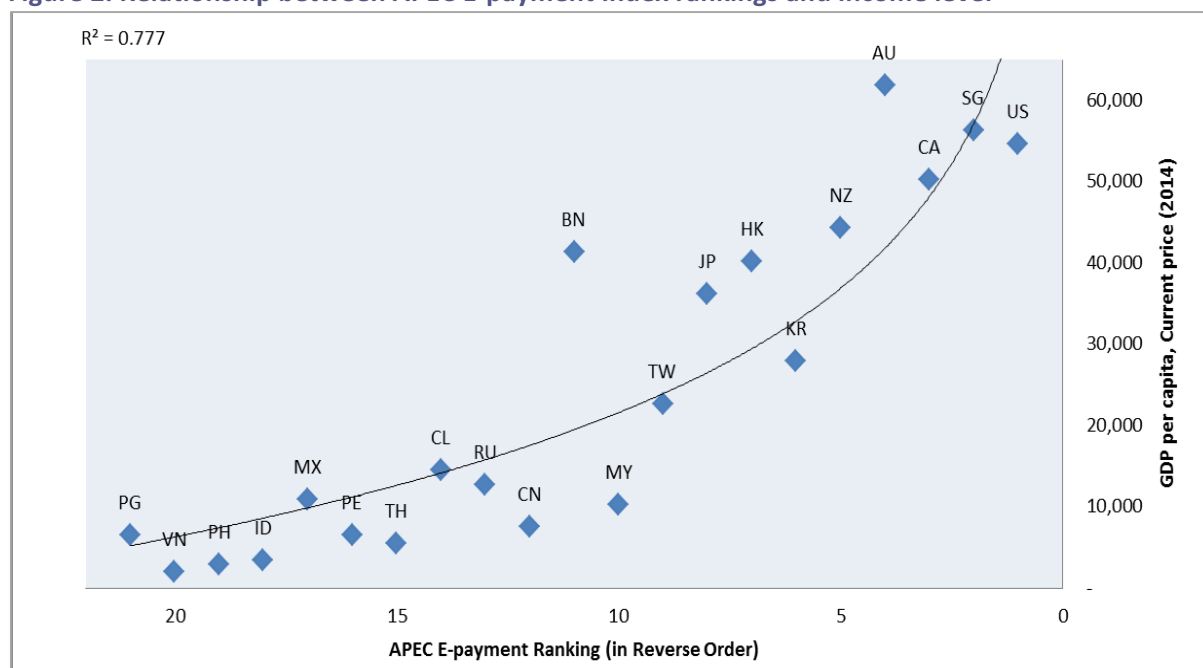
APEC's overall e-payment ecosystem is improving, thanks to the transitioning economies

Compared to 2015, the average e-payment readiness score of the 21 APEC economies has improved from 41.6 to 44.6. The median score is also up to 43.4, from 37.2 in the previous year. This signals an overall improvement in the e-payment ecosystem of the region with the bottom tier group moving up at a faster rate than the rest of the clusters.

The readiness and capacity of an economy to engage in e-payment is strongly influenced by its stage of development.

The level of economic development of an economy is, of course, one key factor driving such a wide range. Indeed, a strong correlation emerges when the economies' e-payment index rankings are overlaid against GDP per capita, (Figure 2); the higher the income, the better the economy tends to do in the ranking of the APEC E-payment Index.⁶ Exceptions do exist in this case; Brunei Darussalam, for instance, appears to lag in ranking compare to its peers of the similar income range while Malaysia and China show higher ranking relative to their income peers.

Figure 2. Relationship between APEC E-payment Index rankings and income level



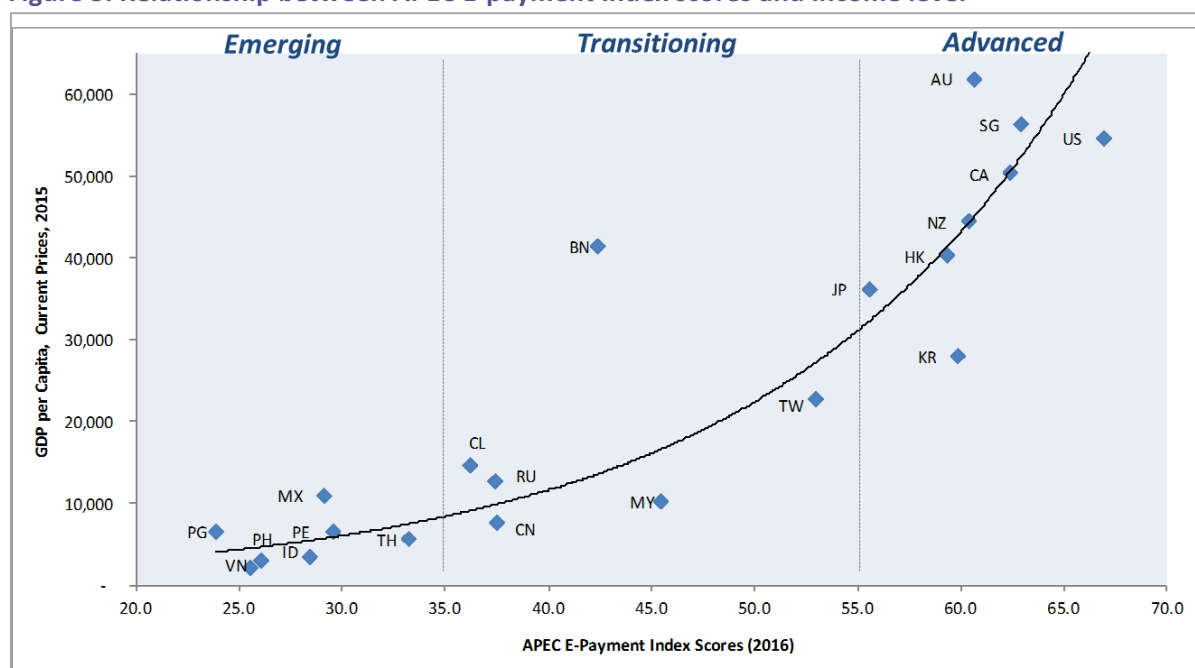
Source: World Development Indicators (2014); for Chinese Taipei, Nominal GDP per capita, 2014 obtained from National Statistics, Republic of China (Chinese Taipei)

Once the APEC e-Payment Index scores are overlaid against income levels, the following three clusters emerge: advanced, transitioning, and, emerging (Figure 3):

- **Cluster 1: Economies with advanced e-payment ecosystems (> 55 points)** – United States of America, Singapore, Canada, Australia, New Zealand, Republic of Korea, Hong Kong China, and Japan
- **Cluster 2: Economies with transitioning e-payment ecosystems (between 35 – 55 points)** – Chinese Taipei, Malaysia, Brunei Darussalam, China, Russian Federation, and Chile
- **Cluster 3: Economies with nascent and emerging e-payment ecosystems (< 35 points)** – Thailand, Peru, Mexico, Indonesia, Philippines, Vietnam, and Papua New Guinea

⁶ The R-squared value of the logarithmic trendline is 0.7662, which shows a good fit of the data and thus a strong correlation between the APEC e-payment readiness rankings and level of economic growth.

Figure 3. Relationship between APEC E-payment Index scores and Income level



Source: World Development Indicators (2014); for Chinese Taipei, Nominal GDP per capita, 2014 obtained from National Statistics, Republic of China (Chinese Taipei)

When compared with the World Bank’s income classification, Clusters 1 and 2 are comprised mainly of high-income economies, with the exception of Malaysia, and China (upper-middle income economies). This demonstrates that Malaysia, and China have achieved high e-payment readiness relative to their level of economic development. A further notable comparator here is between Malaysia and Mexico, two economies with roughly similar levels of GDP per capita and yet starkly different levels of e-payments readiness. Cluster 3 comprises mostly upper-middle and lower-middle income economies, again demonstrating the strong positive relationship between the level of e-payment readiness and the level of economic development.

Table 2. Clusters of the APEC E-payment Index

Clusters	APEC E-payment Index		World Bank Income Classification
Cluster 1 (> 55 pts)	1. United States of America	5. New Zealand	All high-income economies except Malaysia and China
	2. Singapore	6. Republic of Korea	
	3. Canada	7. Hong Kong	
	4. Australia	8. Japan	
Cluster 2 (35-55 pts)	9. Chinese Taipei	12. China	
	10. Malaysia	13. Russian Federation	
	11. Brunei Darussalam	14. Chile	
Cluster 3 (<35 pts)	15. Thailand	19. Philippines	
	16. Peru	20. Vietnam	
	17. Mexico	21. Papua New Guinea	
	18. Indonesia		

High-income economies are more likely to have a thriving ecosystem for e-payments.

Based on the strong linkage between GDP per capita and e-payment readiness, high-income economies are likely to have made significant progress in the four pillars that make up the e-payment ecosystem. Economies in Cluster 1, for instance, have more advanced banking and payment systems, with well-established regulations and infrastructure for e-payments in place. A

larger percentage of its population has bank accounts, and is familiar with credit cards and debit cards, and online shopping.

Cluster 1: Economies

Overall, the **United States** ranks highest based on its strengths in innovation (1st), infrastructure (2nd) and demand (4th). From the ranking by pillar (Table 3), the United States takes the lead in the innovation pillar. US-founded companies such as Amazon, Google, and PayPal as well as major credit card companies like American Express, MasterCard and Visa are internationally-recognised innovators in e-payment. The intensity of competition and the availability of venture capital in the US are leading to the development of innovative e-payment products and services. For example, US FinTech companies saw a 72% rise funding in 2015 year-on-year, which totalled USD\$7.9 billion, which is more than half of the global share. While FinTech activities may have tapered since then, funding recovered by US FinTech companies continue to dwarf other regions (USD\$4.5 billion for Asia and USD\$1.5 billion for Europe).⁷ This capacity to innovate is linked with an advanced digital infrastructure as well as online and social technologies, which are in turn sparking demand for new services and functionalities that increase the convenience and reliability of making payments.

Singapore's runner-up status in the Index is fuelled by its top ranking in the regulatory and policy pillar. The Government of Singapore takes a top-down approach in developing its digital economy with a clear-eyed strategy to build a Smart Nation and focus on business start-ups. The importance of the analogue components of the digital payments ecosystem, namely a favourable policy and regulatory environment cannot be stressed enough and is shown by the Index results to be fundamental in attracting investment, driving innovation, and stimulating the necessary emergence of demand for e-payment products and services.

Canada, ranking third overall, moved up two ranks from 2015, scores high – perhaps surprisingly for some – in the demand pillar (tied 2nd with Australia) where the top three economies score within 0.1 point from each other. Supporting this result, a GfK study corroborates Canadian's strong preference for non-cash payments, reporting that only 1 in 4 transactions in Canada used cash in 2015.⁸ The same study also found that mobile payments were gaining traction, with 63% of Canadian consumers reported making at least one mobile transaction per month in the same year, up 3% from 2014.⁹ Canada's policy and regulatory environment (5th) and infrastructure (4th) for e-payments also scored relatively strong. It is worth noting that Canada has a significantly higher percentage of credit card ownership and usage, at 77% and 73% respectively, than other APEC economies. (Japan is next among APEC economies with 66% credit card ownership and 52% credit card use – a sizeable difference. The gap is even greater when compared with economies in Clusters 2 and 3. In Malaysia, only 20% of the population owns a credit card, and in Indonesia only 2%.)

According to WorldPay, credit cards constitute the greatest proportion of non-cash transactions conducted globally in terms of online transaction purchase value (55%), followed by e-wallet accounts (22%) in 2014.¹⁰ Credit card and e-wallet adoption rates are significantly higher in high-income economies, which reinforces the point that populations in high-income economies are more able to perform e-payment transactions. *However, as the variety of e-payment options grow and*

⁷ KPMG and CB Insight (2016) Pulse of Fintech 2015 Review, <https://home.kpmg.com/content/dam/kpmg/pdf/2016/06/pulse-of-fintech-2015-review.pdf>

⁸ GfK (2016) FutureBuy study, <http://www.gfk.com/en-us/insights/press-release/canadians-preference-for-non-cash-payment-methods-continues-to-grow-gfk-study/>

⁹ Ibid

¹⁰ WorldPay 2015 cited in United Nations Conference on Trade and Development (2016) B2C E-Commerce Index 2016, http://unctad.org/en/PublicationsLibrary/tn_unctad_ict4d07_en.pdf

access to e-payment increases it is precisely this category of credit/debit cards and bank accounts we see giving way, as the transactions base continues to transform. Well-positioned economies in Clusters 2 and 3 will be able to make the leap by best enabling their populations to adopt e-payments outside the use of credit/debit cards and bank accounts.

Australia and New Zealand rank fourth and fifth, respectively, scoring relatively well in three of the four pillars. In **Australia**, the high Internet and smartphone penetration, and high usage of e-payment methods allow it to score relatively well in infrastructure (3rd) and demand (tied 2nd with Canada), with figures similar to New Zealand. For instance, 82% of Australians use debit cards (compared with 92% of New Zealanders), and 68% of Australians use the Internet to pay bills or buy things (compared with 72% of New Zealanders). In the G20 E-trade Readiness Index, Australia topped the rankings, and one of the reasons was due to the economy's high use of e-payment methods. Another reason was related to its relatively well-developed digital infrastructure – although this is one area which there has been domestic consternation in recent years with a lack of consensus in political will.¹¹

For **New Zealand**, its overall ranking went down by 2 spots although it did manage to ascend to the top spot in the demand pillar, albeit with a slightly higher score than Australia and Canada, tied at 2nd spot. It also scored relatively high in regulatory and policy (4th), infrastructure (6th) and innovation (8th). New Zealand has the most favourable regulatory environment for starting up a business, and the use of e-payments is already quite high with over 90% of its population using debit cards, and over 70% of its population using the Internet to pay bills or make purchases.¹² For both of these indicators, New Zealand ranks highest among all APEC economies.

No economy dominates the Index by topping more than one pillar in the e-payment ecosystem.

From Table 3 and from the preceding observations on Cluster 1 economies, it can be seen that none of the economies top more than one of the pillars in the e-payment ecosystem. Moreover, ***only Canada ranked in the top five in all four pillars, meaning that majority of the economies have the potential to improve in one or more aspects of their e-payment ecosystem.***

For instance, the United States leads in the development of innovative products and services but ranks 6th in the provision of a regulatory and policy environment for e-payments. Singapore is the front runner in offering a favourable regulatory and policy environment for e-payments but ranks only 6th in demand and usage. One interesting indicator in this regard: only 28% of Singaporeans use the Internet to pay bills or buy things.¹³ Canada leads in the demand pillar but its 5th rank in regulatory and policy environment pulls down its overall ranking. The Republic of Korea, one of the world's most digitally connected societies, not surprisingly scores highest for infrastructure, but ranks only 11th in the regulatory and policy environment pillar. One of the reasons for this is that, while the laws relating to ICTs are well developed in Korea, laws relating to the banking and financial services sectors have not adjusted quickly to innovations appearing in ICT, leaving new innovative areas such as FinTech, rather less competitive than might otherwise be expected. There is thus room for improvement in the efficiency of the legal frameworks for financial services, in particular where it overlaps with ICT. This need for cross-sectoral understanding, awareness and responsiveness in e-payments is a theme that comes through time and again in looking at the rankings across the APEC E-payments Index.

¹¹ The Economist Intelligence Unit (2014) The G20 e-Trade Readiness Index, https://www.eiuperspectives.economist.com/sites/default/files/Laurel%20West%20-%20eBay%20-%20The%20Global%20e-trade%20Readiness%20Index%20Final%20V2_0.pdf

¹² World Bank (2014) Global Findex, <http://datatopics.worldbank.org/financialinclusion/>

¹³ Ibid

Table 3. The APEC E-payment Index rankings and scores, by pillar

		P1. Regulatory & Policy Environment		P2. Infrastructure		P3. Demand		P4. Innovative Products & services	
		Rank	Score	Rank	Score	Rank	Score	Rank	Score
1	United States of America	6	67.0	2	72.5	4	54.1	1	77.5
2	Singapore	1	96.4	7	59.7	5	48.4	5	55.9
3	Canada	5	68.3	4	66.8	2	56.1	2	59.3
4	Australia	8	62.2	3	70.5	2	56.1	7	51.0
5	New Zealand	4	77.1	6	60.2	1	56.2	8	50.0
6	Korea, Rep.	11	48.8	1	78.9	5	49.3	3	58.3
7	Hong Kong, China	2	83.8	9	57.7	9	45.8	4	57.4
8	Japan	7	64.7	5	63.2	10	42.7	6	54.0
9	Chinese Taipei	9	58.4	8	58.6	8	46.6	9	48.3
10	Malaysia	3	80.6	11	40.8	11	34.2	13	34.4
11	Brunei Darussalam	12	47.4	12	39.0	7	46.6	12	36.3
12	China	15	42.7	16	37.7	13	28.6	10	45.4
13	Russian Federation	20	24.6	10	50.5	12	32.0	11	38.6
14	Chile	10	52.3	14	38.4	14	28.5	17	28.6
15	Thailand	16	35.6	15	37.9	15	28.2	15	31.2
16	Peru	21	24.1	13	39.3	17	23.1	16	29.8
17	Mexico	19	28.3	17	29.3	16	27.1	14	32.8
18	Indonesia	14	42.8	18	28.9	21	18.9	19	27.7
19	Philippines	17	32.0	19	28.7	18	21.1	20	23.4
20	Vietnam	18	31.1	20	25.4	19	20.4	18	28.0
21	Papua New Guinea	13	47.1	21	15.5	20	20.4	21	18.6

Other notable strengths and weaknesses are worth calling out. These include the remarkably rapid pace of development in the Chinese market, internationally known for widely adopted e-payment solutions such as Alipay, Taobao and Tenpay, but still needing to overcome regulatory and infrastructure challenges in order to fully leverage the opportunities. In Japan, its payments infrastructure is mature (ranks 5th), while its demand for e-payment is surprisingly low (ranked 10th). Among APEC economies, the Japanese spend the least amount of time on the Internet and on social media, *and only 8% of its population use mobile banking*, despite the ubiquity of mobile usage elsewhere in other aspects of Japanese life. The lack of prevalent international e-payment solutions in Japan, and the lack of success of Japanese e-payments solutions in foreign markets could explain Japan’s low uptake of mobile banking.

As the results show, ***there is no single pathway to promoting and developing e-payment***. This means that for policymakers e-payment is an area that needs to be developed holistically by considering the ways in which each of the pillars in the e-payment ecosystem affect each other

within the context of each individual economy. And this means that policymakers need to have a broad appreciation of how these factors work if they are to create an effective framework.

Moreover, ***while growth and innovation in e-payment can come from all income levels and from all manner of social groups, the types of innovation finding traction in an economy differ as different needs are addressed and different social groups serviced.***

Cluster 1 economies generally have a longer history of the development and use of e-payment services. These economies have a large percentage of their population already using credit and debit cards, and are familiar with ATMs and, increasingly, with online banking. Here e-payment innovations aim to increase convenience, flexibility and security for consumers; while for businesses they enhance sales and reduce payment processing costs.

For economies in Clusters 2 and 3, the emphasis is often on increasing access to basic financial services, on the one hand, and empowering the SME e-commerce opportunity, on the other. In these economies people are less likely to have bank accounts and the ownership of credit cards is lower, but those with smartphones are increasingly using them to make payments of one sort or another. For SMEs this can mean access to funds for setting up and expanding their businesses; it can mean access to new markets, whether on the supply side or demand side, and unlocking the potential for e-commerce; and it can mean being able to execute on payroll or finance without having to physically visit a bank and carry large sums of cash. *Greater access to e-payments draws more enterprises into the formal sector, raising tax revenues and making workers eligible for better protection and benefits.¹⁴ For consumers, access to payment can mean access to services such as health and education, and enhanced productivity by reducing the time it takes to pay for services and products.*

APEC is rapidly becoming ‘mobile first’ and significant growth will be driven from economies with high smartphone adoption and where the proportions of services offered through smartphones are increasing. These economies are not necessarily high-income economies. For instance, the economy with the highest percentage of smartphone users who have made purchases via their phone is China (69%), with some 930 million people – or three times the total population of the United States – already having done so. This is followed by Vietnam (60%), Indonesia (57%), Republic of Korea (56%) and Thailand (51%). However, in Canada it is 27%, New Zealand 33% and Australia 41%.¹⁵ Figure 4 shows the weak correlation between GDP per capita and the percentage of smartphone users who have purchased via phone. *This is an area requiring significant further research.*

As more people become connected, particularly in the lower-middle and upper-middle income economies of Cluster 3, through the rapid uptake of mobile phones and social media, the market for e-payment and m-payment will grow exponentially. Furthermore, the variety of innovative products and services is likely to increase to meet demand, including alternative e-payment systems for the unbanked consumer segments.

Such conclusions are supported by emerging studies such as the United Nations Conference on Trade and Development’s latest Information Economy Report,¹⁶ which finds that most retail e-commerce payments are still made via credit card, but by 2017 alternate payments will make up the majority of all e-commerce payments, with e-wallets alone set to represent more than 40% of the

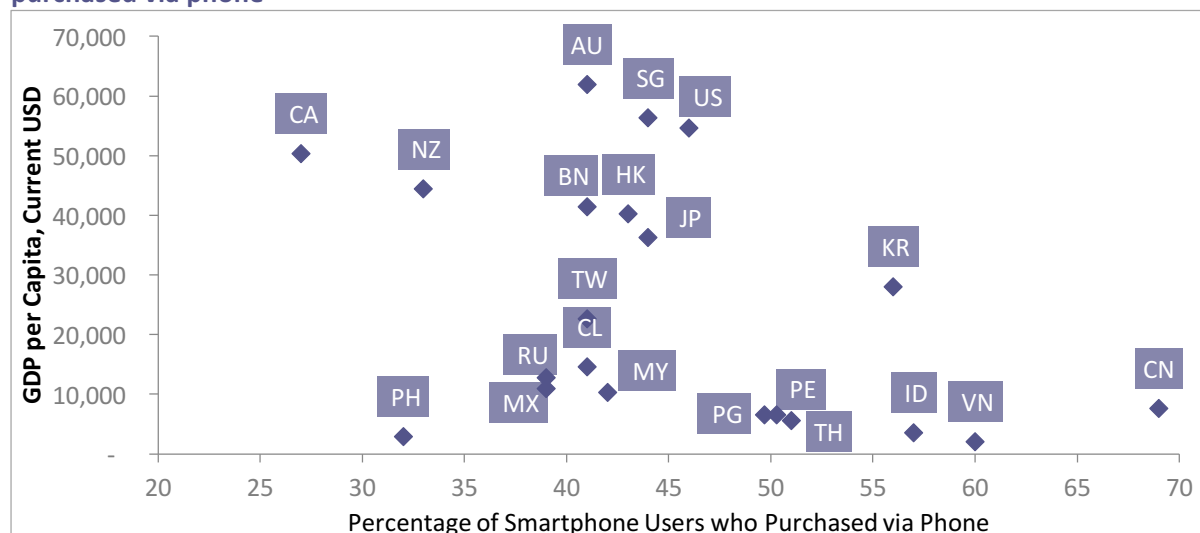
¹⁴ Standard Chartered, Financial Inclusion: Reaching the unbanked, 4 September 2014.

¹⁵ Our Mobile Planet, Google (2014) <http://think.withgoogle.com/mobileplanet/en/downloads>

¹⁶ United Nations Conference on Trade and Development (2015) Information Economy Report 2015: Unlocking the Potential of E-commerce for Developing Countries, http://unctad.org/en/PublicationsLibrary/ier2015_en.pdf

total. According to the World Payments Report 2015,¹⁷ mobile payments are rapidly increasing with non-banks slowly increasing their share of transactions. In China, mobile payments make up 28% of the non-cash transactions by volumes, which reached 4.5 billion in 2014, up by 170% from the previous year. The report also points out that hidden digital payments, including mobile money, cryptocurrencies and mobile app purchases, are estimated to make up at least 10% of non-cash market globally but are not being reported. There are signs that governments are actively playing a catch up to bring new and innovative digital financial services under an overarching regulatory umbrella (See Case Studies: Australia).

Figure 4. Relationship between income level and the percentage of smartphone users who have purchased via phone



Sources: World Development Indicators (2014); for Chinese Taipei, Nominal GDP per capita, 2014 obtained from National Statistics, Republic of China (Chinese Taipei); Consumer Barometer, Google (2015)

Key Findings by Pillar

Pillar 1: Regulatory and Policy Environment

A majority of APEC economies need to focus on creating, or improving, a favourable regulatory and policy environment for ICT infrastructure development, cybersecurity, business innovation and demand for e-payments as illustrated by the E-payments Index. With the exception of Malaysia and China, all lower-middle and upper-middle income economies need to focus on this aspect of their ecosystem to be able to attract investment and further participation. This is of course one area where the government can have an outsized influence and where lower income economies can make substantial headway. It is also an area of significant contention and confusion with many aspects of e-payments now cutting across multiple regulatory jurisdictions. Thus, even some high-income economies such as Australia and the Republic of Korea, suffer from comparatively low scores in this pillar (ranking 8th and 11th, respectively).

Brunei Darussalam, another high-income economy, needs to significantly simplify and shorten the process for business start-ups in particular. According to a World Bank study on economies' ease of doing business, Brunei Darussalam is ranked lowest among APEC economies, requiring 15 procedures, 101 days and 10% of income per capita to start a business.¹⁸

¹⁷ Capgemini and RBS, World Payments Report 2015. https://www.fr.capgemini-consulting.com/resource-file-access/resource/pdf/world_payments_report_2015_vfinal.pdf

¹⁸ World Bank (2014) Doing Business 2015: Going Beyond Efficiency, <https://openknowledge.worldbank.org/bitstream/handle/10986/20483/DB15-Full-Report.pdf?sequence=1>

In Latin America, Chile is most advanced in e-payment (ranking 14th), while Peru and Mexico rank 16th and 17th, respectively. Chile however scores comparatively higher in the regulatory pillar (10th) while Mexico and Peru rank low (19th and 21st). Overall, it is relatively easy to start a business in these three economies—with a score for this indicator of over 85 out of 100, but they all need to improve the efficiency of their legal frameworks for settling disputes and challenging government actions and regulations. In Mexico and Peru, ICT continues to lie low on the government’s agenda, which is reflected in the low development of the e-payment ecosystem, even as e-payment becomes increasingly ICT-driven.

Table 4. Regulatory and Policy Environment

Ranking	Economy	Scores	Ranking Changes
1	Singapore	96.4	-
2	Hong Kong, China	83.8	-
3	Malaysia	80.6	-
4	New Zealand	77.1	-
5	Canada	68.3	-
6	United States of America	67.0	-
7	Japan	64.7	-
8	Australia	62.2	(+1)
9	Chinese Taipei	58.4	(-1)
10	Chile	52.3	-
11	Korea	48.8	(+2)
12	Brunei Darussalam	47.4	-
13	Indonesia	47.1	(+2)
14	Papua New Guinea	42.8	-
15	China	42.7	(-3)
16	Thailand	35.6	-
17	Philippines	32.0	-
18	Vietnam	31.1	-
19	Mexico	28.3	-
20	Russian Federation	24.6	-
21	Peru	24.1	-

The results resonate with the G20 E-trade Readiness Index which noted that “regulators in many countries are still struggling with the question of how to regulate the payments industry.”¹⁹ The creation of new and innovative payment systems only accentuates the need for reviewing existing payments regulations, and reviewing them on a broader cross-sectoral basis.

Canada, for example, has become one of the first countries to pass a national law regulating virtual currencies such as bitcoin and XRP.²⁰ In Australia, the Australian Payments Council was established to better coordinate the country's payment systems with a view to fostering innovation, rather than merely regulating conservatively. This is perhaps the central challenge for all economies: successfully encouraging e-payment operators requires cross-sectoral government coordination, such as a whole-of-government

approach or a coordinating government agency. ***For APEC, e-payments regulatory alignment will accelerate e-payments adoption and usage, and this in turn will drive cross-border transactions and thus regional economic growth.***

¹⁹ The Economist Intelligence Unit (2014) The G20 e-Trade Readiness Index, https://www.eiuperspectives.economist.com/sites/default/files/Laurel%20West%20-%20eBay%20-%20The%20Global%20e-trade%20Readiness%20Index%20Final%20V2_0.pdf

²⁰ Capgemini and RBS, World Payments Report 2014, <https://www.capgemini.com/thought-leadership/world-payments-report-2014-from-capgemini-and-rbs>

Pillar 2: Infrastructure

The gap or divide between high-income, upper-middle-income and lower-middle-income economies is most obvious in the infrastructure pillar.

Table 5. Infrastructure

Ranking	Economy	Scores	Ranking Changes
1	Korea	78.9	-
2	United States of America	72.5	-
3	Australia	70.5	-
4	Canada	66.8	-
5	Japan	63.2	(+1)
6	New Zealand	60.2	(-1)
7	Singapore	59.7	-
8	Chinese Taipei	58.2	(+1)
9	Hong Kong	57.7	(-1)
10	Russian Federation	50.5	-
11	Malaysia	40.8	(+2)
12	Brunei Darussalam	39.4	(-1)
13	Peru	39.3	(+3)
14	Chile	38.4	(-2)
15	Thailand	37.9	-
16	China	37.7	(-2)
17	Mexico	29.3	(+1)
18	Indonesia	28.9	(+1)
19	Philippines	28.7	(-2)
20	Vietnam	25.4	-
21	Papua New Guinea	15.5	-

For example, the number of secure servers using encryption technology in Internet transactions ranges from six per one million people in Indonesia to 2,178 per one million people in the Republic of Korea. Internet penetration rates range from 9.4% in Papua New Guinea to 90.6% in Japan. Wireless broadband subscription rates range from 5.8% in Papua New Guinea to 156.1% in Singapore. Smartphone penetration, however, shows a relatively smaller variance, from 21.9% in Papua New Guinea to 79.1% in Australia.

According to the World Economic Forum, “ICTs are neither as ubiquitous nor spreading as fast as many believe. Some 90% of the population in low-income countries, and over 60% globally, are not online yet.” It goes on to suggest that “as developing countries leapfrog to 4G technology, thus enabling owners

of smartphones to access the Internet, Internet diffusion may accelerate in coming years. Prices of 4G smartphones remain high, but—thanks to innovation and competition—prices are expected to keep falling. Already one-sixth of smartphones sold in 2013 cost less than US\$100.”²¹

Among all APEC economies, only Papua New Guinea has achieved less than 80% mobile penetration, while 15 of 21 APEC economies have mobile penetration rates over 100%, including 144% in Thailand, 147% in Vietnam, and 128% in Indonesia. As more people get connected, particularly in Cluster 3 economies, the market for mobile payments will only grow, and grow strongly. Bridging the digital divide is therefore essential for fully leveraging the opportunities in e- and m-payment. This includes increasing smartphone penetration, and broadband access and affordability. But this requires significant up-front as well as continuous investments in telecommunication and network infrastructure. Ensuring a level playing field and improving market conditions to encourage broad-

²¹ World Economic Forum (2015) Global Information Technology Report 2015, http://www3.weforum.org/docs/WEF_Global_IT_Report_2015.pdf

based participation and competition requires regulatory coordination across regional economies and would help attract the necessary investment.

Innovations in overcoming infrastructure challenges are contributing to higher uptake of e-payment and m-payment services, and are acting as gateways into the banking system for the unbanked, or underbanked, consumer segments.

For example, the high cost of traditional brick-and-mortar bank branches has historically concentrated financial access points in urban areas where higher population density makes them profitable. However, innovations such as mobile financial services and agent banking, and the modernisation of post offices provide the opportunities for rural and low-income individuals to access financial services, including e-payments.

The World Payments Report 2015²² notes that the Russian Federation's non-cash transactions grew by 37.7% during 2012-2013, driven by an improved payment infrastructure. The number of point-of-sale terminals, for example, grew 23% annually since 2011, leading to increased card acceptance. The Russian Federation ranks 10th in infrastructure – significantly higher than its ranking in other pillars.

²² Capgemini and RBS, World Payments Report 2014, <https://www.capgemini.com/thought-leadership/world-payments-report-2014-from-capgemini-and-rbs>

Pillar 3: Demand

Compared to the 2015 index, New Zealand moved up 2 positions to the top rank followed by Australia and Canada, tied at 2nd. However, the score variance of the top 3 is less than 0.1 point, indicating similarity in maturity and penetration level of e-payments in these three countries.

As discussed above, **populations in Cluster 3 economies are less likely to have bank accounts and the ownership of credit cards is low, but those with smartphones have readily used them to make payments.**

Table 6. Demand

Ranking	Economy	Scores	Ranking Changes
1	New Zealand	56.2	(+1)
2	Australia	56.1	(+1)
2	Canada	56.1	(-1)
4	United States of America	54.1	-
5	Korea	49.3	-
6	Singapore	48.4	-
7	Brunei Darussalam	46.6	-
8	Chinese Taipei	46.6	-
9	Hong Kong, China	45.8	-
10	Japan	42.7	-
11	Malaysia	34.2	-
12	Russian Federation	32.0	-
13	China	28.6	-
14	Chile	28.5	-
15	Thailand	28.2	(+1)
16	Mexico	27.1	(-1)
17	Peru	23.1	-
18	Philippines	21.1	(+2)
19	Papua New Guinea	20.4	(-1)
20	Vietnam	20.4	-
21	Indonesia	18.9	-

69% of smartphone users in China and 60% in Vietnam have purchased via phone, marking the highest among the APEC economies. While the ownership of smartphones in the transitioning economies is still relatively low, it has grown rapidly in recent years. Nevertheless, **mobile payments are poised for rapid expansion across emerging economies.**

According to WeAreSocial.com,²³ almost 46% of the world's population had access to the Internet as of January 2016—a majority of them increasingly doing so from a mobile device. At least one-third of all web pages are now served to mobile phones. *In Papua New Guinea, 89% of all web pages are served to mobile phones.* In Figure 4, a comparison on the use of

different e-payment methods in Canada and China provides an illustration of why this increasing mobile access and changing usage patterns is poised to have such a dramatic and transformational impact.

E-payments are poised for expansion across emerging economies fuelled by increasingly tech-savvy and social populations. Economies with populations that spend an average of over five hours a day on the Internet include Indonesia, Malaysia, Mexico, Philippines, Thailand and Vietnam. As early as 2012, social media platforms served as entry points for e-commerce in many emerging part

²³ WeAreSocial.com (2016) Digital, Social and Mobile Worldwide in 2016, Digital in 2016, WeAreSocial.com, <http://wearesocial.com/sg/special-reports/digital-2016>

of APEC such as Indonesia with more than 50% of online buyers making online purchases on Facebook.²⁴ Since 2011, social networks have become important players in today's marketing industry, acting as middlemen between users and businesses, and are aggressively moving into the retail space. In other words, social media usage will soon spill over to social commerce activities, indicating an imminent demand for m-payment and e-payment services.

Another underexplored accelerator for e-payments is bulk payments from big spenders in the economy such as governments, which can initiate a virtuous cycle of e-payment adoption. Currently, 6% of Mexicans receive government transfers through a mobile phone and 3% receive wages through mobile—the highest among all APEC economies.

Consumer familiarity, willingness, and actual usage are necessary conditions for mobile payments to take off.

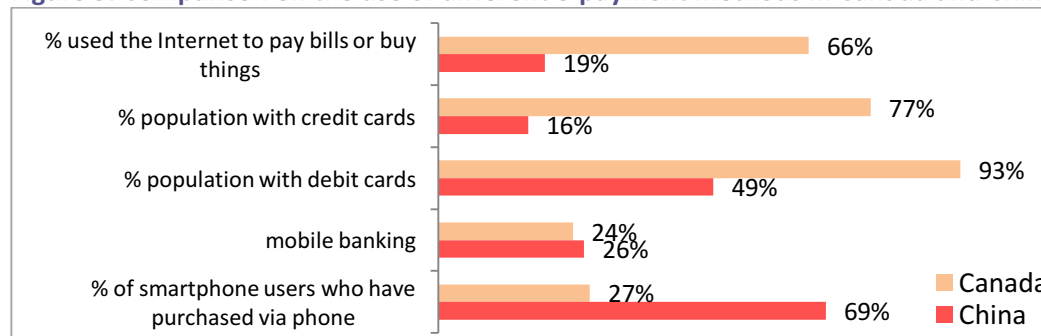
According to MasterCard's Mobile Payments Readiness Index,²⁵ consumers are typically drawn to mobile payments either for access to e-payments (mainly in the emerging economies) or the convenience of mobile phone payments (in the high-income economies).

The MasterCard study also reports that “consumer readiness is a critical success factor. The most advanced infrastructures in the world, with responsive legal systems, mature economies, and sophisticated technology networks, may be fertile ground, but until consumers embrace mobile payments, that ground will remain fallow. Consumer familiarity, willingness, and actual usage are necessary conditions for mobile payments to take off.”²⁶

E-commerce drives e-payment and vice versa.

The MasterCard report claims that “more consumers are using mobile payments for m-commerce than for person-to-person or point-of-sale transactions in the vast majority of the markets,” and “significant consumer experience with e-commerce is part of the reason why m-commerce is the leading mobile payment type in most of the markets surveyed.”²⁷ At the same time, the United Nations Conference on Trade and Development claims that the emergence of secure and reliable e-payment instruments is an essential element for expanding e-commerce.²⁸ Thus, e-/m-commerce and e-/m-payment reinforces demand for each other spurring growth in both industries.

Figure 5. Comparison on the use of different e-payment methods in Canada and China



Sources: World Bank Global Findex Database, WeAreSocial.com, and Consumer Barometer.

²⁴ eMarketer (2012) Social networks provide ecommerce entry point in Indonesia, <http://www.emarketer.com/Article/Social-Networks-Provide-Ecommerce-Entry-Point-Indonesia/1009560>

²⁵ MasterCard (2012) The Mobile Payments Readiness Index: A Global Market Assessment, <https://mobilereadiness.mastercard.com/globalreport.pdf>

²⁶ Ibid

²⁷ Ibid

²⁸ United Nations Conference on Trade and Development (2015) Information Economy Report 2015: Unlocking the Potential of E-commerce for Developing Countries, http://unctad.org/en/PublicationsLibrary/ier2015_en.pdf

Pillar 4: Innovation

Compared to the 2015 index, the innovation pillar has had the most changes in ranking in part due to the introduction of new indicators from the Global Innovation Index. Developments in cryptocurrency and the increasing number of investments into FinTech start-ups also led to further shifts in the pillar.

USA retained its top position, and is ahead of second-placed Canada by a large margin (over 18 points) in score, aided by its strong lead in FinTech activities. **Canada** made a remarkable ascent to the second by jumping up 7 positions, thanks to the prevalence of venture capital deals in the country – the highest in the APEC economy ahead of USA. **Generally, high-income economies appear much better placed to develop innovative products and services than their lower income peers, with the majority of the top 10 belonging to the high-income bracket.**

Table 7. Innovation

Ranking	Economy	Scores	Ranking Changes
1	United States of America	77.5	-
2	Canada	59.3	(+7)
3	Korea	58.3	(+4)
4	Hong Kong, China	57.4	(-1)
5	Singapore	55.9	(-1)
6	Japan	54.0	(-4)
7	Australia	51.0	(-1)
8	New Zealand	50.0	-
9	Chinese Taipei	48.3	(-4)
10	China	45.4	-
11	Russian Federation	38.6	(+2)
12	Brunei Darussalam	36.3	(+5)
13	Malaysia	34.4	(-2)
14	Mexico	32.8	(+5)
15	Thailand	31.2	-
16	Peru	29.8	(+4)
17	Chile	28.6	(-3)
18	Vietnam	28.0	(+1)
19	Indonesia	27.7	(-7)
20	Philippines	23.4	(-4)
21	Papua New Guinea	18.6	-

The exception is **China**, ranked 10th, and home to Alipay, Taobao and Tenpay. China has already emerged as the largest global market for business-to-consumer e-commerce—measured both by online buyers and by revenue.²⁹ eMarketer estimates that China, in fact, accounts for over 40% of the global retail e-commerce sales with mobile accounting for more than half of sales.³⁰

Other economies to watch out for with upcoming innovative e-payment solutions include Mexico and Peru. Mexico, and Peru, up 5 and 4 spots respectively, can attribute their improvements to having higher proportions of graduates in technology and the ease of getting credit in their countries. These translate to an increasing favourable business environment for tech-entrepreneurs to develop

innovative products in the e-payments industry.

²⁹ Ecommerce Europe (2015) Asia Pacific B2C E-commerce Light Report, <http://www.ecommerce-europe.eu/news/2015/asia-pacific-remains-the-largest-b2c-e-commerce-market>

³⁰ eMarketer (2016) Ecommerce drives retail sales growth in China, <http://www.emarketer.com/Article/Ecommerce-Drives-Retail-Sales-Growth-China/1013028>

The propensity to adopt disruptive digital payment technologies appears to be wide spread, regardless of income level. The most high-profile virtual currency, Bitcoin, while predominantly used in North America, is gaining traction in other parts of the world, for example Bitnode recorded 182 bitcoin nodes in the Russian Federation and 118 in China, which are at comparable levels as Japan (202) and Singapore (200).³¹ 2016 also witnessed a shift in discussion on cryptocurrency with PWC claiming that “it is no longer one of whether cryptocurrency will survive but rather how it will survive”.³² While the expanding use of cryptocurrency has the potential to connect financially excluded consumers to global payments systems affordably and instantaneously, its expansion is fraught with challenges such as low user acceptance, as well as security issues.³³

Regulatory systems are burgeoning, with myriad approaches being taken by various governments; on one hand, Australia, Canada, Japan, Singapore and the USA are leading the way of legitimising cryptocurrency by promoting consumer protection and issuing guidelines on taxation while on the other hand the Russian Federation, China, Mexico and Vietnam have taken more restrictive stances.³⁴ **Cryptocurrency will not reach its true market potential unless regulations evolve to embrace cryptocurrency, albeit cautiously.**

There is a need for collaboration among banks and non-banks in order to accelerate innovation.

This includes mobile money and agent banking ventures, for instance encouraging non-bank players—such as retailers, e-commerce platforms, and telecommunication firms—to join the system of financial services delivery and access providers in an interoperable and open manner. Financial regulatory collaboration in and across economies will also be essential.

Conclusion

The key trends and insights that emerge from this Index include the following:

- Globally, the rate of e-payment adoption continues to rise, and the range of e-payment channels is broadening significantly.
- APEC economies’ level of advancement and experience in the development of an e-payment ecosystem varies widely. The growth of and innovation in e-payment can come from all income levels but the types of innovation will be different as the needs that these innovations are trying to meet are different.
- The readiness and capacity of an economy to engage in e-payment is strongly influenced by its stage of development. High-income economies are more likely to have a thriving ecosystem for e-payment.
- Yet, APEC is becoming mobile first and major growth will come from economies where smartphone adoption is growing and the proportion of services offered through smartphones are increasing. These economies are not necessarily high-income ones.
- None of the economies except Canada ranked in the top five of all the pillars in the e-payment ecosystem. Thus, economies in all stages of development have an opportunity to improve on one or more aspects of the e-payment ecosystem.

³¹ Bitnode (2016) Global Bitcoin Nodes Distribution, <https://bitnodes.21.co/>, figures as of April 2016.

³² PWC (2015) Money is no object: Understanding the evolving cryptocurrency market <https://www.pwc.com/us/en/financial-services/publications/assets/pwc-cryptocurrency-evolution.pdf>

³³ As recently as in June 2016, DAO, a crowdsourcing investing organization, became a victim of USD 79million heist of ether, a rival cryptocurrency to Bitcoin. For more, see <http://qz.com/710126/a-massive-79-million-heist-just-happened-and-its-threatening-the-future-of-blockchains/>

³⁴ Wharton Research Scholar Journal (2015) An Analysis of Cryptocurrency Industry, http://repository.upenn.edu/cgi/viewcontent.cgi?article=1133&context=wharton_research_scholars

- There is no single pathway to promoting and developing e-payments. E-payment needs to be developed holistically by considering the ways in which each of the pillars in the e-payment ecosystem affect or reinforce the other in the context of each individual economy.

Regulatory and Policy Environment

- Many economies need to improve their ease of doing business and focus on fostering a favourable regulatory and policy environment to enhance the confidence of businesses and consumers.
- Government's vision and efforts to make use of technology to improve transparency, efficiency and accountability in its own finances through e-payments can kick-start a virtuous cycle of adoption. This should be achieved through public-private partnerships involving the finance, retail, and telecommunications sectors in particular.

Infrastructure

- The gap or divide between high-income, upper-middle-income and lower-middle-income economies is most obvious in the infrastructure pillar.
- Bridging the digital divide will be essential to fully leveraging the opportunities in e-payments. This includes increasing smartphone penetration, broadband access, and affordability. Focusing on availability and affordability of basic financial services is key in driving e-payments.
- At the same time, innovations in overcoming infrastructure challenges are contributing to higher uptake of e-payment and m-payment services, and are acting as gateways into the banking system for unbanked consumer segments.

Demand

- Populations in upper-middle and lower-middle income economies are less likely to have bank accounts and the ownership of credit cards is low, but those with smartphones have readily used it to make payments.
- As more people get connected in these economies, particularly through the rapid uptake of mobile phones and social media, the market for e-payment and m-payment is likely to grow exponentially.
- E-commerce and e-payment are closely interlinked; e-commerce can drive e-payment growth and e-payment will facilitate e-commerce growth.

Innovation

- Generally, high-income economies have better human resources and more financial resources to develop innovative products and services.
- But developing economies are coming up with innovative e-payment solutions as well to meet their development needs. China has been one of the key innovators in e-payment with solutions like Alipay, Taobao and Tenpay.
- Other economies to watch out for to come up with innovative e-payment solutions are Mexico and Peru.
- Cryptocurrency will not reach its true market potential unless regulations evolve to embrace cryptocurrency, albeit cautiously.
- As the number of non-bank players in the e-payment system increases, particularly in developing m-payment solutions, there is a need for collaboration among banks and non-banks in order to accelerate innovation. This will need to be accompanied by regulatory cooperation in and between APEC economies.

3. Case Studies: In-Depth Look at Selected Economies

The APEC E-payment Index provides a high-level view of the entire APEC economy and a systematic analysis of various elements of the e-payment ecosystem. As the vast number of indicators that were aggregated in the Index shows, however, e-payment readiness and adoption depend on a multitude of factors. Each economy also has a different baseline and a different set of challenges to surmount. To complement the findings from the Index, this section provides a set of case studies which assesses a mix of advanced and nascent e-payment ecosystems, namely Australia, Hong Kong, China, Indonesia and the Philippines.

Australia

Australia maintained its position in 4th place in the 2016 APEC E-payment Readiness Index, and remains closely behind leaders the United States, Singapore, and now Canada which leapfrogged to third place. Within the respective pillars, Australia has shown improvement in the regulatory and policy environment pillar, which is reflected by its slightly higher score and improved rank from 9th to 8th. However in the innovation pillar, Australia has fallen one position to 7th place. Australia continues to remain a lucrative market for the adoption of e-payments and other innovative FinTech services.

Australia has a high GDP per capita of over USD60,000 and is the sixth-largest country in the world in terms of size, and the least densely populated. This means that Australia has a considerable amount of land mass to provide coverage for, in terms of mobile networks, Internet access, ATMs and bank branches. The government continues to do well in these areas, and the latest iteration of the National Broadband Network (NBN) employs a multi-technology model including fibre-optic, fixed wireless and satellite infrastructure to improve Internet access. Although the NBN continues to run into its fair share of problems and criticisms, it continues to be the government's long-term national infrastructure program to improve Internet connectivity with faster and more reliable broadband connections.³⁵ Australians are fast adopters of technology, and the increased availability and affordability of smartphones means many mobile phone users are upgrading, or have already upgraded to the use of smartphones. With the promise of improved Internet broadband connectivity of the NBN, Australians will find themselves well equipped to navigate the opportunities of its developing digital economy.

With its strong regulatory environment and emerging infrastructure progress, the Australian government has turned its attention to support the FinTech industry to become internationally competitive, and to attract and retain local talents in Australia. This will help enable the use and spread of e-payments as more electronic services become available and more merchants readily accept e-payments.

Recent E-payment Developments

The Australian government continues to express its commitment to support the emerging local FinTech industry and aspires for Australia to become the FinTech hub of Asia. To this extent, the Australia government treasury announced a set of FinTech reforms in March 2016, outlining its support to the industry.³⁶

³⁵ Tucker, H. (2016) The NBN is reportedly facing huge problems, *Business Insider Australia*,

<http://www.businessinsider.com.au/the-nbn-is-reportedly-facing-huge-problems-2016-2>

³⁶ Morrison, S. (2016) Supporting Australia's FinTech future, <http://sjm.ministers.treasury.gov.au/media-release/032-2016/>

These include the creation of a new FinTech advisory group which is chaired by FinTech hub, Stone and Chalk chairman Craig Dunn, and includes representation from banks, venture capitalists, payment providers, and other FinTech start-ups.³⁷ Other new measures include providing better access to concessional tax treatment for venture capital investments in start-up FinTech firms, commissioning the Productivity Commission to outline options to increase data availability and access to facilitate new products and better consumer outcomes, addressing the 'double GST' treatment of digital currencies, creating a regulatory sandbox to test ideas with minimal regulations, and many others.³⁸

The government is also looking at amending the priority areas of existing financial regulation to ensure they are technology neutral, and thus future proofing regulations on FinTech innovations. With the Attorney-General's Department also looking at making obligations under the existing anti-money laundering/counter terrorism financing (AML/CTF) regime tech neutral, this will significantly ease the restrictions for e-payment and FinTech services on offering new services which use biometric identification and identity verification.³⁹

The New Payments Platform (NPP) is a system created by the Australian Payments Clearing Association to allow low-value transactions among different financial institutions to be made in real time and 24/7. Initially designed in 2012, and set for completion in the second half of 2017, the NPP remains on track for its scheduled completion date. Bill payments provider Bpay has won the tender to offer a payment service on the NPP, known as the "Initial Convenience Service", allowing consumers to instantaneously transfer funds to and from their bank accounts through their mobile phone, tablet, or the Internet.⁴⁰ The service will allow users better visibility of their budgets, as their transactions and accounts are updated instantly. As the NPP begins to near completion, the Reserve Bank of Australia (RBA) should continue to work with financial institutions and other stakeholders to educate and build awareness on the benefits and services available on the NPP.

Looking Ahead

Australia is already among the top five countries in the E-payment Readiness Index, and looks set to further advance its position and improve its rankings in the near-future. Strong support from the government on FinTech will help enable the local industry to flourish, increasing exposure to e-payments for a wider range of services. The mobile payments market is also becoming increasingly competitive as international platforms including Apple Pay, Google Wallet, and incoming Samsung Pay and Android Pay compete against local bank payment apps in Australia.

Australia is in a good position to become a global leader in e-payments, and the various policy and regulatory agencies, including Treasury, the RBA, ASIC, Australian Prudential Regulation Authority (APRA), and Australian Transaction Reports and Analysis Centre (AUSTRAC), have been actively engaging with the FinTech industry to remove unnecessary regulatory burden and red tape, in line with the government's deregulatory agenda. While this will help FinTech innovations to take-off, the policy and regulatory agencies will still continue to provide some form of regulatory oversight over to ensure investor and consumer trust and confidence in these emerging business models.

³⁷ The Treasury (2016) Working with Australia's FinTech industry, <http://fintech.treasury.gov.au/working-with-australias-fintech-industry/>

³⁸ The Treasury (2016) Australia's FinTech priorities, <http://fintech.treasury.gov.au/australias-fintech-priorities/>

³⁹ The Treasury (2016) Australian Regulators engagement with the FinTech industry, <http://fintech.treasury.gov.au/australian-regulators-engagement-with-the-fintech-industry/>

⁴⁰ Drummond, S. (2015) BPay first to offer instant payments on banks' New Payments Platform, <http://www.smh.com.au/business/banking-and-finance/bpay-first-to-offer-instant-payments-on-banks-new-payments-platform-20151029-gkmjkw.html>

Hong Kong, China

Hong Kong fell one spot to 7th place in the Index, although scores remain close, with less than 4 points separating second to seventh place. Hong Kong now trails closely behind Korea, but continues to demonstrate high scores for the regulatory and policy environment pillar (2nd behind Singapore) and the innovation pillar (4th behind the United States, Canada, and Korea). However, Hong Kong continues to be plagued by problems in Infrastructure and Demand with average scores in those two pillars.

Hong Kong is a prominent trade hub and financial centre and is synonymous with a light-touch regulated economy which has attracted many multinational corporations to set up their regional offices and headquarters there. However while it may be non-interventionist in many areas, one area where Hong Kong still regulates tightly is the e-payments space. Payment providers of mobile and electronic payment services are required to obtain a banking license from the Hong Kong Monetary Authority (HKMA).⁴¹ The HKMA announced a new regulatory regime for Stored Value Facilities (SVF) and Retail Payment Systems (RPS) in November 2015, with the HKMA set to issue new licenses in November 2016. The HKMA announced the major tools it would employ to regulate licenses, including (a) on-site examinations; (b) off-site reviews; (c) independent assessments; (d) review of auditors' reports; and (e) meetings with the management of the licensee.⁴² While well intended to protect consumer deposits, and money laundering, the regulations may inadvertently frighten off e-payments providers from operating in Hong Kong. To date, Apple Pay is already available in China, and despite announcing plans to launch in Hong Kong, Apple have yet to announce a timetable for the mobile payment service launch. The HKMA revealed in April 2016, that of the some 20 applications it had already received, only a third that had applied were seeking to operate Internet or mobile payment services.⁴³

With the government announcing in its 2016-17 Budget speech in February that it wants to take advantage, and support FinTech, the HKMA needs to consider lessening the regulatory burden for e-payment providers to operate in Hong Kong.⁴⁴

Recent E-payment Developments

Nine Hong Kong banks launched an e-cheque system in December 2015, which allows users to use their phones and Internet-enabled devices to settle bills, transfer money, and even give out electronic red packets during the Lunar New Year. The e-cheque system works similar to that of paper cheque, but adds the convenience of being able to be generated electronically through mobile phones. E-cheques have the added advantage over traditional electronic payment/transfer services in that they would not require parties to register with the payment platform, and do not require the payee to provide his/her account information to the payer. As part of its awareness campaigns, the HKMA and the Hong Kong Association of Banks (HKAB) jointly launched a publicity campaign including a series of educational materials such as advertisements on television and radio, posters and electronic brochures.⁴⁵

⁴¹ Hong Kong Monetary Authority (2015) Explanatory Note on Licensing for Stored Value Facilities, http://www.hkma.gov.hk/media/eng/doc/key-functions/financial-infrastructure/infrastructure/retail-payment-initiatives/Explanatory_note_on_licensing_for_SVF.pdf

⁴² Hong Kong Monetary Authority (2015) Regulation of Stored Value Facilities (SVF), <http://www.hkma.gov.hk/eng/key-functions/international-financial-centre/regulatory-regime-for-svf-and-rps/regulation-of-svf.shtml>

⁴³ RTHK (2016) HKMA says it won't set cap for e-payment services, <http://news.rthk.hk/rthk/en/component/k2/1252673-20160405.htm>

⁴⁴ Hong Kong Government (2016) Budget Speech, Fintech, <http://www.budget.gov.hk/2016/eng/budget11.html>

⁴⁵ Hong Kong Government (2015) Launch of Electronic Cheque (e-Cheque) publicity campaign, <http://www.info.gov.hk/gia/general/201511/23/P201511230374.htm>

The Steering Group on FinTech released its recommendations to the government to promote FinTech in February 2016. The report highlights the potential for Hong Kong to become a premier FinTech Hub, and that appropriate support and measures from the government can help to develop the fledgling sector. The key recommendations proposed by the Steering Group include: (i) formulating a vision to underline Hong Kong's commitment in developing FinTech and positioning as a launch pad for companies in the sector; (ii) providing assistance to FinTech start-ups; (iii) establishing in and attracting to Hong Kong more FinTech-themed programs and innovation laboratories; (iv) encouraging the application and setting of standards for cutting-edge FinTech technologies; (v) facilitating communication between financial regulators and the FinTech community; (vi) improving dissemination of information on funding sources and immigration policy; and (vii) encouraging young talents to enter the FinTech sector.⁴⁶

The HKMA created the FinTech Facilitation Office (FFO) in March 2016 to facilitate the development of the FinTech ecosystem in Hong Kong, and promote Hong Kong as a FinTech hub in Asia, which will put it in direct competition against Singapore and Australia who share similar aspirations.⁴⁷ The FFO describes itself among other things, as: (i) a platform for exchanging ideas of innovative FinTech initiatives among key stakeholders and conducting outreaching activities; (ii) an interface between market participants and regulators within the HKMA to help improve the industry's understanding about the parts of the regulatory landscape which are relevant to them; and (iii) an initiator of industry research in potential application and risks of FinTech solutions. This follows a similar move by the Securities and Futures Commission (SFC), which also set up in March 2016 a contact point for the FinTech industry to liaise on regulatory issues.⁴⁸

Looking Ahead

Hong Kong remains on the right track for e-payments and other innovative FinTech services to flourish. The Hong Kong government has announced its support of the sector, and is already taking steps to aid the development and encourage greater adoption of e-payments. However, Hong Kong still remains a few steps behind its closest regional competitors Singapore and Australia. To catch-up swiftly, the Hong Kong government should look at relaxing its requirements for e-payments, for example implementing transaction limits on e-payments, rather than requiring banking licenses. When providing financial assistance to FinTech ventures, the government should ensure that information on how to receive and apply for funding is easily available, and accessible.

The Hong Kong government needs to ensure it has a clear, articulated vision with the relevant supporting mechanisms on enabling e-payments and FinTech less it get left behind.

⁴⁶ Hong Kong Government (2016) Steering Group on Fintech releases report, <http://www.info.gov.hk/gia/general/201602/26/P201602260497.htm>

⁴⁷ Hong Kong Monetary Authority (2016) Fintech Facilitation Office (FFO), <http://www.hkma.gov.hk/eng/key-functions/international-financial-centre/fintech-facilitation-office-ffo.shtml>

⁴⁸ Securities and Futures Commission (2016) SFC Fintech Contact Point, <http://www.sfc.hk/web/EN/sfc-fintech-contact-point/>

Indonesia

Indonesia has been gaining increasing attention as Asia's next focal market for e-commerce and e-payments. Its growing economy, emerging middle class, youthful demographic, increasing spending power and rapidly growing Internet user-base are all reasons to be optimistic about the future prospects of Indonesia's digital economy.⁴⁹

The immediate priority for Indonesia appears to be on improving the ICT infrastructure to provide secure and reliable Internet connectivity. While mobile penetration has reached near ubiquitous levels, broadband connectivity is still limited, and national cybersecurity capabilities remain questionable.

Indonesia also needs a strategy for unlocking the nascent demand for e-payments, as this is Indonesia's weakest pillar (21st). The low ranking can be explained by Indonesia's heavy cash-dependency. Only 36% of the population was banked as of 2014, with credit card penetration at around only 5%, one of the lowest among APEC economies.⁵⁰ While 1 out of 4 Indonesians own a debit card, only 1 out of 10 would actually use it.⁵¹ However, Indonesia is also the world's fourth largest country by population with a very young demographic group and therefore the *potential* for growth amongst Indonesian consumers and businesses remains potent, and e-commerce and e-payments, particularly when delivered via mobile connectivity offer ways around many of the existing market constraints.

In the regulatory and policy pillar Indonesia fares relatively better (14th), but fell significantly in the provisioning of e-payment products and services (19th). There is, however, still a lot of room for Indonesia to improve the ease of doing business, the effectiveness of its legal system and the investment climate. Bureaucratic hurdles of market entry and investment clearly need to be addressed for Indonesia to fully benefit from the efficiencies and social gains possible from digital payments.

Recent E-payment Developments

More favourable regulatory change has begun taking place in recent years as the government recognised the potential of e-payments in fostering financial inclusion. A case in point is branchless banking, which uses agents and mobile phones to provide basic savings and transaction services, that has risen to prominence in Indonesia's national agenda. In 2013, Bank of Indonesia (BI) released guidelines for allowing selected banks and mobile network operators to pilot agent-model and mobile wallet initiatives to test the viability of the business model.⁵² A year later, the Financial Services Authority (OJK) formally opened the door for banks to hire agents to improve financial inclusion and expand basic financial services to remote and rural parts of the economy,⁵³ eventually

⁴⁹ TechnAsia (2015) Barriers to Indonesian e-commerce: Separating fact from friction, <https://www.techinasia.com/friction-points-and-barriers-indonesia-ecommerce/>

⁵⁰ Only 1.6% of 15 years or older Indonesians have credit cards, lower than Vietnam (1.9%) according to the World Bank's 2016 Findex figure. The figure for Papua New Guinea was not available. See <http://datatopics.worldbank.org/financialinclusion/>

⁵¹ World Bank (2016) Global Findex Database, <http://datatopics.worldbank.org/financialinclusion/>

⁵² CGAP (2013) Latest on Branchless Banking from Indonesia, <http://www.cgap.org/blog/latest-branchless-banking-indonesia>

⁵³ The Jakarta Post (2014) OJK Targets Deeper Financial Market with New Rules, <http://www.thejakartapost.com/news/2014/11/21/ojk-targets-deeper-financial-market-with-new-rules.html>

launching a nationwide campaign, *Laku Pandai*, in March 2015.⁵⁴ The initial four banks participating in this campaign had hired 30,000 agents as of September 2015.⁵⁵ As of October 2015, there were a total of 6 banks⁵⁶ that participated in the campaign. OJK expanded the programme by introducing Islamic banking, or Syariah Banking, in December 2015,⁵⁷ including two other Islamic banks in the process.⁵⁸ As of January 2016, there was IDR41.3 billion worth in saving funds and 1.09 million new customers nationwide.⁵⁹ Once OJK approves all pending licensing requests from 9 other banks, the number of agents is expected to grow to 300,000,⁶⁰ which will drastically improving the accessibility of mobile-based financial services.⁶¹ While OJK has achieved reasonable success in the past year with the programme, it hopes to expand it to include private lenders and rural banks in the near future.⁶²

Similar developments on the horizon should further help Indonesia move up the ranks in the coming years, such as the Ministry of Communication and Information Technology's aspirations to improve broadband connectivity⁶³ and to establish a national control tower for cybersecurity. The Ministry's forthcoming e-commerce roadmap will also provide regulatory clarity and boost the already-growing e-commerce market, and in turn, e-payments as well.⁶⁴

The private sector is also weighing in on Indonesia's e-payments opportunities. In May 2013 the three leading mobile network operators launched a ground-breaking initiative to make their mobile wallet services interoperable.⁶⁵ This allowed Telkomsel's T-cash, Indosat's Dompektu, and XL Tunai users to send money electronically across any of their networks. Furthermore, Telkomsel launched an NFC mobile payment service that seamlessly connects with T-Cash.⁶⁶ Separately, in June 2016,

⁵⁴ Participating banks include Bank Mandiri, Bank Rakyat Indonesia, Bank Central Asia and Bank Tabungan Pensiunan Nasional.

⁵⁵ OJK (2015) Siaran Pers: OJK Perluas Program Laku Pandai ke Perbankan Syariah, <http://www.ojk.go.id/id/kanal/syariah/berita-dan-kegiatan/siaran-pers/Pages/OJK-Perluas-Program-Laku-Pandai-ke-Perbankan-Syariah.aspx#sthash.kk14FULa.IDdEiTVi.dpuf>

⁵⁶ Bank Tabung Negara and Bank Negara Indonesia joined in May and September 2015, respectively. Refer to The Jakarta Post (2016) OJK Invites More Players to Join Branchless Banking Program,

<http://www.thejakartapost.com/news/2016/01/05/ojk-invites-more-players-join-branchless-banking-program.html>

⁵⁷ OJK (2015) Siaran Pers: OJK Perluas Program Laku Pandai ke Perbankan Syariah,

<http://www.ojk.go.id/id/kanal/syariah/berita-dan-kegiatan/siaran-pers/Pages/OJK-Perluas-Program-Laku-Pandai-ke-Perbankan-Syariah.aspx#sthash.kk14FULa.IDdEiTVi.dpuf>

⁵⁸ The Jakarta Post (2016) OJK Invites More Players to Join Branchless Banking Program,

<http://www.thejakartapost.com/news/2016/01/05/ojk-invites-more-players-join-branchless-banking-program.html>

⁵⁹ Ibid

⁶⁰ Ibid

⁶¹ The Jakarta Post (2015) Four Major Banks Launch Branchless Banking Program,

<http://www.thejakartapost.com/news/2015/03/27/four-major-banks-launch-branchless-banking-program.html#sthash.mgLqXTEm.dpuf>

⁶² The Jakarta Post (2016) OJK Invites More Players to Join Branchless Banking Program,

<http://www.thejakartapost.com/news/2016/01/05/ojk-invites-more-players-join-branchless-banking-program.html>

⁶³ GSMA (2016) Indonesian Government Encourages Operator to Share their Networks for Faster MBB Deployment,

<http://www.gsma.com/mobilefordevelopment/programme/connected-society/indonesian-government-encourages-operator-to-share-their-networks-for-faster-mbb-deployment>

⁶⁴ The Jakarta Post (2014) Government to Launch E-commerce Law Framework This Year,

<http://www.thejakartapost.com/news/2015/03/07/govt-launch-e-commerce-law-framework-year.html>

⁶⁵ GSMA (2013) Implementing Mobile Money Interoperability in Indonesia,

<http://www.gsma.com/mobilefordevelopment/wp-content/uploads/2013/10/Implementing-mobile-money-interoperability-in-Indonesia.pdf>

⁶⁶ NFC World (2015) Telkomsel Launches NFC Mobile Payments and Loyalty Service in Indonesia,

<http://www.nfcworld.com/2015/10/16/338743/telkomsel-launches-nfc-mobile-payments-and-loyalty-service-in-indonesia/>

Lotte, the Korean multinational company, expressed interest in offering credit card services in Indonesia.⁶⁷

Looking Ahead

While banks and telcos currently dominate the e-payment market, e-commerce and alternate payment solutions providers will play a critical role in spurring demand in the future. E-commerce platforms such as Lazada and Tokopedia have circumvented the limitations on current e-payment infrastructure by offering cash-on-delivery and bank transfers options. As more and more Indonesians become accustomed to the convenience of online commerce, the demand for digitally-enabled payments will continue to rise, particularly among young and tech-savvy Indonesians.

Another hurdle is inconsistent regulations and the siloed approach of different government agencies. BI, for example, has one set of governing rules for e-money while, OJK has another for *Laku Pandai*, with the latter linked to savings accounts.⁶⁸ The programme is thus heavily reliant upon banks with limited support from telcos, limiting the programme's potential reach.⁶⁹

Finally, consumer mistrust of e-payment systems needs to be addressed. Progress has been made⁷⁰ but there is still a long way to go in improving the reliability of payment gateways, for example.⁷¹

⁶⁷ The Jakarta Post (2016) Lotte Aims to Take Slice of Indonesia's Credit Card Industry,

<http://www.thejakartapost.com/news/2016/06/06/lotte-aims-take-slice-indonesia-s-credit-card-industry.html>

⁶⁸ The Wall Street Journal (2015) Mobile Banking Struggles in Indonesia

⁶⁹ Ibid

⁷⁰ Tech in Asia (2014) Doku Transacts IDR 520 million, <https://www.techinasia.com/doku-2014-520-million-transaction/>

⁷¹ According to Veritrans, a typical payment gateway in Indonesia had reliability of 96% (4 out of 100 transactions will return error) when the company was first established. The company subsequently improved the rate to 98% but is still below international average, which is above 99.9%.

The Philippines

With a relatively long history in mobile payment services and a growing e-commerce market, the Philippines is primed to be a hotbed for e-payments. At the macro level, the Philippines still has some way to go in improving its rule of law and the business environment, both of which dragged the economy's scores down in the regulatory and policy environment pillar. According to the assessment of the United States Agency for International Development (USAID) and the American Bar Association, Philippine courts are burdened with lengthy backlogs, making timely delivery of justice difficult and ultimately undermining the credibility of the judicial system.⁷² Despite government efforts at improving the business climate, the economy is losing ground to its peers when it comes to facilitating market entry of new businesses (below Malaysia, Thailand and Vietnam).

While the Philippines fares well in mobile penetration, there is still significant room for improving ICT infrastructure security and access to formal financial systems. Its score in the Global Cybersecurity Index lags behind regional and income peer groups, and formal financial services remain out of reach for the majority of Filipinos. Supporting the latter assessment are indicators on the ownership and use of credit cards in the Philippines, amongst the lowest in APEC at 2%.⁷³

The silver lining is the active use of the Internet and social media by the country's young and growing population. While the majority of Filipinos have yet to use the Internet or mobile for day-to-day payments activities (only 2.5% of the population are using their mobile to make a transaction according to the latest Findex results), the current levels of social media use show significant latent demand to be tapped.

The growth trajectory of e-commerce also shows that Filipinos are increasingly becoming comfortable with online shopping. The e-commerce market is projected to grow at a compound annual growth rate (CAGR) of 101.5% during 2013-2018,⁷⁴ led by regional e-commerce juggernauts such as Zalora and Lazada, and local retail heavyweights such as the SM group. The overseas Filipino worker community, whose remittance amounted to 8.5% of the economy's GDP in 2014,⁷⁵ is another factor that is likely to contribute to the increasing demand for e-payment products and services.

The Philippines is relatively well positioned when it comes to the supply side of the e-payment services and products. Home to two of the earliest mobile payments services in the world—GCash and Smart Money, launched in the early 2000s—the Philippines enjoys a plethora of options when it comes to mobile payments. Leading forces include the telco duopoly (PLDT and Globe), and alternative payments services by international players such as PayPal and local firm Dragonpay. The key priority for the Philippines is to drive adoption widely throughout the economy so that the pervasiveness of the e-payment reaches critical mass. Building consumer trust is key in driving adoption but that requires sustained efforts from services providers, supported by an enabling legal and regulatory environment.

⁷² The American Bar Associations, The Rule of Law Programs in the Philippines, http://www.americanbar.org/advocacy/rule_of_law/where_we_work/asia/philippines/programs.html

⁷³ World Bank (2016) Global Findex Database, <http://datatopics.worldbank.org/financialinclusion/>

⁷⁴ Ken Research (2014) The Philippines E-Commerce Market Outlook to 2018, <http://www.kenresearch.com/it-enabled-services/e-commerce-industry/philippines-e-commerce-market-research-report/590-105.html>

⁷⁵ Manila Times (2015) OFW Remittance Hit Record High, <http://www.manilatimes.net/ofw-remittances-hit-new-high/163522/>

Recent E-payment Developments

In recent years, the Philippines government has paid particular attention to the potential of e-payments in reducing corruption and increasing efficiency of financial flows in the public sector.⁷⁶ As a result, the government has initiated a number of initiatives that show a deliberate and strategic shift toward e-payment systems.

In 2011, the government started a number of e-government initiatives to create an integrated financial management information system for a more transparent and effective way of monitoring public funds. One of the initiatives is the development of an e-procurement system (PhilGEPS) to allow e-bids, e-payments and e-transactions in the use of public funds. PhilGEPS eventually went live in 2013 in partnership with the Land Bank of the Philippines, allowing government agencies to pay for procured items through an online portal. The Department of Science and Technology further supported the shift with the launch of a payment platform for all government agencies, PhPay, in 2013, which integrated existing market services providers such as Dragonpay, PVB Card, Asia Pay and Rural Net. The National Telecommunications Council and the Social Security System followed suit by implementing and accepting real-time online payments. In 2016, the Bureau of Central Revenue partnered with Globe to re-launch the mobile payment service for tax filing and payments.⁷⁷

The Central Bank, Bangko Sentral ng Philipinas (BSP) has also played an important role in enabling the growth of mobile money services. In part due to its financial inclusion mandate, BSP has taken a 'test and learn' attitude instead of an *ex-ante* approach to mobile money regulations, enabling innovations from market players. This includes approving non-bank agents to perform cash in/out services in 2005, effectively turning pawnshops, airtime sellers and moneychangers in the rural areas into e-payment network extensions.⁷⁸ It hopes to see more consumers adopt the usage of e-payments and targets its share in the payment industry to reach 20% by 2020.⁷⁹ With the development of virtual currency systems, policymakers are considering tightening regulations for bitcoins to curb money laundering and to strengthen its cybersecurity.⁸⁰

The latest development in the government-to-consumer space stems from the Kasambahay Law, which aims to improve social security benefits of overseas domestic workers. The law prompted Globe and Smart to roll out new mobile wallet offerings. Smart Communications, a subsidiary of PLDT, for example, rolled out BayardLoad, an e-money platform to facilitate employers of overseas Filipino workers to subscribe to and pay for government social benefits, including the Social Security System, Philippine Health Insurance Corp (PhilHealth), and the Home Development Mutual Fund.⁸¹ With such developments the Philippines has become one of the most interesting markets for e-payment initiatives and can be expected to rise up the rankings in the coming years.

⁷⁶ World Bank (2015) Infrastructure Challenges in the Philippines,

<http://www.worldbank.org/transport/transportresults/regions/eap/infra-chall-philippines.pdf>

⁷⁷ Manila Bulletin (2016) BIR, GCash Relaunch First E-tax Filing and Payment System in PH, <http://www.mb.com.ph/bir-gcash-relaunch-first-e-tax-filing-and-payment-system-in-ph/#HQ3y2tqqKXx4wlp7.99>

⁷⁸ GSMA (2012) Mobile Money in the Philippines – The Market, the Models and Regulation.

⁷⁹ The Manila Times (2016) E-commerce Seen as Major Growth Driver by 2020, <http://www.manilatimes.net/bsp-sees-e-payments-growing-by-20-in-2020/233809/>

⁸⁰ Reuters (2016) UPDATE 2-Philippine central bank bolsters cyber security, may regulate bitcoin operators, <http://www.reuters.com/article/cyber-heist-philippines-idUSL4N18W05K>

⁸¹ Also known as Pag-IBIG Fund. CGAP (2013) <http://www.cgap.org/blog/innovation-person-government-payments-philippines>

Looking Ahead

While the Philippines has been slowly moving towards a 'cash-lite' society for some time, a few impediments in market conditions need to improve for the economy to make it to the next stage of broad-based e-payment adoption. Similar to Indonesia, customers' lack of trust and preference in using cash for payments are barriers to the expansion of online shopping.⁸² Furthermore, the archipelagic geography of the country makes logistics operations difficult.⁸³ The long-standing duopoly of PLDT and Globe has reduced the incentives for the companies to work together and thus make the e-payment pie bigger. Although GCash and Smart Money has announced successful trials in mobile interoperability,⁸⁴ the fact that both payment systems are still not interoperable a decade after their inception is a case in point. Anecdotal evidence shows that existing e-payment players are not investing enough to improve the consumer experience in e-payments.⁸⁵ New entrants such as Coins.Ph, a cryptocurrency-based P2P payment platform, is banking on this gap to be able to penetrate and grow in the market.

The government has taken steps to map out the future of e-commerce with the Philippines E-Commerce Roadmap (PECR) 2016-2020. The Department of Trade and Industry expects e-commerce to take up 25% of the country's GDP by 2020.⁸⁶ This masterplan will help the Philippines slowly inch towards a 'cash-lite' society.

⁸² The Freeman (2015) Barriers to E-commerce Growth Online Shoppers Prefer Paying Cash <http://www.philstar.com/freeman/cebu-business/2015/10/18/1512451/barrier-to-e-commerce-growth-online-shoppers-prefer-paying-cash>

⁸³ *ibid*

⁸⁴ Inquirer (2016) PayMaya, GCash Announces Successful Trials of Mobile Money Interoperability, <http://business.inquirer.net/207626/paymaya-gcash-announce-successful-trials-of-mobile-money-interoperability>

⁸⁵ Telephone interview with Ron Rose, Founder of Coins.Ph. Dated 15 June 2015.

⁸⁶ The Manila Times (2016) E-commerce seen as major growth driver by 2020, <http://www.manilatimes.net/e-commerce-seen-as-major-growth-driver-by-2020/262182/>

4. Conclusion and Recommendations: Looking Ahead

E-payment enables economies to run better and boosts growth through different ways such as reducing transaction costs, expanding formal financial services to the 'uneconomic', inducing productivity gains for government and businesses, and opening markets and increasing access for SMEs.

This study documents the linkages between e-payment penetration and economic growth and canvasses where each APEC economy stands in the usage and level of development in e-payments. The APEC E-payment Index provides a tool with which to understand where the barriers are and which areas need to be improved in order to benefit from the opportunities presented by e-payments.

Noting the wide-ranging socio-economic impacts e-payments adoption can have on APEC economies, the following are some of the lessons that can be taken forward by the APEC Business Advisory Council.

- **Understanding that the level of economic growth is not the sole determinant of e-payment readiness or adoption.** While supportive infrastructure such as ICT and payment networks are heavily influenced by income level, others such as regulatory regimes, demand, and even the capacity to innovate, show weak correlation to income levels.
- Conversely, **fostering digital payments, or transactions can enable an economy to 'leapfrog' in its economic development trajectory.** This involves a systemic focus and a whole of government policy-driven approach to establish an environment that promotes e-payment adoption and innovation.
- While each economy can have a different pathway towards maximizing e-payments, **a few building blocks need to be in place for a transformational shift towards e-cash-lite society.**
 - No matter the stage of development of the e-payment ecosystem, facilitating an attractive market (including business) climate, and investments into innovative e-money solutions is important to sustain development of an e-payment ecosystem.
 - Building consumer trust is crucial to achieving the desired network effects of e-payments.
- **Understanding that future growth will come disproportionately from emerging economies fuelled by affordable smartphones and interoperable network access.** The playing field for innovations is being levelled for both developed and developing countries.
- **Government adoption of e-payments creates new opportunities, new needs for payment infrastructure and a change in consumer cash dependence.**
- **Fostering e-payments is a multi-faceted endeavour that cuts across different sectors and government agencies.** Therefore, bridging various issues – services and technology, financial and Internet access, for example, in policymaking and creating enabling conditions for industry collaborations especially among financial institutions, telcos, and alternative payment service providers are important for balanced development of e-payments.

- The region includes a mix of developed and emerging markets operating with different agendas and multiple regulations that govern e-payments. For SMEs to fully benefit from the market access and growth opportunities e-payments offer, and to enable societies to fully benefit from e-payments, **APEC economies need to create a consistent and coordinated approach to e-payments**, including harmonisation of procedures and e-payment policy alignment.

In addition, there are areas of future works that can be considered:

- **For a longitudinal view of APEC:** Compile the APEC E-payment Index on an annual basis so that economies can build a trend-line of information to track progress
- **Empirically substantiate the linkages between the use of e-payments and economic growth:** Conduct a thorough econometric modelling of the economic contribution of e-payments across all 21 APEC economies over an extended period of time
- **To understand market dynamics:** Conduct country-level research that involves a matrix of stakeholders and existing regulations that govern e-payments. This will help identify where the inconsistencies and gaps are that throttle adoption and innovation.
- **To provide insights on how best to roll out an e-payment regulatory framework:** Research potential operational risks stemming from diversity, concentration and complexity of various payments players and networks.

Digitisation of payments is not a question of 'if', but 'when'. Cash-dependent economies face not only frictions in businesses transactions but in public service delivery, cross-border trade and inclusive financial growth. While there are many barriers to adoption, the benefits of e-payments far outweigh the risks of non-adoption. Wider use of e-payments and policies that support their adoption is a priority no APEC economy can afford to ignore.

Appendix 1. Econometric Methodology and Results

Data

The dataset used in this proof-of-concept econometric analysis includes variables listed below for five economies, namely Australia, China, Indonesia, Japan, Republic of Korea, and the United States, observed across four years, spanning from 2011 to 2014.

Methodology

Since the purpose of the econometric modelling was to prove that the Deloitte modelling used for the Europe is applicable to the APEC economies, the researchers simplified the Deloitte modelling into the following equation.

$$\ln(GDPpercap_{i,t}) = (\alpha + \beta \ln(GDPpercap_{i,t})) + \gamma \ln(OnlineRetailSales_{i,t}) + x_{i,t}\delta + \theta_i + \varepsilon_{i,t}$$

where $x_{i,t}$ includes $Inv_{i,t}$, $GovExp_{i,t}$, $LabPart_{i,t}$ and $Trade_{i,t}$,

wherein the variables used are defined as below:

Table A-1. Variables

Variable Name	Variable Description
LnGDPpercap	Log of GDP per capita in constant 2005 USD
GovExp	Gen government final consumption expenditure as a share of GDP
LnOnRetailSales	Log of Online Retail Sales
Inv	Gross capital formation as a share of GDP
LabPart	Labour force participation rate
Trade	Trade as a share of GDP

The econometric results are as follows:

Table A-2. ANOVA^a

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	38.453	5	7.691	67.194	.000 ^b
Residual	2.747	24	.114		
Total	41.200	29			

a. Dependent Variable: LnGDPpercap

b. Predictors: (Constant), GovExp, Trade, Inv, LaborPart, LnOnlineRetail

First, the fitness of the model to the data was tested (see Table S-2). An F-test in regression compares the fits of different linear relationships and can assess multiple coefficients simultaneously. The F-test of overall significance determines whether this model is statistically significant. The regression analysis shows that the F-test outcome is highly significant (< .001), so the model does fit the data.

Table A-3. R square

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.966 ^a	.933	.919	.33831

a. Predictors: (Constant), GovExp, Trade, Invt, LaborPart, LnOnlineRetail

In regression, the R-squared coefficient of determination is a statistical measure of how well the regression line approximates the real data points. Despite the modification in the modelling from the Deloitte study, R square shows the percentage of the dependent variable variation that is explained by the model. In our case, 93.3% of the variance in GDP per capita can be explained by all the independent variables (see Table A-3).

Table A-4. Coefficients^a

Model		Unstandardised Coefficients		Standardised Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	7.078	1.651		4.288	.000
	Lnnonlineretail	.175	.043	.360	4.123	.000
	Invt	-.055	.010	-.413	-5.373	.000
	LaborPart	.003	.020	.015	-.172	.865
	Trade	-.001	.004	-.022	-.309	.760
	GovExp	.205	.029	.534	6.997	.000

a. Dependent Variable; LnGDPpercap

Online retail sales show a significant coefficient and has a low p-value (<.05), which suggests that changes in its value are related to changes in GDP per capita. The results suggest that a 1% change in online retail sales is associated with 0.175 % change in GDP per capita.

Appendix 2. APEC E-payment Index – Methodology

The E-payment Ecosystem

The APEC E-payment Index gauges the readiness and capacity of the 21 economies that comprise APEC⁸⁷ to engage in e-payment, the level of use of e-payment and m-payment services, as well as their development potential based on each economy's e-payment ecosystem.

Using 44 business, technology, financial access and payments-specific variables, the Index scores and ranks the 21 economies to identify who are successful in adopting and utilising electronic forms of payment today, and also those that offer future potential in terms of capacity to innovate.

Four pillars make up the e-payment ecosystem, and the weighting given to each pillar in the Index is as follows:

1. **Regulation and Policy** (business climate and openness to technology) – 20%
2. **Infrastructure** (level of enabling technology and financial connectivity) – 30%
3. **Demand** (e-payment usage level and latent demand) – 30%
4. **Innovative Products and Services** (the supply-side landscape and capacity to innovate) – 20%

Pillar 1 looks at the extent to which regulations and policies are hindering or fostering the development and growth of businesses related to e-payment, as well as e-payment adoption by businesses and individuals. It therefore focuses on the regulatory and policy environment for both the technology and business sectors. It reflects on the presence of ICT-related regulations and policies (e.g., electronic commerce, digital signatures, consumer protection), and the extent to which government is using technology to enhance competitiveness. It also examines the time and costs required to start a business, the efficiency of the legal framework in settling disputes and challenging regulations, and the range of financial products and services available to businesses.

Pillar 2 includes indicators on the connectivity and financial infrastructure required to provide reliable and secure e-payment services. It captures the level of penetration of the Internet, wireless broadband, mobile phones and smartphones, as well as the coverage of payment options through ATMs and commercial bank branches in each economy. It also examines national capabilities in cybersecurity. Capabilities to address security risks are vital to enable both the demand for e-payment, as well as promote e-payment innovation.

Pillar 3 provides a picture of both latent and actual demand for e-payment services from businesses and consumers. It contains indicators on three aspects: the use of cashless transactions, the use of mobile payments, and the usage level of the Internet at large. Indicators for the latter include the use of the Internet to buy things and pay bills, and as e-payment options are being introduced through social media, the time spent on social media is also measured.

Pillar 4 focuses on the supply-side of e-payment, including the presence of international e-commerce and e-payment players such as Alibaba, Alipay, Amazon, Bitcoin, eBay, PayPal, Taobao and Tenpay, and each economy's capacity to develop innovative e-payment solutions. The presence of international players both promotes and is indicative of open access and demand, which leads to

⁸⁷ The 21 APEC economies are: Australia, Brunei Darussalam, Canada, Chile, China, Hong Kong, Indonesia, Japan, Republic of Korea, Malaysia, Mexico, New Zealand, Papua New Guinea, Peru, Philippines, Russia, Singapore, Chinese Taipei, Thailand, United States of America and Vietnam.

diverse business models and competition. This pillar is represented by indicators assessing the availability of credit, capacity of human resources for innovation through the number of graduates in engineering and science, number of venture capital deals, ICT patents application, the extent of digitisation of new businesses, and the extent and quality of electronic transactional services being offered to citizens as part of e-government initiatives.

A team of researchers collected data for the Index in February to April 2016. The process of developing the Index included establishing relevant sub-indexes or pillars, selecting relevant indicators for each pillar, normalising the data, addressing missing data, and finally calculating the Index. The Index is based on a 100-point scale, where 1 represents the worst situation and 100 the best.

Selecting the Indicators

A total of 44 indicators were selected for the 2016 APEC E-payment Index, up 5 indicators from previous 39 in 2015. Aside from the 5 new indicators, 14 indicators were refreshed with the latest available statistics. Only indicators with data available for at least two-thirds of APEC economies were used. For all the indicators, the latest data available at the time of research was used, and the values for each indicator were taken from the same year, with the exception of Brunei Darussalam.⁸⁸

The indicators selected for each of the pillars are summarised below:

1. Regulation & Policy <i>(8 indicators)</i>	2. Infrastructure <i>(8 indicators)</i>	3. Demand <i>(19 indicators)</i>	4. Innovative Products & Services <i>(9 indicators)</i>
Time and cost required to start a business	Commitment to cybersecurity	Average daily use of the Internet via a PC or tablet, on social media(2 indicators)	Ease of getting credit and venture capital deals
Efficiency of legal framework in settling disputes	Number of secure Internet servers	Use of mobile payment – to make transactions, pay bills, receive wages, receive government transfers (4 indicators)	Graduates in the Sciences and Engineering
Efficiency of legal framework in challenging regulations	Number of Internet users	Payment through accounts in financial institutions - having an account, receive wages, receives government transfers, or pay utility bills (4 indicators)	Transactional and connected e-services offered by government
Business impact of rules on foreign direct investment	Wireless broadband subscriptions	Use of electronic payment – to make payments / percentage of population who used the Internet to pay bills or buy things (2 indicators)	PCT ICT patents application
Level of development of laws relating to ICT	Smartphone penetration	Proportion of population with credit cards and number of people who used	ICT and business model creation

⁸⁸ The latest World Economic Forum's Networked Readiness Index 2015 did not include Brunei Darussalam, therefore in cases where the indicators used were from this Index, Brunei Darussalam's data came from the 2014 Index while the other economies used the 2015 Index.

		credit cards in the past 12 months (2 indicators)	
Importance of ICTs to government vision of the future	Mobile subscribers	Proportion of population with debit cards and number of people who used debit cards in the past 12 months (2 indicators)	Availability of Amazon, PayPal and eBay in a country
Government success in ICT promotion	Number of automated teller machines (ATMs)	Percentage of population using mobile banking and percentage of the national population who bought something online in the past month (2 indicators)	Availability of Alibaba, Taobao, Alipay and Tenpay in a country
Availability of financial services	Number of commercial bank branches	Percentage of smartphone users who have purchased via phone	Number of Bitcoin nodes

The indicators under each pillar were weighted equally.

Normalisation

As the indicators had different units and scales, any indicator that did not use a 100-point scale had to be normalised to make the indicator values comparable, as well as to construct aggregate scores for each economy.

Some indicators, such as the one utilising the International Telecommunication Union Global Cybersecurity Index, and the number of Internet users per 100 inhabitants, already used a 100-point scale so these did not need to be normalised. Indicators not based on a 100-point scale, such as the indicators using the results from the World Economic Forum's Executive Opinion Survey which gave a rating of 1 to 7 for each economy, were normalised.

For indicator values that required normalisation, minimum and maximum values were set in order to transform the indicators expressed in different units into indices between 0 and 100 using the following formula:

$$\text{Normalised value} = ((\text{actual value} - \text{minimum value}) / (\text{maximum value} - \text{minimum value})) \times 100$$

Certain indicators, such as the one on mobile subscription per 100 inhabitants had values over 100. For these indicators it was decided that the maximum value would be 100, and any economy with a value over 100 was adjusted to 100.

Treatment of Missing Values

Many of the indicators contained missing values for a handful of economies. Brunei Darussalam, Hong Kong, Papua New Guinea, and Chinese Taipei in particular had missing data for a number of the indicators. For this reason, resulting ranking of these countries need to be interpreted with caution. It was necessary to estimate the missing values because missing values would have led to a bias in calculating the Index and limited the ability to make comparisons across economies.

To estimate the missing values for an economy, a clustering technique was used. The economies were grouped by the World Bank's income classification, and for a particular indicator with missing

value, the average of the normalised data for each income group was calculated to estimate the missing values.

World Bank's income classification used to group the economies is as follows:

- *High-income economies* (GDP per capita of USD 12,746 or more): Australia, Brunei Darussalam, Canada, Chile, Hong Kong, Japan, Republic of Korea, New Zealand, Russian Federation, Singapore, Chinese Taipei, United States of America
- *Upper-middle-income economies* (GDP per capita of USD 4,126 to USD 12,745): China, Malaysia, Mexico, Peru, Thailand
- *Lower-middle-income economies* (GDP per capita of USD 1,046 to USD 4,125): Indonesia, Papua New Guinea, Philippines, Vietnam

For example, to estimate the missing value for Papua New Guinea for a particular indicator, an average of the normalised data for the lower-middle-income economies, that is Indonesia, Philippines and Vietnam, was used.

A disadvantage of this technique is the overestimation of some of the missing data for economies like Brunei Darussalam, Chile and Papua New Guinea.

Aggregation and Production of the APEC E-payment Index

Once all the values were normalised and the missing values estimated, an average was calculated for each economy in each pillar. This allows us to see the economies' score and ranking for each pillar.

To calculate the overall score, the sum of the score for each pillar was used, taking into consideration the weight given to each pillar. For example, for Australia, the average score for each pillar was as follows:

1. Regulation and Policy (20%) – 62.2
2. Infrastructure (30%) – 70.5
3. Demand (30%) – 56.1
4. Innovative Products and Services (20%) – 51.0

The overall score was calculated as follows:

$$(62.2 \times 20\%) + (70.5 \times 30\%) + (56.1 \times 30\%) + (51.0 \times 20\%) = 60.6$$

Data Sources

The indicators and data were drawn from official and publicly available sources such as the International Telecommunication Union, United Nations and World Bank.

While many of the datasets are hard, factual data such as the Internet penetration rate, some of the data are more subjective and are taken from, for example, the World Economic Forum's Executive Opinion Survey that gathers the opinions of decision makers and influencers who are familiar with a particular economy. The survey is used to measure concepts that are qualitative in nature or for which internationally comparable statistics are not available for enough economies, and a rating of 1 to 7 is provided for each economy, where 1 corresponds to the worst situation and 7 the best. For example, one of the indicators looks at the extent to which government have a clear implementation plan for utilising ICTs to improve the country's overall competitiveness, 1=no plan and 7=clear plan.

The complete data sources are listed below.

- Bitnodes, Global Bitcoin Nodes Distribution, <https://getaddr.bitnodes.io/>

- International Telecommunication Union, Global Cybersecurity Index 2014, <http://www.itu.int/en/ITU-D/Cybersecurity/Pages/GCI-2014.aspx>
- International Telecommunication Union, World Telecommunication/ICT Indicators Database 2015, <http://www.itu.int/en/ITU-D/Statistics/Pages/publications/wtid.aspx>
- Consumer Barometer, <https://www.consumerbarometer.com/en/>
- United Nations, E-government Survey 2014, <https://publicadministration.un.org/egovkb/en-us/Reports/UN-E-Government-Survey-2014>
- United Nations Conference on Trade and Development, Information Economy Report 2015, <http://unctad.org/en/Pages/Publications/InformationEconomyReportSeries.aspx>
- WeAreSocial.com, <http://wearesocial.com/sg/special-reports/digital-2016>
- World Intellectual Property Organisation (WIPO), Global Innovation Index 2015, <https://www.globalinnovationindex.org/content/page/GII-Home>
- World Bank Doing Business 2015: Going Beyond Efficiency, <http://www.doingbusiness.org/reports/global-reports/doing-business-2015>
- World Bank, Global Findex Database, <http://datatopics.worldbank.org/financialinclusion/>
- World Bank, World Development Indicators, <http://data.worldbank.org/data-catalog/world-development-indicators>
- World Economic Forum, Global Competitiveness Index 2015-2016, <http://reports.weforum.org/global-competitiveness-report-2015-2016/>
- World Economic Forum, Networked Readiness Index 2014 and 2015, <https://www.weforum.org/reports/global-information-technology-report-2014/>, <http://reports.weforum.org/global-information-technology-report-2015/network-readiness-index/>