asia cloud computing association

Cloud Readiness Index 2018

The ACCA is the apex industry association representing the stakeholders of the cloud computing ecosystem in Asia Pacific. Its mission is to accelerate adoption of cloud computing in Asia by creating a trusted and compelling market environment and a safe and consistent regulatory environment for cloud computing products and services.

The association works to ensure that the interests of the cloud computing community are effectively represented in the public policy debate. Drawing on subject-matter expertise from member companies, expert working groups, and special interest groups, it develops best practice recommendations and other thought leadership materials.

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The Asia Cloud Computing Association's

Cloud Readiness Index 2018

Table of Contents

Tables and Figures

I. Executive Summary

Welcome to the fifth iteration of the Cloud Readiness Index (CRI), developed by the Asia Cloud Computing Association (ACCA). Since its first publication in 2011, the CRI has become a definitive reference point to assess the readiness of Asia Pacific (APAC) markets to adopt cloud computing.

CRI 2018 measures economies' preparedness through ten quantitative parameters, followed by a qualitative review of the regulations and policies each APAC market has put in place since the last iteration of the CRI. Three key observations may be made from this year's results:

1. 'Cloud First' Policies Advance in APAC
2. APAC Cloud Readiness Remains Stable; Though Inequality Remains
3. APAC Continues Global Lead on Cloud Readiness

'Cloud First' Policies Advance in APAC

In previous years, the ACCA has noted that economies that have 'Cloud First' government policies in place tend to score better in the CRI. This was the case of Australia and New Zealand, for instance. Since 2016, a number of APAC economies have made progress in this regard. In the Philippines, the Department of Information and Communications Technology (DICT) announced a government-wide 'Cloud First' approach in January 2017, pushing departments and agencies to make cloud computing solutions a key part of their infrastructure planning and procurement.[1] Similarly, in October 2017, Malaysia announced a 'Cloud First' strategy as part of the nation's digital adoption initiatives, to be driven by the Malaysia Digital Economy Corporation (MDEC).[2]

'Cloud First' policies and frameworks may not be in place across all of APAC yet, but regional governments are working to make the shift, putting cloud infrastructure and expertise at the heart of their wider national digital transformation agendas. Some economies are moving further, refining these policies in their transition to the cloud. Australia, for example, replaced its 2014 'Cloud First' policy with a new approach in February 2018. Titled 'Secure Cloud Strategy', the policy is designed to actively respond to changing technology landscapes and security needs.[3]

The ACCA recommends that economies who do not have 'Cloud First' policies consider their implementation, and that economies who have them in place look into developing supporting measures. These may include cloud vendor registration/accreditation schemes, guidelines for baseline security standards to enhance cybersecurity, or data management policies.

APAC Cloud Readiness Remains Stable; Though Inequality Remains

The CRI 2018 results are telling – most economies did not move in the rankings, save for Japan, Singapore, and Taiwan (ascending one rank each), and Australia and Hong Kong (respectively losing two and one positions). Combined with Hong Kong's tumble, Singapore's ascension allowed it to pull ahead of the pack and take the top regional spot. The lack of major movements suggests that all markets are improving at the same aggregated pace in terms of Cloud Infrastructure, Security, Regulation, and Governance.

The intra-regional readiness divide observed in the 2016 report remains. The difference between economies' CRI 2018 scores averages 2.7 points – just above the 2.6 of 2016 – which means the gap has slightly widened over time. The fact that the eight highest ranking economies remain unchanged between CRI 2014 and CRI 2018 suggests that this divide may already be deeply entrenched. Without further intervention, this divide could widen despite the efforts being made by emerging markets to leverage the smart technologies of the Fourth Industrial Revolution to leapfrog into digitally-enabled economies.

To reduce the cloud computing divide, the ACCA recommends emerging APAC economies accelerate work to develop initiatives that boost connectivity fundamentals. These could be government cloud (gCloud) schemes that improve international and domestic connectivity, as well as national digitisation plans that drive short-term technological innovation in emerging fields (5G, Internet of Things, Artificial Intelligence) and address longer term development goals.

APAC Continues Global Lead in Cloud Readiness

As in its previous edition, the CRI 2018 includes six non-Asian economies to provide an additional layer of international comparison. The results show that the top APAC performers (Singapore and Hong Kong) come out as global leaders, ahead of much larger economies such as the United Kingdom (UK), Germany, and the United States (US).

Closer examination reveals that leading APAC economies outperform non-APAC markets in the Cloud Infrastructure segment, thanks to higher scores in the International Connectivity, Broadband Quality, and Power Grid, Green Policy, and Sustainability parameters. APAC economies also have a slight advantage in terms of Cloud Regulation, with several of them having taken steps to strengthen privacy and intellectual property frameworks in the last year.

The ACCA notes that APAC economies are in a strong position to lead the next wave of global innovation; the more cloud technologies are ingrained in future policies, the easier it will be to seize the opportunities that drive the world's digital economy.

Needed: Metrics for the Data Economy

The results of the CRI 2018 do beg some questions, such as: if China has been making leaps and bounds through its development of cloud, IoT, AI, and robotics – why does it remains at the bottom of the index? Likewise, India's forward-looking approach to digital is not reflected in its index ranking of 12th place. The ACCA believes that these gaps are due to the lack of publicly-available metrics on cloud adoption and cloud application and usage – including mobile app usage, e-payment schemes, industrial adoption of IoT and AI technologies, to name but a few.

We cannot improve what we do not measure. Globally-comparable metrics are needed to not only assess the social and economic impact of cloud, but also to paint an accurate picture of what is needed to succeed in today's data economy. The concluding chapter of this report explores what some of these metrics and next steps could be.

Looking Ahead Beyond Cloud Readiness: Unlocking Digital Opportunities

The ACCA believes that enabling the seamless flow of data through cloud computing is key to economic growth. Moving further into the Fourth Industrial Revolution, cloud-based technologies will continue to drive intelligent innovation that connects people, products, and platforms. In this context, APAC economies must be aware of where their cloud readiness stands so that they go beyond following trends and effectively drive the cloud movement. To this end, the CRI 2018 provides perspectives that help APAC economies keep up with global technology trends.

The ACCA believes that the public and private sectors must work together towards better data management solutions that allow pertinent, timely information to be shared safely and securely across borders. The answers may not come easily, but in our function as a vendor-neutral platform, we will continue to enable frank and productive discussions between governments, private companies, international organisations, and academia.

We welcome your feedback at secretariat@asiacloudcomputing.org, and look forward to continuing existing partnerships and forging new relationships. Working together, we can better understand the implications that new cloud technologies will have on national, regional, and global growth.

II. Cloud Readiness Index 2018

Table 1: Cloud Readiness Index 2018

Rank, Economy	CRI#01 International Connectivity	CRI#02 Broadband Quality	CRI#03 Power Grid, Green Policy, and Sustainability	CRI#04 Data Centre Risk	CRI#05 Cybersecurity	CRI#06 Privacy	CRI#07 Government Regulatory Environment	CRI#08 Intellectual Property Protection	CRI#09 Business Sophistication	CRI#10 Freedom of Information	**TOTAL CRI 2018 SCORE (/100)**	**Rank Change**
#1 Singapore	7.0	9.5	6.0	4.6	9.3	9.0	9.0	8.9	8.5	4.9	**76.6**	+1
#2 Hong Kong	9.3	7.7	4.4	5.3	8.1	9.0	6.7	8.4	8.3	7.1	**74.1**	-1
#3 New Zealand	3.9	5.7	7.2	4.8	7.2	8.5	7.7	8.9	8.7	8.6	**71.1**	-
#4 Japan	3.5	6.5	5.3	4.4	7.9	9.0	7.7	8.3	7.6	7.1	**67.1**	+1
#5 Taiwan	6.5	6.5	4.5	4.2	8.1	7.0	7.1	7.4	8.0	7.6	**66.9**	+1
#6 Australia	3.5	5.2	4.1	4.3	8.2	9.0	7.1	8.3	8.0	8.4	**66.3**	-2
#7 South Korea	2.8	7.4	4.1	4.3	7.8	8.5	8.0	6.3	8.4	7.2	**64.8**	-
#8 Malaysia	2.5	5.5	4.0	4.1	8.9	7.5	7.9	7.6	7.8	5.3	**61.0**	-
#9 Philippines	2.5	4.8	4.5	3.9	5.9	8.5	5.7	5.9	5.9	5.9	**53.6**	-
#10 Thailand	2.7	6.9	2.2	3.8	6.8	4.5	5.4	5.0	7.7	5.5	**50.6**	-
#11 Indonesia	1.7	5.5	2.9	3.8	4.2	6.5	5.6	6.4	6.7	6.0	**49.4**	-
#12 India	1.1	4.7	1.5	3.4	6.8	6.0	5.9	6.3	6.1	5.7	**47.4**	-
#13 China	1.0	4.9	1.6	3.7	6.2	4.0	6.6	6.4	6.5	2.2	**43.1**	-
#14 Vietnam	3.6	5.3	2.1	3.9	2.5	3.5	5.7	5.1	6.8	2.6	**41.0**	-

Comparison with non-APAC economies

Brazil	*3.1*	*4.9*	*4.3*	*3.9*	*5.9*	*4.0*	*5.1*	*6.0*	*5.7*	*6.6*	***49.6***
Germany	*3.8*	*5.5*	*7.7*	*4.4*	*6.8*	*9.5*	*6.9*	*8.1*	*7.9*	*8.5*	***69.2***
South Africa	*5.1*	*4.4*	*1.8*	*3.7*	*5.0*	*9.0*	*4.7*	*6.9*	*6.5*	*8.0*	***55.1***
United Arab Emirates	*4.1*	*6.0*	*4.8*	*4.4*	*5.7*	*5.0*	*8.9*	*8.1*	*7.9*	*6.1*	***61.0***
United Kingdom	*5.9*	*5.9*	*8.1*	*4.3*	*7.8*	*9.0*	*7.7*	*8.9*	*8.2*	*7.8*	***73.5***
United States	*4.1*	*6.2*	*6.2*	*4.4*	*9.2*	*7.0*	*7.7*	*8.3*	*8.3*	*7.6*	***68.9***

Note: All values to 1 decimal place

III. Index Parameters

The Cloud Readiness Index measures the extent to which economies are prepared to adopt and roll out cloud computing technologies. As the region continues to improve its cloud readiness, the CRI measures where economies are in relation to each other (rather than comparing absolute scores).

It is a composite index made up of 10 parameters grouped into four readiness segments: cloud infrastructure, cloud security, cloud regulation, and cloud governance.

Scores are derived from secondary, publicly-sourced data and indexes. Original sources and their URLs have been provided throughout the report. We have also provided a methodology note for each parameter, explaining how aggregated indexes were derived and normalised to obtain comparable values. More detailed methodology notes can be found in the Appendix.

Table 2: CRI 2018 Segments and Parameters

Segment #01 – **CLOUD INFRASTRUCTURE**
Parameter #01 – **International Connectivity** Parameter #02 – **Broadband Quality** Parameter #03 – **Power Grid, Green Policy, and Sustainability**
Segment #02 – **CLOUD SECURITY**
Parameter #04 – **Data Centre Risk** Parameter #05 – **Cybersecurity**
Segment #03 – **CLOUD REGULATION**
Parameter #06 – **Privacy** Parameter #07 – **Government Regulatory Environment** Parameter #08 – **Intellectual Property Protection**
Segment #04 – **CLOUD GOVERNANCE**
Parameter #09 – **Business Sophistication** Parameter #10 – **Freedom of Information**

CRI Segment #01 – Cloud Infrastructure

The Cloud Infrastructure segment comprises three parameters: International Connectivity, Broadband Quality, and Power Grid, Green Policy, and Sustainability. The data for each of the three parameters was normalised to a 10-point scale and then aggregated to provide scores out of 30.

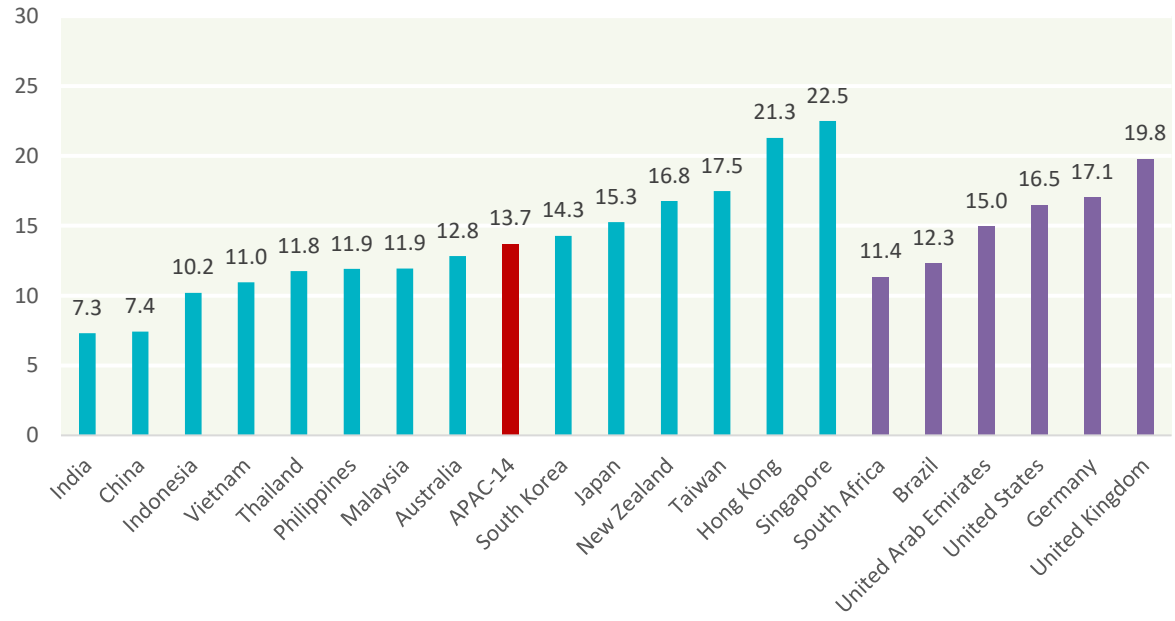
International Connectivity: International bandwidth is one of the prime components of the physical infrastructure needed both to develop competitive cloud services and to enable domestic cloud users to use international cloud services. The parameter is derived from the World Economic Forum's *Global Competitiveness Report 2017-2018* and is expressed in Internet bandwidth (kb/s) per Internet user.

Broadband Quality: Average peak connection speeds show an economies' readiness to provide fast and reliable access to the cloud, ensuring advanced computing demands can effectively be met. The parameter is derived from Akamai's *State of the Internet/Connectivity Report (Q1 2017)* and is expressed in average peak connection speed (Mbps).

Power Grid, Green Policy, and Sustainability: Stable, continuous access to power, water, and sustainable energy contributes to economies' ability to provide favourable environments for data centres to grow, a key factor for the rise of cloud computing services. The parameter is derived from the World Energy Council's *Energy Trilemma Index 2017*. It is the normalised sum of three sub-components: Energy Security, Energy Equity, and Environmental Sustainability.

The aggregated cloud infrastructure measure shows that Singapore and Hong Kong stand out as clear leaders, largely above other APAC and global economies. The United Kingdom is a close third, while Australia is the only mature economy under the APAC-14 average.

Figure 1: Cloud Infrastructure, aggregated scores out of 30



Sources:
- *World Economic Forum, http://reports.weforum.org/global-competitiveness-index-2017-2018/downloads*
- *Akamai, www.akamai.com/uk/en/about/our-thinking/state-of-the-internet-report/global-state-of-the-internet-connectivity-reports.jsp*
- *World Energy Council, https://trilemma.worldenergy.org/#!/energy-index*

CRI Parameter #01 – International Connectivity

Table 3: International Connectivity, APAC rankings

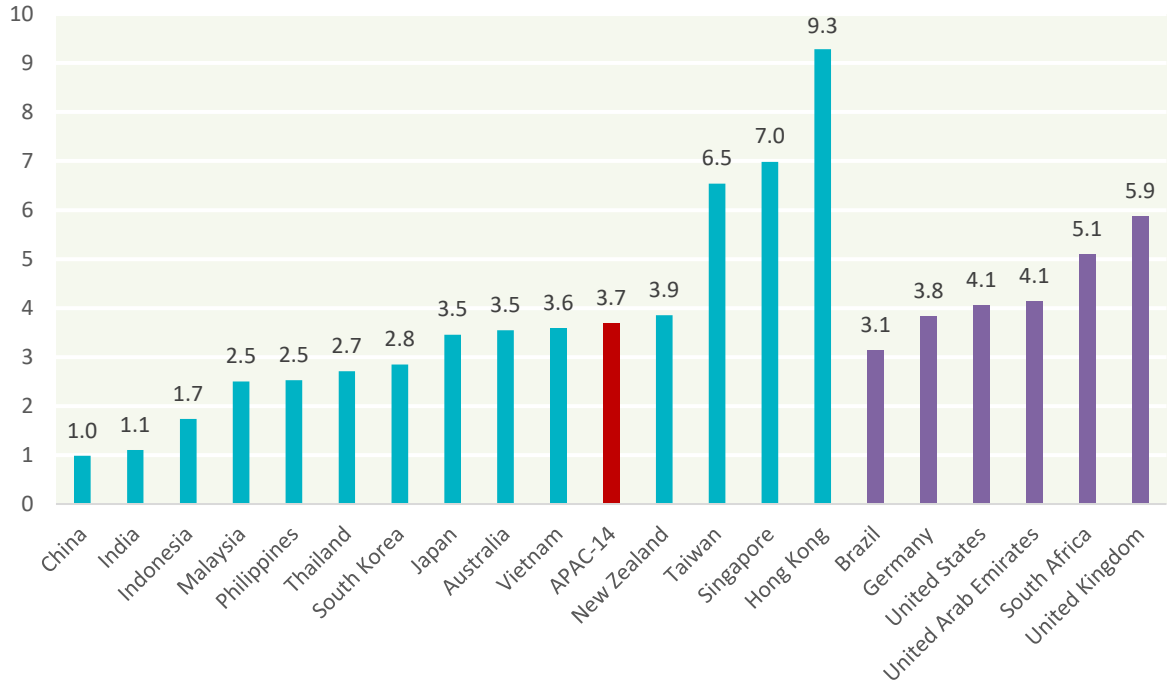
	AU	CN	HK	IN	ID	JP	MY	NZ	PH	SG	KR	TW	TH	VN
Rank 2018	**=6**	**14**	**1**	**13**	**12**	**=6**	**=10**	**4**	**=10**	**2**	**8**	**3**	**9**	**5**
Rank 2016	4	14	1	13	12	6	=9	3	=9	2	=7	5	=7	11
Rank 2014	10	12	2	14	13	=5	4	9	7	1	=5	3	8	11

Overall international connectivity in the 14 markets has increased by 63% year-on-year, close to 2016's 62%. The growth has not been equal in all markets; at 1,088%, Taiwan saw some remarkable bandwidth growth between 2016 and 2018, while Thailand's only grew by 5%.

Unlike the 2016 report, emerging markets took the lead in terms of growth. India, China, Indonesia, and Vietnam all saw per-user speeds grow above 100%; 180%, 194%, 302%, and 341%, respectively. Japan and Taiwan are the only mature economies to have year-on-year growth rates above the APAC-14 average of 63%. New Zealand, Australia, and South Korea saw moderate growths of 20% or less.

The disconnect between growth trends and overall rankings points to the work that remains ahead for emerging economies. Despite their high year-on-year growth rates, China, India, and Indonesia occupy the bottom three positions, while Taiwan, Singapore, and Hong Kong lead the way (3rd, 2nd, and 1st, respectively). All other economies have gone down or stagnated in the rankings, except for Vietnam, which has made an exceptional jump from 11th to 5th.

Figure 2: International Connectivity, scores out of 10



Source: World Economic Forum, http://reports.weforum.org/global-competitiveness-index-2017-2018/downloads

CRI Parameter #02 – Broadband Quality

Table 4: Broadband Quality, APAC rankings

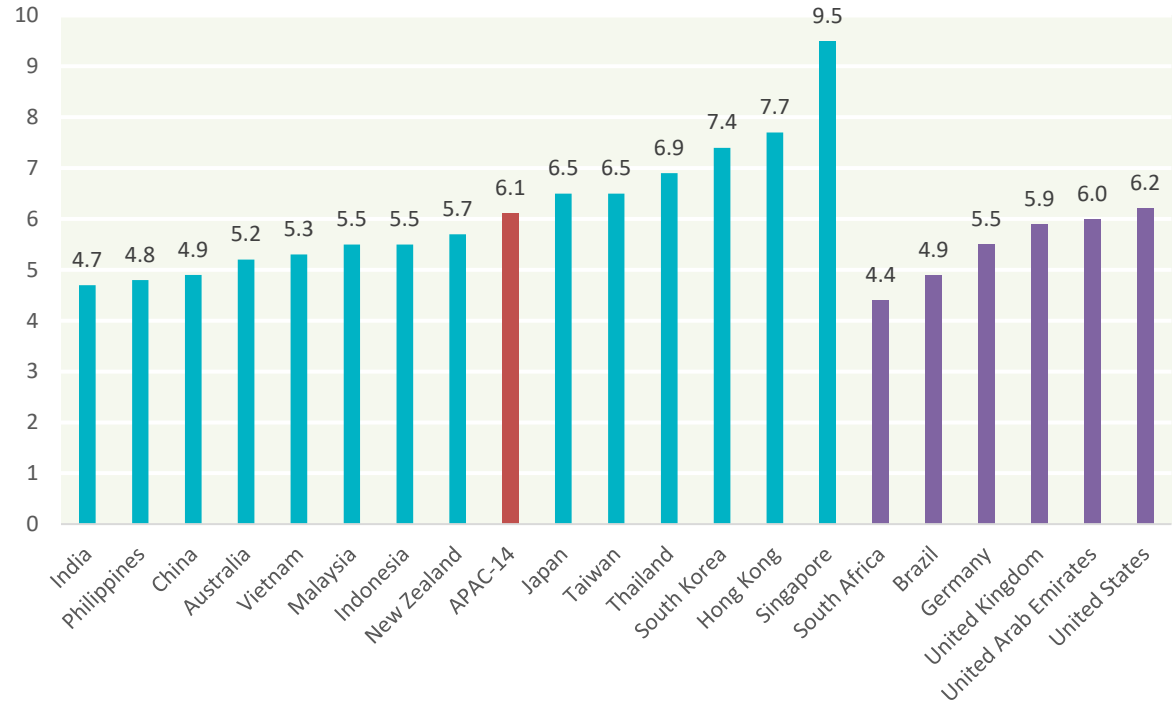
	AU	CN	HK	IN	ID	JP	MY	NZ	PH	SG	KR	TW	TH	VN
Rank 2018	**11**	**12**	**2**	**14**	**=8**	**=5**	**=8**	**7**	**13**	**1**	**3**	**=5**	**4**	**10**
Rank 2016	8	11	2	13	12	4	9	7	14	1	3	5	6	10
Rank 2014	=6	10	2	13	14	3	9	8	12	4	1	5	=6	11

The APAC-14 average peak connection speed was 84.2 Mbps, a year-on-year 51% increase compared to 2016's 55.8 Mbps. With 129.5 Mbps and 184.5 Mbps respectively, Hong Kong and Singapore top the charts. India, the Philippines, and China, meanwhile, remain largely behind the pack with less than 46 Mbps (respectively 14th, 13th, and 12th positions).

In terms of year-on-year growth, five emerging markets dominate the charts: the Philippines (91% growth), China (99%), Indonesia (113%), India (121%), and Vietnam (131%). Mature markets, meanwhile, are all under the APAC-14 year-on-year growth average of 51%: South Korea (40% growth), Singapore (36%), Australia (33%), Taiwan (22%), and Japan (21%).

In terms of overall rankings, many economies seem to be stagnating in 2016's positions. Australia's steady descent from 8th to 11th stands out, and mirrors Indonesia's steady rise from 12th to 8th. China, Japan, and Thailand seem to be on a downward trajectory, with their rankings becoming progressively worse.

Figure 3: Broadband Quality, scores out of 10



Source: Akamai, www.akamai.com/uk/en/about/our-thinking/state-of-the-internet-report/global-state-of-the-internet-connectivity-reports.jsp

CRI Parameter #03 – Power Grid, Green Policy, and Sustainability

Table 5: Power Grid, Green Policy, and Sustainability, APAC rankings

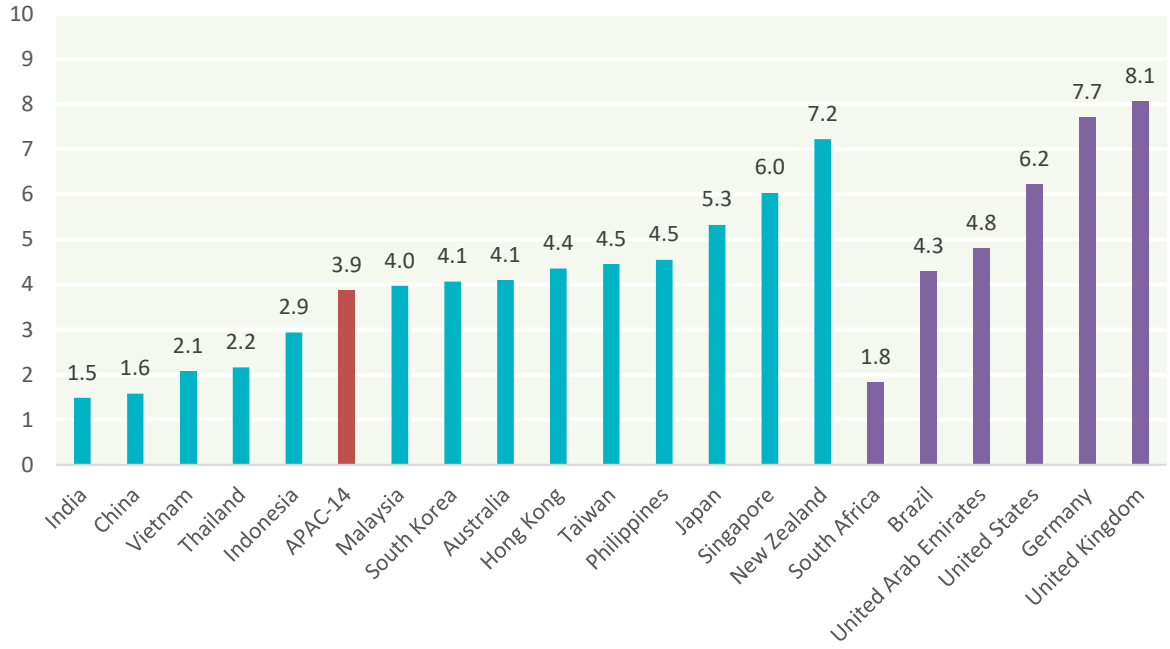
	AU	CN	HK	IN	ID	JP	MY	NZ	PH	SG	KR	TW	TH	VN
Rank 2018	**7**	**13**	**6**	**14**	**10**	**3**	**9**	**1**	**4**	**2**	**8**	**5**	**11**	**12**
Rank 2016	5	13	=2	14	=10	=2	=10	1	=8	6	7	=2	=8	=10
Rank 2014	2	14	9	11	8	3	12	1	10	7	5	4	6	13

There is a clear divide between mature and emerging APAC economies. Five of them – all emerging economies – are below the APAC-14 average of 3.9, while the nine others – mostly mature economies – are above it. Malaysia and the Philippines stand out as the only emerging economies above the regional average.

New Zealand has not moved from its top position since 2014. Likewise, China, India, and Indonesia have not budged since 2016 (respectively 13th, 14th, and 10th), while all others have shifted positions. Singapore has jumped from 6th to 2nd, while Taiwan and Hong Kong have fallen from 2nd to 5th and 6th, respectively. Malaysia and the Philippines have made notable progress over the years, steadily making their way to top 10 positions.

It is worth noting that this is one of two parameters in which non-APAC economies lead the way.[4] With 8.1, the United Kingdom scores well above APAC's top scorer and more than double the regional average of 3.9 – signalling that sustainable growth may be a challenge for the region in the near future.

Figure 4: Power Grid, Green Policy, and Sustainability, scores out of 10



Source: World Energy Council, https://trilemma.worldenergy.org/#!/energy-index
Note: The latest available data for Taiwan is from 2015 (www.worldenergy.org/data/trilemma-index/country/taiwan)

CRI Segment #02 – Cloud Security

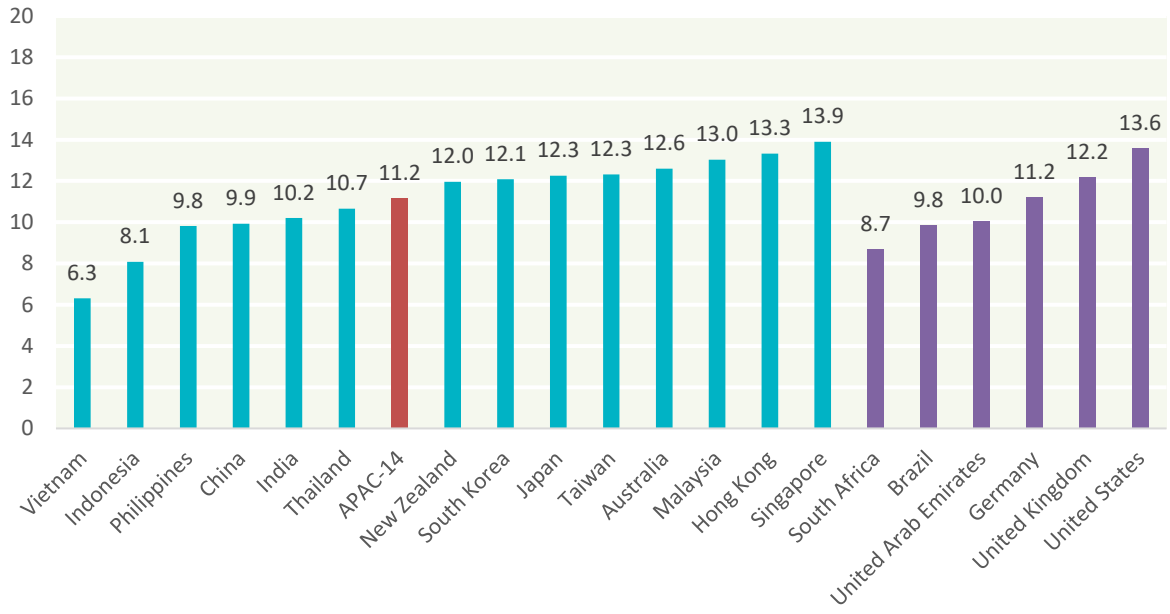
The Cloud Security segment comprises two parameters: Data Centre Risk and Cybersecurity. The data for each of the two parameters was normalised to a 10-point scale and then aggregated to provide scores out of 20.

Data Centre Risk: Data centres are core to cloud development, and building them involves a substantial amount of investment. Whether foreign or domestic, investors assess the extent to which data centre infrastructure is safe within a given location. The data centre risk parameter looks at a number of factors involved in assessing different types of risks, including corporate tax, labour cost, inflation, water availability, and vulnerability to natural disasters. It is important to note that the parameter illustrates potential attractiveness for cloud providers, not actual adoption of cloud technologies. The parameter is derived from Cushman & Wakefield's *Data Centre Risk Index 2016*.

Cybersecurity: Cybersecurity is paramount for cloud readiness, as the perception of lack of security remains a key barrier to cloud adoption. The parameter assesses governments' use of legal instruments – technical standards, frameworks and initiatives, ICT education and infrastructure, coordinated ICT and cybersecurity strategies – to address all types of cyber-crime. The parameter is derived from the International Telecommunication Union's *Global Cybersecurity Index 2017*.

The aggregated cloud security measure shows that Singapore and South Korea stand out as clear leaders, largely above the APAC-14 average and far ahead of Vietnam and Indonesia. In 3rd position, Malaysia is the only emerging economy at the top of the rankings, demonstrating the effectiveness of recent cybersecurity initiatives.[5]

Figure 5: Cloud Security, aggregated scores out of 20



Sources:
- *Cushman & Wakefield, www.cushmanwakefield.com/en/research-and-insight/2016/data-centre-risk-index-2016*
- *ITU, www.itu.int/en/ITU-D/Cybersecurity/Pages/GCI-2017.aspx*

CRI Parameter #04 – Data Centre Risk

Table 6: Data Centre Risk, APAC rankings

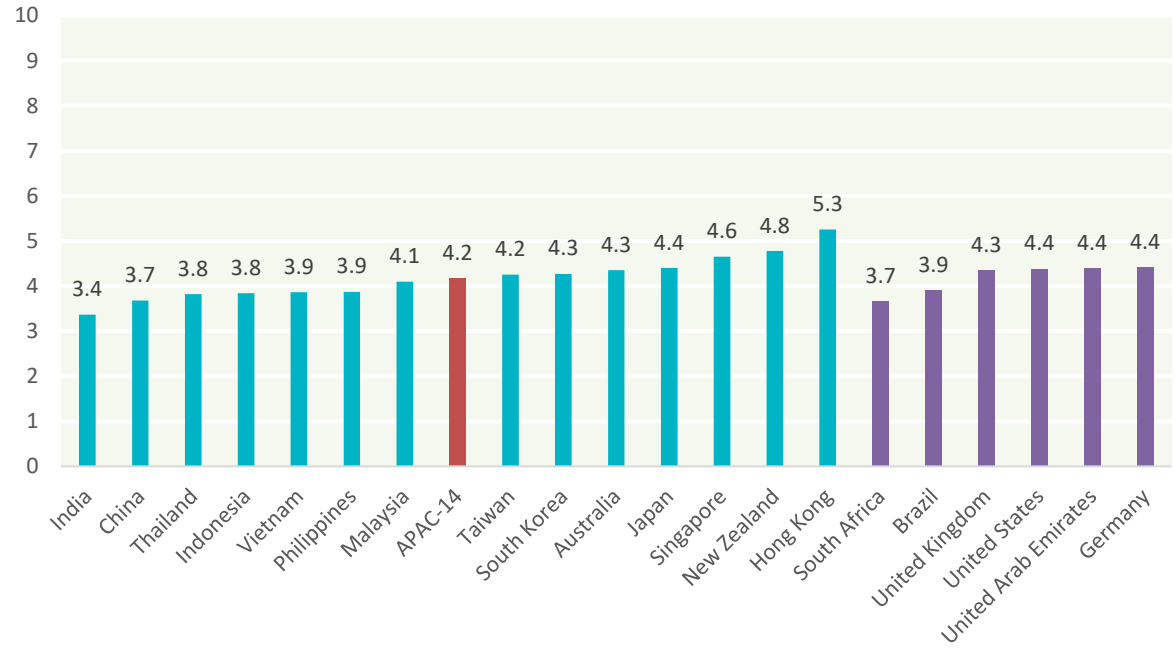
	AU	CN	HK	IN	ID	JP	MY	NZ	PH	SG	KR	TW	TH	VN
Rank 2018	**=5**	**13**	**1**	**14**	**=11**	**4**	**8**	**2**	**9**	**3**	**=5**	**7**	**=11**	**9**
Rank 2016	5	13	1	14	11	=7	=7	3	10	2	6	4	9	12
Rank 2014	1	10	=6	14	=11	9	3	4	13	=6	2	8	5	=11

Mature APAC markets stand out as generally low-risk environments for data centres. Hong Kong and New Zealand lead the region (respectively 1st and 2nd positions), closely tailed by Singapore and Japan (respectively 3rd and 4th positions). At the bottom of the rankings, India and China seem to be particularly high-risk locations for data centres.

Several economies have kept their spot in the rankings; Australia, China, Hong Kong, India, and Indonesia have not changed rankings since 2016. Japan, the Philippines, South Korea, and Vietnam have climbed by up to three positions, while Taiwan and Thailand have noticeably tumbled.

Here too, a clear divide exists between the region's mature and emerging economies. Half of the economies – all emerging ones – are under the regional average, while the other half – all mature ones – are above it. With a score of 4.4, the United States, the United Arab Emirates, and Germany are the top non-APAC performers, but they remain well below the score of top APAC scorers.

Figure 6: Data Centre Risk, scores out of 10



Source: Cushman & Wakefield methodology, www.cushmanwakefield.com/en/research-and-insight/2016/data-centre-risk-index-2016

CRI Parameter #05 – Cybersecurity

Table 7: Cybersecurity, APAC rankings

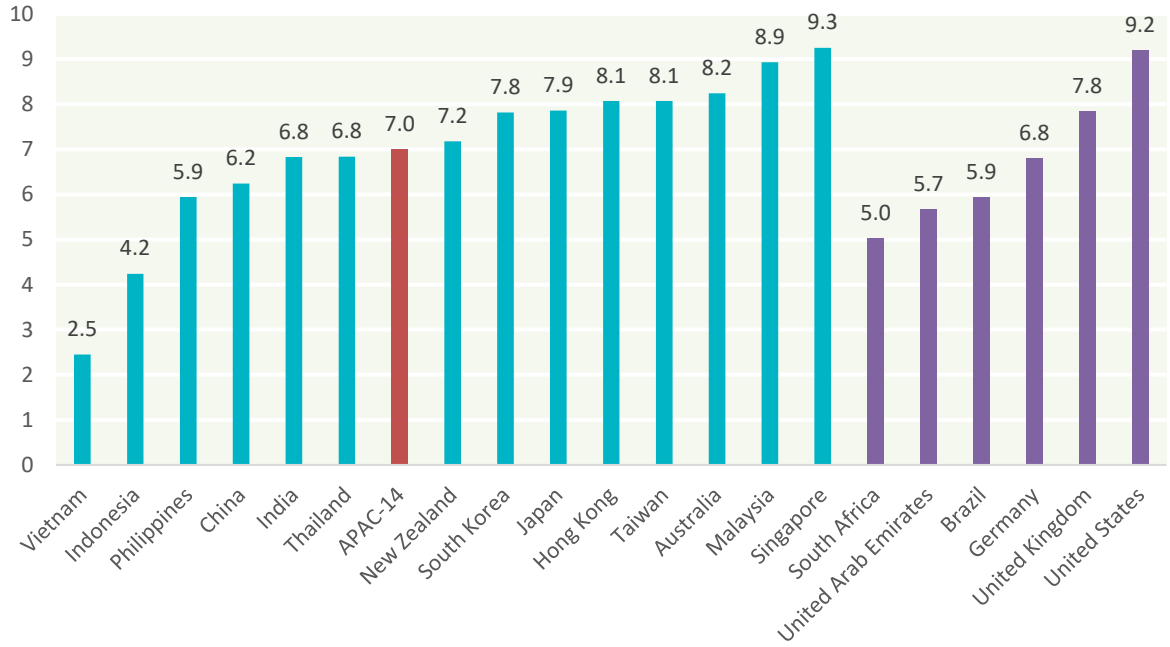
	AU	CN	HK	IN	ID	JP	MY	NZ	PH	SG	KR	TW	TH	VN
Rank 2018	**3**	**11**	**=4**	**9**	**13**	**6**	**2**	**8**	**12**	**1**	**7**	**=4**	**9**	**14**
Rank 2016	=1	11	9	14	10	=4	=1	3	13	8	=4	7	12	14

Cybersecurity is a key area for which there seems to be little middle ground, as illustrated by the sharp gap between the top two economies (Malaysia and Singapore) and the bottom two (Vietnam and Indonesia).

At 9.3, Singapore scores almost four times higher than Vietnam (2.5) and more than double Indonesia's score (4.2). All of the economies scoring lower than the APAC-14 average of 7.0 are emerging ones that may not have the infrastructure or skills to address cybersecurity risks: Vietnam, Indonesia, the Philippines, China, India, and Thailand.

In terms of rankings, the most noticeable trend is the fact that Australia and Malaysia have lost their top spots, going from being tied for 1st position to 3rd and 2nd, respectively. This is largely due to Singapore's exceptional ascent; from 8th in 2016 to 1st in 2018. Hong Kong, India, Taiwan, and Thailand also made significant progress, while Indonesia, New Zealand, and South Korea declined sharply.

Figure 7: Cybersecurity, scores out of 10



Source: International Telecommunication Union (ITU), www.itu.int/en/ITU-D/Cybersecurity/Pages/GCI-2017.aspx
Note: Missing values for Hong Kong and Taiwan are estimated based on the the average of five economies in the same World Bank lending group which had values in this dataset (Australia, Japan, New Zealand, Singapore, and South Korea)

CRI Segment #03 – Cloud Regulation

The Cloud Regulation segment comprises three parameters: Privacy, Government Regulatory Environment, and Intellectual Property Protection. The data for each of the three parameters was normalised to a 10-point scale and then aggregated to provide scores out of 30.

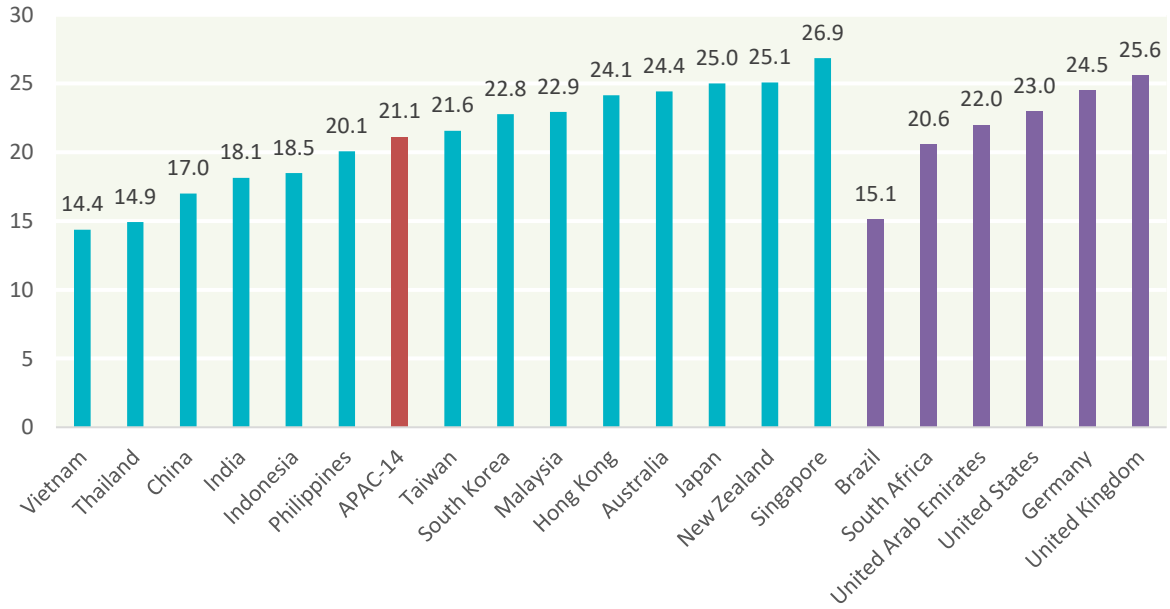
Privacy: Cloud services need secure and reliable data flows across borders, networks, and third-party providers. Users will only adopt cloud if their information is secure and held private without any unexpected breaches. Regulations and effective oversight and enforcement of data privacy rules are therefore important aspects of cloud readiness. The parameter is derived from Business Software Alliance's *Global Cloud Computing Scorecard 2016*, using the Data Privacy item.

Government Regulatory Environment: Government support and use of technology is key to the success of national cloud uptake. Governments that do well in this parameter have strong regulatory frameworks that promote and enable the use of cloud technologies within the public sector. The parameter is derived from the World Economic Forum's *Global IT Report 2016*, using the aggregate score of for Pillar 8 (Government Usage).

Intellectual Property Protection: Robust protections and enforcement of intellectual property rights are seen as protecting both consumer and corporation interests and an institutional prerequisite to foster technological innovation. Consumers need to know that their data is subjected to adequate safeguards, and cloud service providers need reassurance that their information is protected against misappropriation and misuse. The parameter is derived from the World Economic Forum's *Global Competitiveness Report 2017-2018*, using index 1.02 (IP Protection).

The aggregated cloud regulation measure shows that Singapore has particularly conducive regulatory frameworks. It is largely above the APAC-14 average and far ahead of non-APAC leaders (Germany and the United Kingdom). Vietnam and Thailand, meanwhile, lag far behind the rest of the region's emerging economies.

Figure 8: Cloud Regulation, aggregated scores out of 30



Sources:
- *Business Software Alliance, http://cloudscorecard.bsa.org/2016*
- *World Economic Forum, www.weforum.org/reports/the-global-information-technology-report-2016*
- *World Economic Forum, http://reports.weforum.org/global-competitiveness-index-2017-2018/downloads*

CRI Parameter #06 – Privacy

Table 8: Privacy, APAC rankings

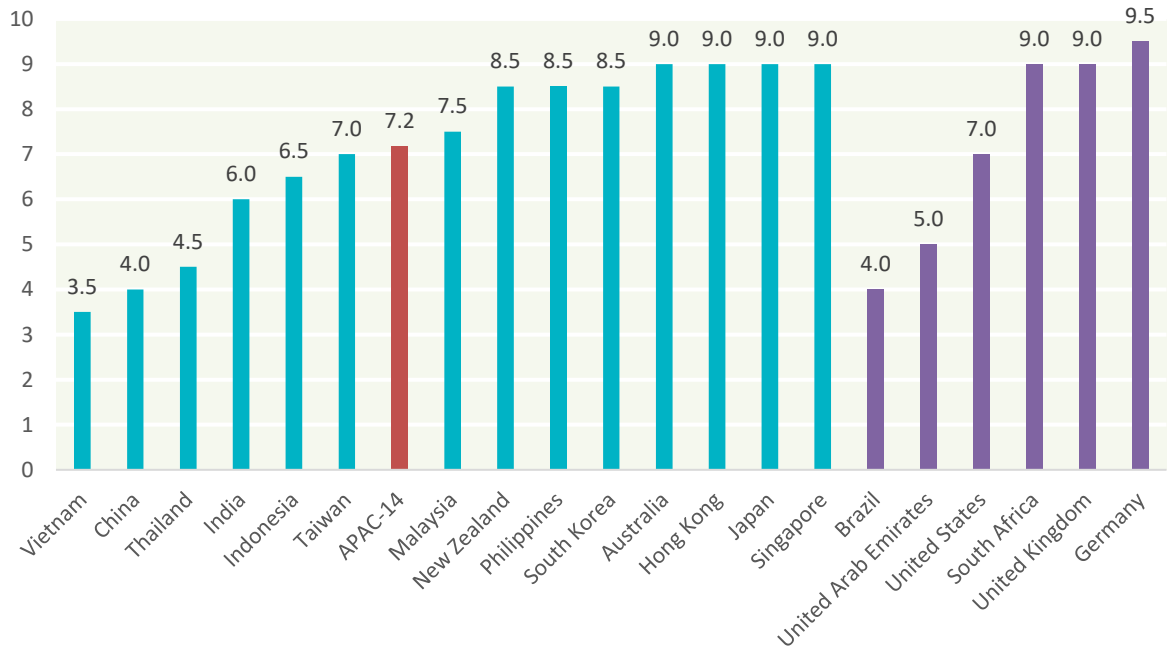
	AU	CN	HK	IN	ID	JP	MY	NZ	PH	SG	KR	TW	TH	VN
Rank 2018	**=1**	**13**	**=1**	**11**	**10**	**=1**	**8**	**=5**	**=5**	**=1**	**=5**	**9**	**12**	**14**
Rank 2016	=1	11	=1	14	10	=7	=7	=4	9	=4	=4	=1	=12	=12
Rank 2014	=3	7	5	=10	12	2	=8	=3	=8	6	1	=10	13	14

The strongest institutional safeguards for privacy can be found in Australia, Hong Kong, Japan, and Singapore (all tied in 1st position with scores of 9.0). Vietnam, China, and Thailand, meanwhile, lag far behind the regional average of 7.2.

Australia and Hong Kong have maintained their top positions from 2016, while Japan and Singapore experienced an impressive climb from their respective 7th and 4th positions. The Philippines also rose out of its 9th position to join the top 5. The most notable change is the tumble taken by Taiwan, which dropped from 1st to 9th.

A divide between mature and emerging economies seems to be taking shape, though Taiwan, Malaysia, and the Philippines are outliers in this regard. Taiwan is below the APAC-14 average, while the Philippines is a top-5 scorer. Regarding non-APAC economies, Germany stands out with a score above APAC leaders.

Figure 9: Privacy, scores out of 10



Source: Business Software Alliance methodology, http://cloudscorecard.bsa.org/2016

CRI Parameter #07 – Government Regulatory Environment

Table 9: Government Regulatory Environment, APAC rankings

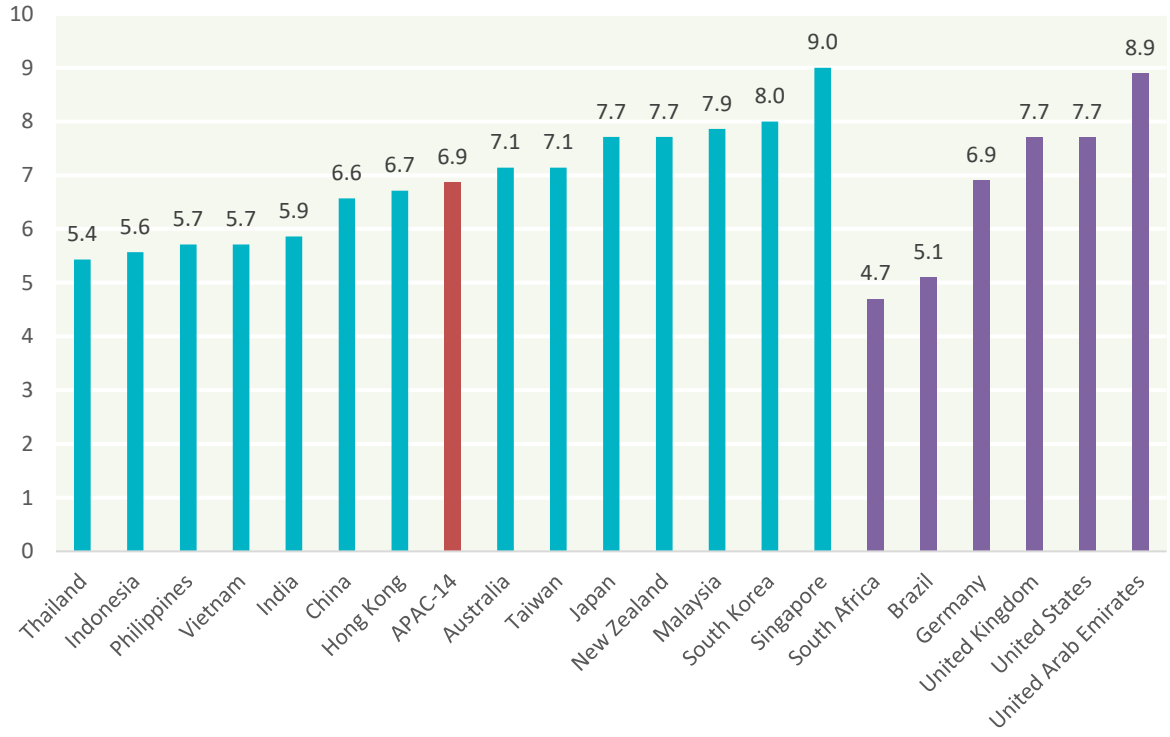
	AU	CN	HK	IN	ID	JP	MY	NZ	PH	SG	KR	TW	TH	VN
Rank 2018	**=6**	**9**	**8**	**10**	**13**	**=4**	**3**	**=4**	**=11**	**1**	**2**	**=6**	**14**	**=11**
Rank 2016	=4	9	6	=11	10	3	=4	2	=11	1	7	8	14	13
Rank 2014	3	9	=5	10	11	=7	4	2	=13	1	=5	=7	=13	12

Singapore has continuously ranked 1st in this parameter over the years. It is closely followed by South Korea and Malaysia, two economies experimenting with 'Cloud First' frameworks in the government sector. Thailand remains last, in the company of Indonesia.

South Korea has experienced a sharp improvement, going from 7th in 2016 to 2nd in 2018. Taiwan and Vietnam have also improved their rankings by two positions, while all the other economies have either stagnated or lost their footing. China, for instance, has not budged from its 9th place since 2014, while Indonesia has tumbled from 10th to 13th, and Hong Kong and Australia have lost two positions.

Despite these ranking variations, a clear divide can be seen between mature and emerging economies. Six mature APAC economies are above the APAC-14 average of 6.9, while six emerging economies are just below it. Hong Kong (8th) and Malaysia (3rd) are the two exceptions.

Figure 10: Government Regulatory Environment, scores out of 10



Source: World Economic Forum, www.weforum.org/reports/the-global-information-technology-report-2016

CRI Parameter #08 – Intellectual Property Protection

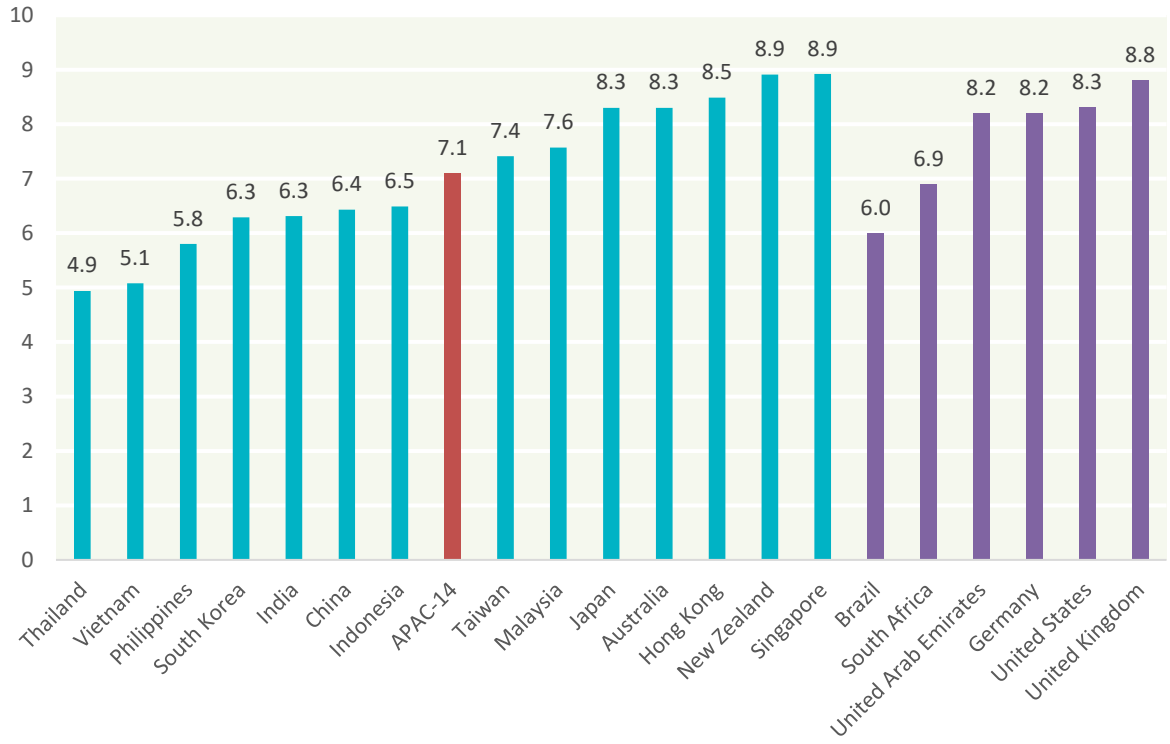
Table 10: Intellectual Property Protection, APAC rankings

	AU	CN	HK	IN	ID	JP	MY	NZ	PH	SG	KR	TW	TH	VN
Rank 2018	**=4**	**9**	**3**	**=10**	**8**	**=4**	**6**	**=1**	**12**	**=1**	**=10**	**7**	**14**	**13**
Rank 2016	5	11	4	=9	8	=2	6	=2	12	1	=9	7	14	13
Rank 2014	5	=9	=3	11	=9	=3	7	2	12	1	8	6	13	14

Singapore and New Zealand have a stronghold on the top positions for intellectual property protection. At 8.9, both score higher than all other APAC and non-APAC economies, occupying the 1st and 2nd positions for the third consecutive time. The Philippines has also remained 12th for three consecutive times, while the last and before-to-last spots have alternated between Thailand and Vietnam.

India and Japan have fallen in the rankings, while South Korea has consistently declined since 2014. China and Hong Kong, meanwhile, have made moderate progress since 2016. In that sense, China stands out above all other APAC economies, as it is the only one to have moved by more than one position; all others have either moderately risen, stagnated, or declined.

Figure 11: Intellectual Property Protection, scores out of 10



Source: World Economic Forum, http://reports.weforum.org/global-competitiveness-index-2017-2018/downloads

CRI Segment #04 – Cloud Governance

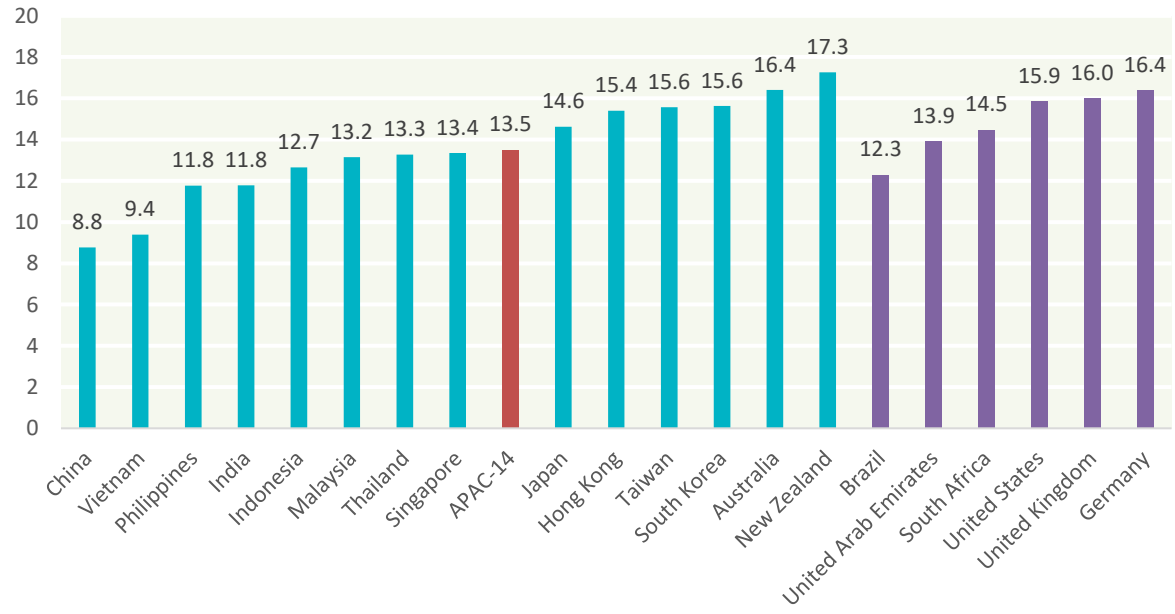
The Cloud Governance segment comprises two parameters: Business Sophistication and Freedom of Information. The data for each of the two parameters was normalised to a 10-point scale and then aggregated to provide scores out of 20.

Business Sophistication: The race for innovation in the digital age requires governments to simplify and streamline the process of setting up businesses. The business sophistication score demonstrates an economy's ability to not only facilitate the creation of a new business entity, but also help existing businesses become flexible, responsive players in the digital economy. The parameter is derived from the World Bank's *Ease of Doing Business Index 2018*, using the Distance to Frontier score.

Freedom of Information: The freedom to access all information online has been stymied in recent years, with many economies limiting content access and distribution. Allowing information to flow freely is a key condition of digital communications, just as uninhibited cross-border data flows are essential for cloud technologies to thrive. The parameter is derived from Reporters Without Borders' *World Press Freedom Index 2017*.

The aggregated cloud governance measure shows that Australia and New Zealand rank highest in terms of overall governance, ahead of both APAC and non-APAC economies. The region's mature markets are all above the APAC-14 average, except for Singapore, which shares some governance features with the region's emerging economies.

Figure 12: Cloud Governance, aggregated scores out of 20



Sources:
- *World Bank, www.doingbusiness.org/data/distance-to-frontier*
- *Reporters Without Borders, https://rsf.org/en/ranking*

CRI Parameter #09 – Business Sophistication

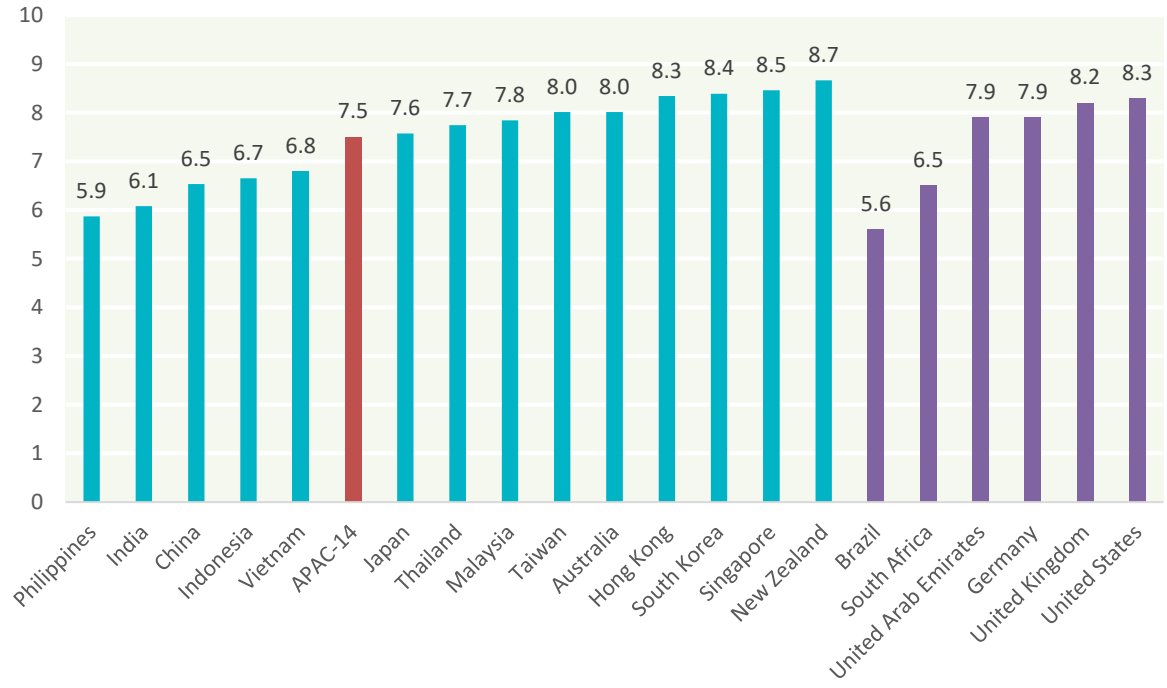
Table 11: Business Sophistication, APAC rankings

	AU	CN	HK	IN	ID	JP	MY	NZ	PH	SG	KR	TW	TH	VN
Rank 2018	**=5**	**12**	**4**	**13**	**11**	**9**	**7**	**1**	**14**	**2**	**3**	**=5**	**8**	**10**
Rank 2016	8	=10	3	13	=10	1	2	=6	=10	4	=6	5	9	14
Rank 2014	8	12	2	=9	=9	1	5	7	13	4	6	3	=9	14

Mature APAC economies dominate in the field of business sophistication. South Korea, Singapore, and New Zealand all stand out in this regard, ahead of Germany, the United Kingdom, and the United States. At the other end of the spectrum, the Philippines and India have scores with more than one-point difference with the regional average.

In terms of rankings, a great shake-up seems to have taken place. Japan fell sharply from 1st to 9th and Malaysia tumbled from 2nd to 7th. This allowed New Zealand to climb from 6th to 1st, and Singapore to go from 4th to 2nd. Australia, South Korea, and Vietnam, meanwhile, made steady progress, but all others have either declined or stagnated.

Figure 13: Business Sophistication, scores out of 10



Source: World Bank, www.doingbusiness.org/data/distance-to-frontier

CRI Parameter #10 – Freedom of Information

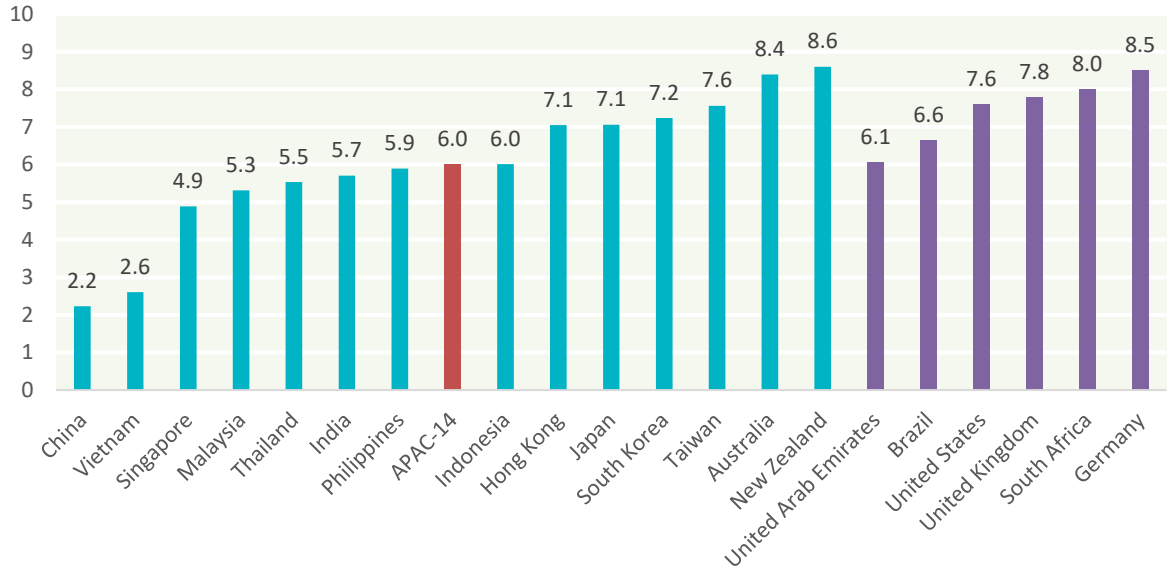
Table 12: Freedom of Information, APAC rankings

	AU	CN	HK	IN	ID	JP	MY	NZ	PH	SG	KR	TW	TH	VN
Rank 2018	**2**	**14**	**=5**	**9**	**7**	**5**	**11**	**1**	**8**	**12**	**4**	**3**	**10**	**13**
Rank 2016	1	14	=4	=9	=9	2	=9	=4	3	8	7	=4	12	13
Rank 2014	=2	13	=2	12	10	1	9	4	5	=6	=6	=6	11	14

Freedom of information seems largely tied to economic maturity. Emerging markets such as China and Vietnam lag behind the APAC-14 average of 6.0. Australia and New Zealand, meanwhile, lead the region with scores above 8. Singapore stands out in this regard, ranking 12th despite being one of the region's more mature economies. Interestingly, all non-APAC economies rank higher than the APAC-14 average.

Despite losing its top spot, Australia has not moved from its leading position since 2016, as has China at the other end of the spectrum. Indonesia, South Korea, and Vietnam have all made remarkable jumps in the rankings, while Malaysia and the Philippines have fallen sharply.

Figure 14: Freedom of Information, scores out of 10



Source: Reporters Without Borders, https://rsf.org/en/ranking

IV. Market Highlights

Australia #6 (-2)

Falls from CRI 2016's 4th ranking

Table 13: Australia, scores and rankings

	CRI #01 Int'l Connectivity	CRI #02 Broadb. Quality	CRI #03 Power and Sust.	CRI #04 Data Cent. Risk	CRI #05 Cybersecurity	CRI #06 Privacy	CRI #07 Govt Reg. Env.	CRI #08 IP Protection	CRI #09 Biz Sophistication	CRI #10 Freedom of Info.	TOTAL Cloud Infrastructure	TOTAL Cloud Security	TOTAL Cloud Regulation	TOTAL Cloud Governance	TOTAL All
Score	3.5	5.2	4.1	4.3	8.2	9.0	7.1	8.3	8.0	8.4	12.8	12.6	24.4	16.4	66.3
Ranking	6	11	7	5	3	1	6	4	5	2	7	4	4	2	6

Overcoming Structural Weaknesses

Despite its tumble in the rankings, Australia remains a strong regional contender. Weighed down by its relatively poor cloud infrastructure, it remains a strong performer in the aggregated Security, Regulation, and Governance segments thanks to its forward-looking 'Cloud First' policy. It remains, for instance, a low-risk location to build data centres and it strongly protects intellectual property rights.

Seeing an early cloud adopter with solid regulatory frameworks rank 7th in the aggregated Infrastructure segment may seem like a paradox, but it can be explained by Australia's unique topographical challenges. Its geographically large territory makes it difficult for businesses and governments to roll out large-scale, next-generation technologies. This has been clearly demonstrated in the stumbling roll-out of the National Broadband Network (NBN) since 2013.

Recent Digital Economy Regulation/Legislation and ICT Developments

- In March 2017, the Digital Transformation Agency (DTA) announced the development of GovPass, a national digital identity scheme set to streamline the delivery of digital public services.[6]
- In July 2017, the Australian Prudential Regulation Authority (APRA) updated the Prudential Standard CPS 231 on 'Outsourcing' to facilitate firms' outsourcing to cloud service providers.[7]
- A new Home Affairs Ministry was announced in August 2017 to structurally and administratively transform the way national security is handled, including cybersecurity.[8]
- In November 2017, the Consumer Data Right was announced to allow Australians to own their banking, energy, telecom, and Internet data.[9]
- Also in November 2017, the Australian Attorney-General's Department announced Australia's participation in the APEC Cross Border Privacy Rules system.[10]
- In December 2017, the Universal Service Guarantee (USG) was announced to ensure wide, continuous access to voice and broadband services.[11]
- In February 2018, The Office of the Australian Information Commissioner (OAIC) made data breach reporting mandatory for all organisations.[12]
- Also in February 2018, the DTA replaced the 2014 Australian Government Cloud Computing Policy with its new Secure Cloud Strategy.[13]

Recommendations

- Australia should prioritise the improvement of existing cloud infrastructure, as well as optimise the potential scale and scope of future cloud services.
- Australia should continue its efforts to combat cyber-crime across sectors and industries.
- It should also continue to support projects and initiatives that keep the IT sector open and transparent.

China #13 (-)

Retains CRI 2016's 13th ranking

Table 14: China, scores and rankings

	CRI #01 Int'l Connectivity	CRI #02 Broadb. Quality	CRI #03 Power and Sust.	CRI #04 Data Cent. Risk	CRI #05 Cybersecurity	CRI #06 Privacy	CRI #07 Govt Reg. Env.	CRI #08 IP Protection	CRI #09 Biz Sophistication	CRI #10 Freedom of Info.	TOTAL Cloud Infrastructure	TOTAL Cloud Security	TOTAL Cloud Regulation	TOTAL Cloud Governance	TOTAL All
Score	1.0	4.9	1.6	3.7	6.2	4.0	6.6	6.4	6.5	2.2	7.4	9.9	17.0	8.8	43.1
Ranking	14	12	13	13	11	13	9	9	12	14	13	11	12	14	13

Rising to Greatness

At 13th place, China retains its 2016 ranking despite having made some progress in several parameters. Moderate jumps can be seen in the Data Centre Risk, Regulatory Environment, Intellectual Property Protection, and Business Sophistication parameters, pointing to slow – but steady – improvements. The most significant progress was made in Cybersecurity, an area so crucial to cloud readiness that China may yet become a regional cloud leader.

China's biggest dips since 2016 are in Power Sustainability and Broadband Quality, reflecting the difficulty of driving nation-wide adoption of cloud technologies across such a vast territory. Its worst performance is in the Freedom of Information and International Connectivity parameters, two areas that are crucial for all segments of the population to reap the benefits of the digital economy. The Chinese government continues to devote considerable fiscal resources to the development and improvement of infrastructure, a move that will undoubtedly pay off in the next few years.

Recent Digital Economy Regulation/Legislation and ICT Developments

- In 2016, the Network Security Law made it mandatory for personal information and other important data gathered or produced by critical information infrastructure (CII) operators to be stored in mainland China.[14]
- In January 2017, the Ministry of Industry and Information Technology (MIIT) launched the ICT Industry Development Plan (2016-2020) to increase revenues generated by cutting-edge technologies.[15]
- The Internet Investment Fund was also launched in January 2017 to invest in equity stakes in China's Internet companies, supporting their growth and development.[16]
- The Guideline to Boost Mobile Internet Usage was issued in January 2017 to ensure the transport, tourism, education, medical service, and public security sectors adopt mobile internet services.[17]
- In April 2017, The MIIT launched the Cloud Computing Development Plan (2017-2019) to improve cloud computing readiness by supporting industries, companies, and technologies.[18]
- In June 2017, a new Cybersecurity Law made it compulsory for network operators to obtain users' consent before collecting personal information, and to keep the collected information strictly confidential.[19]
- In December 2017, the Cyberspace Administration of China (CAC) released the first National Cybersecurity Strategy to strengthen its cybersecurity efforts.[20]

Recommendations

- China should prioritise its cloud infrastructure and governance to improve its data privacy laws.
- Using the Gui'an New Area as a model, China should continue to make specific parts of the territory much more amenable to host data centres.
- China should start working to implement policies that ensure the safe and free flow of data, with government agencies acting as facilitators.

Hong Kong #2 (-1)

Falls from CRI 2016's 1st ranking

Table 15: Hong Kong, scores and rankings

	CRI #01 Int'l Connectivity	CRI #02 Broadb. Quality	CRI #03 Power and Sust.	CRI #04 Data Cent. Risk	CRI #05 Cybersecurity	CRI #06 Privacy	CRI #07 Govt Reg. Env.	CRI #08 IP Protection	CRI #09 Biz Sophistication	CRI #10 Freedom of Info.	TOTAL Cloud Infrastructure	TOTAL Cloud Security	TOTAL Cloud Regulation	TOTAL Cloud Governance	TOTAL All
Score	9.3	7.7	4.4	5.3	8.1	9.0	6.7	8.4	8.3	7.1	21.3	13.3	24.1	15.4	74.1
Ranking	1	2	6	1	4	1	8	3	4	5	2	2	5	5	2

Finding Room to Grow

Hong Kong loses its leading CRI position, though the fall may be indicative of the significant advances made by other APAC economies rather than any specific shortcomings. Cloud Infrastructure remains one of its strengths, thanks to a strong performance in International Connectivity and Broadband Quality. With significant improvements in Cloud Security, Hong Kong clearly positions itself as a world-leading cloud computing destination. Its high score in the Data Centre Risk parameter also makes it an appealing data centre hub.

But there is still room for improvement. Hong Kong ranks 5th in the aggregated Cloud Regulation and Governance segments, suggesting either not all aspects of its cloud strategy are solidly executed, or it is not keeping abreast of improving best practices. It has, for instance, tumbled in three key Cloud Readiness parameters: Government Regulatory Environment, Freedom of Information, and Business Sophistication.

Recent Digital Economy Regulation/Legislation and ICT Developments

- In March 2016, the Office of the Government Chief Information Officer (OGCIO) extended the number of government venues that provide free public Wi-Fi services.[21]
- In July 2017, HKT's Netvigator service launched a 1Gbps-fibre-optic service for households, improving overall bandwidth speeds.[22]
- In September 2017, the Hong Kong Monetary Authority (HKMA) revealed seven upcoming initiatives in support of smart banking, including a Faster Payment System (FPS) that supports the use of mobile phone numbers or email addresses for digital payments, as well a consultation paper on the use of Open API in banking.[23]
- In October 2017, the OGCIO announced the expansion of the Digital 21 Strategy to drive development of cloud computing in Hong Kong.[24]
- In December 2017, the Innovation and Technology Bureau released the Smart City Blueprint, outlining the government's Smart City vision and priorities.[25]

Recommendations

- Hong Kong should ensure its exceptional infrastructure is supported by effective security, regulation, and governance frameworks, which at the moment lack effective coordination.
- It should examine its weakest areas and design corresponding regulatory responses and business practices.
- Hong Kong should consider a coordinated and government-led 'Cloud First' programme to tie all of these initiatives together.

India #12 (-)

Retains CRI 2016's 12th ranking

Table 16: India, scores and rankings

	CRI #01 Int'l Connectivity	CRI #02 Broadb. Quality	CRI #03 Power and Sust.	CRI #04 Data Cent. Risk	CRI #05 Cybersecurity	CRI #06 Privacy	CRI #07 Govt Reg. Env.	CRI #08 IP Protection	CRI #09 Biz Sophistication	CRI #10 Freedom of Info.	TOTAL Cloud Infrastructure	TOTAL Cloud Security	TOTAL Cloud Regulation	TOTAL Cloud Governance	TOTAL All
Score	1.1	4.7	1.5	3.4	6.8	6.0	5.9	6.3	6.1	5.7	7.3	10.2	18.1	11.8	47.4
Ranking	13	14	14	14	9	11	10	10	13	9	14	10	11	11	12

Taking Small but Steady Steps

India is one of nine economies that have not budged in the CRI 2018 rankings despite making progress in several areas – demonstrating that advancing faster than others is just as important as improving indicator performance. It has seen small but notable improvements in the Cybersecurity, Data Centre Risk, and Data Privacy parameters, three key factors in the emergence of a strong cloud framework. Its best performance is in the Cloud Security segment, though it is not enough to break away from the 12th position.

Cloud Infrastructure is the weakness that is weighing India down. Lack of access to quality broadband and sustainable power remain serious issues throughout India, making it difficult for even the most polished security and governance frameworks to drive cloud adoption. Much like other emerging economies, this is slowly but steadily improving, but the sheer scale of the task poses a serious challenge.

Recent Digital Economy Regulation/Legislation and ICT Developments

- In March 2017, the Ministry of Electronics and Information Technology (MeitY) issued guidelines on storing all government departments' cloud computing data within India.[26]
- In June 2017, the MeitY issued general guidelines to secure personal information in compliance with the Aadhaar Act 2016 and Information Technology Act 2000.[27]
- In August 2017, India's Supreme Court Upheld privacy as a fundamental right, a breakthrough that will help frame current and future digital identity initiatives.[28]
- In August 2017, the Telecom Regulatory Authority of India (TRAI) released recommendations on cloud services, including the establishment of a Cloud Services Advisory Group and a registration framework for cloud service provider industry bodies. [29]
- Also in August 2017, the TRAI released a consultation paper on privacy, security, and ownership of data in the telecom sector, identifying key issues pertaining to data protection in the delivery of digital services.[30]
- In January 2018, the TRAI issued a consultation paper on National Telecom Policy 2018, an initiative that aims to establish India as a global hub for internet services.[31]

Reccommendations

- India should improve its broadband quality and sustainable access to energy if it wants to move up in the rankings.
- It should accelerate digital literacy and support IT start-ups to ensure its workforce drives cloud adoption in the public and private sectors.
- India should also leverage its technologically-skilled workforce to improve its attractiveness as a regional/global data centre hub.

Indonesia #11 (-)

Retains CRI 2016's 11th ranking

Table 17: Indonesia, scores and rankings

	CRI #01 Int'l Connectivity	CRI #02 Broadb. Quality	CRI #03 Power and Sust.	CRI #04 Data Cent. Risk	CRI #05 Cybersecurity	CRI #06 Privacy	CRI #07 Govt Reg. Env.	CRI #08 IP Protection	CRI #09 Biz Sophistication	CRI #10 Freedom of Info.	TOTAL Cloud Infrastructure	TOTAL Cloud Security	TOTAL Cloud Regulation	TOTAL Cloud Governance	TOTAL All
Score	1.7	5.5	2.9	3.8	4.2	6.5	5.6	6.4	6.7	6.0	10.2	8.1	18.5	12.7	49.4
Ranking	12	8	10	11	13	10	13	8	11	7	12	13	10	10	11

Building Solid Foundations

Indonesia has seen some improvements since CRI 2016, but it has not budged from its 11th position. Progress has been more visible in the Cloud Infrastructure segment, mostly thanks to improvements in the Broadband Quality parameter. Cloud Regulation and Governance are Indonesia's strong points; the government has indeed taken the issue of citizen data privacy seriously, and enforced multiple provisions defining what firms may do with a citizen's data.

Indonesia's rankings may change in the near future as a direct result of these policies, but at the moment all parameters have either dropped or held constant. Data Centre Risk remains unchanging at 11th, while Government Regulatory Environment and Cybersecurity both worsened to 13th. Business Sophistication and Freedom of Information have also fallen in response to new regulations.

Recent Digital Economy Regulation/Legislation and ICT Developments

- In December 2016, Kominfo's Regulation No. 20 of 2016 was adopted to require personal data to be stored in Indonesia.[32]
- In January 2017, Law No.38/POJK.03/2016 was passed to ensure banks' data centre and disaster recovery centre facilities are located within Indonesia.[33]
- In March 2017, a presidential regulation established the Cyber Body and National Encryption Agency (BSSN), tasked with protecting Indonesia's cyberspace and boosting the economy.[34]
- In August 2017, the Coordinating Minister for Economic Affairs released an e-commerce roadmap to regulate the use of digital technologies in areas such as logistics, taxation, and consumer protection.[35]
- In December 2017, Bank Indonesia launched the National Payment Gateway (NPG), an interbank cooperation mechanism, to provide more efficient and secure digital transactions.[36]

Recommendations

- Indonesia should prioritise initiatives that improve its cloud infrastructure, such as increasing broadband speeds and making the provision of electricity more reliable.
- It should also ease data localisation requirements to enable firms to take advantage of outsourcing opportunities.
- Indonesia should present a clear regulatory enviroment by improving communication and coordination across government bodies.
- It should also work with public and private sector stakeholders to develop comprehensive and targeted policies.

Japan #4 (+1)

Climbs from CRI 2016's 5th ranking

Table 18: Japan, scores and rankings

	CRI #01 Int'l Connectivity	CRI #02 Broadb. Quality	CRI #03 Power and Sust.	CRI #04 Data Cent. Risk	CRI #05 Cybersecurity	CRI #06 Privacy	CRI #07 Govt Reg. Env.	CRI #08 IP Protection	CRI #09 Biz Sophistication	CRI #10 Freedom of Info.	TOTAL Cloud Infrastructure	TOTAL Cloud Security	TOTAL Cloud Regulation	TOTAL Cloud Governance	TOTAL All
Score	3.5	6.5	5.3	4.4	7.9	9.0	7.7	8.3	7.6	7.1	15.3	12.3	25.0	14.6	67.1
Ranking	6	5	3	4	6	1	4	4	9	5	5	5	3	6	4

Making Additional Progress

Japan is one of three economies to have climbed one rank compared to 2016. A decidedly mature economy, Japan's performance was at its best in the Regulation and Infrastructure segments. With its high internet speeds, reliable power supply, secure environment, and reliable regulatory frameworks, Japan is well positioned to lead regional cloud adoption. Its most notable improvement was in the Data Privacy parameter, reflecting recent legislative reforms such as the amendments to the Act on the Protection of Personal Information (APPI) and the establishment of the Personal Information Protection Commission (PPC) as a privacy commissioner.

Japan remains stable in most other parameters, with minor fluctuations in the mid-range rankings. Its most notable weakness was the dramatic fall in Business Sophistication rankings. It also experienced a precipitous fall to 9th in Business Sophistication, which may be explained by a tight clustering of scores in the Ease of Doing Business Index, combined with good performances from the mid-range economies.

Recent Digital Economy Regulation/Legislation and ICT Developments

- Since 2016, the My Number System Information scheme – a new social security and tax number system – enables the sharing of personal data across government bodies.[37]
- In May 2017, The PPC was established to function as privacy commissioner and to develop a centralised data protection scheme. [38]
- Also in May 2017, The Amended Act on the Protection of Personal Information (APPI) came into force with changes to the way consent is obtained from data holders.[39]
- In June 2017, the Ministry of Economy, Trade, and Industry shared a number of Guidelines on the Sharing Economy to ensure the growing sector is properly regulated.[40]
- Hosting the 2020 Summer Olympics has urged the Japanese government to deliver a variety of smart innovations to visitors and athletes. It has pledged to provide 5G coverage, as well as a range of inter-connected smart services.[41]

Recommendations

- Japan should continue to push its drive for innovation, especially in the way start-ups and entrepreneurs make cloud services part of their business models.
- It should also keep developing high quality broadband access to compete globally with other advanced cloud markets such as Hong Kong and Singapore.
- Japan should prioritise its international connectivity to remain a competitive location for cloud data centres.

Malaysia #8 (-)

Retains CRI 2016's 8th ranking

Table 19: Malaysia, scores and rankings

	CRI #01 Int'l Connectivity	CRI #02 Broadb. Quality	CRI #03 Power and Sust.	CRI #04 Data Cent. Risk	CRI #05 Cybersecurity	CRI #06 Privacy	CRI #07 Govt Reg. Env.	CRI #08 IP Protection	CRI #09 Biz Sophistication	CRI #10 Freedom of Info.	TOTAL Cloud Infrastructure	TOTAL Cloud Security	TOTAL Cloud Regulation	TOTAL Cloud Governance	TOTAL All
Score	2.5	5.5	4.0	4.1	8.9	7.5	7.9	7.6	7.8	5.3	11.9	13.0	22.9	13.2	61.0
Ranking	10	8	9	8	2	8	3	6	7	11	8	3	6	9	8

Sowing the Seeds of Success

Malaysia retained its 2016 ranking of 8th place. It performed exceptionally well in the Cybersecurity parameter, and made moderate progress in Government Regulatory Environment. The latter may soon become more prominent, as Malaysia's proposed 'Cloud First' strategy takes shape; driven by the Malaysia Digital Economy Corporation (MDEC), the policy is set to stimulate cloud adoption in both public and private sectors.

For now, however, Malaysia has declined or stagnated in most other parameters. It has lost five spots in Business Sophistication, suggesting that it could be doing more to facilitate business operations. It has also experienced lower scores in the aggregated Cloud Infrastructure and Governance segments, two fundamental drivers of cloud readiness.

Recent Digital Economy Regulation/Legislation and ICT Developments

- In September 2017, Bank Negara Malaysia published an Exposure Draft on Outsourcing Arrangements to ensure risk management practices for outsourcing arrangements remain effective amid a more globalised and digitised environment.[42]
- In October 2017, MDEC announced a 'Cloud First' strategy to enable the delivery of cloud-based public services as well as to drive the private sector's adoption of cloud technologies.[43]
- Also in October 2017, the Ministry of Health (MoH) launched the Malaysian Health Data Warehouse (MyHDW) as a central system to house citizens' health data.[44]
- In November 2017, Malaysia launched a Digital Free Trade Zone to facilitate seamless cross-border trade and grow and support local eCommerce businesses.[45]
- Also in November 2017, Malaysia's Mass Rapid Transit (MRT) leveraged cloud solutions to improve productivity and safety standards.[46]

Recommendations

- Malaysia should focus on improving its physical cloud infrastructure – especially broadband speeds – to effectively reach the aims of its proposed 'Cloud First' policy.
- It should also demonstrate the value of cloud technologies by improving the regulatory environment in a way that truly helps businesses and government agencies.
- Malaysia should review its freedom of information and privacy laws, seen to be going against the dynamism that cloud computing can bring about.

New Zealand #3 (-)

Retains CRI 2016's 3rd ranking

Table 20: New Zealand, scores and rankings

	CRI #01 Int'l Connectivity	CRI #02 Broadb. Quality	CRI #03 Power and Sust.	CRI #04 Data Cent. Risk	CRI #05 Cybersecurity	CRI #06 Privacy	CRI #07 Govt Reg. Env.	CRI #08 IP Protection	CRI #09 Biz Sophistication	CRI #10 Freedom of Info.	TOTAL Cloud Infrastructure	TOTAL Cloud Security	TOTAL Cloud Regulation	TOTAL Cloud Governance	TOTAL All
Score	3.9	5.7	7.2	4.8	7.2	8.5	7.7	8.9	8.7	8.6	16.8	12.0	25.1	17.3	71.1
Ranking	4	7	1	2	8	5	4	1	1	1	4	8	2	1	3

Capitalising on Unique Strengths

New Zealand has not moved from the position it held in CRI 2016. A regional leader, it is especially strong in the aggregated Governance, Regulation, and Infrastructure segments. Its highest marks are in the Power Grid, Green Policy, and Sustainability and the Business Sophistication parameters. To strengthen its position, New Zealand is developing a set of mandatory data breach reporting laws that will soon support its 'Cloud First' policy.

A great overall ranking should not, however, distract from the fact that the aggregated Cloud Security segment is a major weakness. New Zealand may perform well in the Data Centre Risk parameter, but the tumble to 8th in Cybersecurity hinders its ability to rise above its current position. If left to persist, this weakness may grow to dampen the progress already made in terms of cloud adoption.

Recent Digital Economy Regulation/Legislation and ICT Developments

- In March 2017, the Ministry of Business, Innovation, and Employment (MBIE), launched a report outlining the different steps for New Zealand to become a Digital Nation.[47]
- In May 2017, the MBIE announced the position of a government Chief Technology Officer position to help drive the economy's digital agenda.[48]
- In June 2017, the New Zealand IoT Alliance launched a multi-disciplinary research project to estimate the risks and benefits of Internet of Things (IoT) technologies to the national economy.[49]
- Likewise, an AI Forum is being developed to examine the potential of artificial intelligence to drive economic growth and influence policy change.[50]

Recommendations

- New Zealand should continue to improve its infrastructure to ensure its ambitious regulatory initiatives actually have an impact on overall cloud readiness.
- Cybersecurity policies and measures should also be strengthened, particularly through stronger collaboration between industry, non-profit, academic, and government organisations.
- New Zealand should reduce its data centre risk if it wants individuals, businesses, and institutions to see it as a safe and stable destination for critical data.
- It should also address its looming digital skills shortage by reinforcing the way computer science is integrated into school curriculums.

Philippines #9 (-)

Retains CRI 2016's 9th ranking

Table 21: Philippines, scores and rankings

	CRI #01 Int'l Connectivity	CRI #02 Broadb. Quality	CRI #03 Power and Sust.	CRI #04 Data Cent. Risk	CRI #05 Cybersecurity	CRI #06 Privacy	CRI #07 Govt Reg. Env.	CRI #08 IP Protection	CRI #09 Biz Sophistication	CRI #10 Freedom of Info.	TOTAL Cloud Infrastructure	TOTAL Cloud Security	TOTAL Cloud Regulation	TOTAL Cloud Governance	TOTAL All
Score	2.5	4.8	4.5	3.9	5.9	8.5	5.7	5.9	5.9	5.9	11.9	9.8	20.1	11.8	53.6
Ranking	10	13	4	9	12	5	11	12	14	8	8	12	9	11	9

Taking the Road Less Travelled

The Philippines remains in 2016's 9th position. It has reached the 4th position for the Power Grid, Green Policy, and Sustainability parameter, and has made small improvements in Cybersecurity and Broadband Quality. The aggregated Cloud Regulation segment has become its strongest suit, mainly thanks to two technology-related initiatives: the establishment of the DICT to better coordinate the government's ICT policies, and the development of a 'Cloud First' policy for government services.

The impact of both these initiatives will take time to be reflected in CRI scores. At the moment, the Philippines has either stagnated or regressed in most CRI rankings, especially in the Cybersecurity and Data Centre Risk parameters. However, as a market with no explicit prohibitions on using cloud in the public sector, the Philippines is well-placed to climb up the ranks in the next iteration of the CRI.

Recent Digital Economy Regulation/Legislation and ICT Developments

- In May 2016, the DICT was created, along with several other special agencies: the National Telecommunications Commission (NTC), the National Privacy Commission (NPC), and the Cybercrime Investigation and Coordination Centre (CICC). [51]
- In January 2017, The DICT adopted a "Cloud First" policy for government procurement and service delivery.[52]
- In March 2017, the DICT re-launched GovCloud, a major component of Integrated Government Philippines (iGovPhil), the flagship e-government program of the Aquino administration.[53]
- In May 2017, the DICT released the National Cybersecurity Plan (NCSP) 2022 to shape policy on cybersecurity and develop guidelines for all government units.[54]
- In August 2017, the Free Internet Access in Public Places Act was approved, giving free access to the Internet in public places including parks, plazas, public hospitals, and educational institutions.[55]
- In December 2017, the Philippines joined the APEC Cross Border Privacy Enforcement Arrangement (CPEA), becoming the 11th PEA along with those from eight other APEC economies.[56]

Recommendations

- The Philippines should strengthen its governance for cloud technologies to become a viable option outside of government agencies.
- It should also focus its attention on cybersecurity issues, ensuring that data kept within its borders is safe and sound.
- The Philippines should also prioritise cloud infrastructure to guarantee a nation-wide access to cloud government services.

Singapore #1 (+1)

Climbs from CRI 2016's 2nd ranking

Table 22: Singapore, scores and rankings

	CRI #01 Int'l Connectivity	CRI #02 Broadb. Quality	CRI #03 Power and Sust.	CRI #04 Data Cent. Risk	CRI #05 Cybersecurity	CRI #06 Privacy	CRI #07 Govt Reg. Env.	CRI #08 IP Protection	CRI #09 Biz Sophistication	CRI #10 Freedom of Info.	TOTAL Cloud Infrastructure	TOTAL Cloud Security	TOTAL Cloud Regulation	TOTAL Cloud Governance	TOTAL All
Score	7.0	9.5	6.0	4.6	9.3	9.0	9.0	8.9	8.5	4.9	22.5	13.9	26.9	13.4	76.6
Ranking	2	1	2	3	1	1	1	1	2	12	1	1	1	7	1

Maintaining a Stellar Track Record

Singapore's remarkable performance in most segments and parameters allows it to overtake Hong Kong and rank first in this year's CRI. Significant improvements in Data Centre Risk, Cybersecurity, Data Privacy, and Intellectual Property Protection have pushed it up in those parameter rankings. It has also held on to its past rankings in many other parameters, consistently ranking among the top three economies. This demonstrates the power of strong, coordinated infrastructure and the benefits of flexible regulatory frameworks.

Singapore's key weakness can be found in the aggregated Governance segment. A top Business Sophistication scorer, it is brought down by a poor Freedom of Information score. If it wants to continue succeeding, Singapore will have to ensure it balances the need for structured policies with sufficient space for innovation and experimentation.

Recent Digital Economy Regulation/Legislation and ICT Developments

- In April 2017, the Ministry of Communications and Information (MCI) announced a new Digital Readiness Programme Office to help citizens access digital technologies.[57]
- In May 2017, the government announced the Smart Nation Sensor Platform, a nation-wide network of sensors that will enable connectivity, data and video analytics, and data sharing across government agencies.[58]
- Also in May 2017, the National Research Foundation (NRF) pledged up to SGD150 million (USD108 million) over five years to AI.SG, a new national programme that will boost Singapore's artificial intelligence (AI) capabilities.[59]
- In September 2017, the Monetary Authority of Singapore (MAS) set up the Cyber Security Advisory Panel (CSAP) to enhance the cyber-resilience of Singapore's financial sector.[60]
- In October 2017, SPRING Singapore revised its Cloud Outage Incident Reporting (COIR) standards to improve transparency for users on how cloud service providers respond to cloud outages.[61]
- In December 2017, the Info-communications Media Development Authority (IMDA) announced the "SMEs Go Digital Programme" to help SMEs use digital technologies to improve productivity.[62]
- In January 2018, the Cybersecurity Bill was introduced in Parliament to empower the Cyber Security Agency of Singapore (CSA) to manage and respond to cybersecurity threats.[63]
- Also in January 2018, the Parliament voted unanimously to form a Select Committee that will recommend possible ways to tackle the threat of 'fake news'.[64]

Recommendations

- Singapore should continue to foster and support cybersecurity initiatives, as the valuable digital assets it possesses make it a prime target for cyber-attackers.
- Singapore should not stifle the creativity and innovation associated with new digital business models through over-regulation.

South Korea #7 (-)

Retains CRI 2016's 7th ranking

Table 23: South Korea, scores and rankings

	CRI #01 Int'l Connectivity	CRI #02 Broadb. Quality	CRI #03 Power and Sust.	CRI #04 Data Cent. Risk	CRI #05 Cybersecurity	CRI #06 Privacy	CRI #07 Govt Reg. Env.	CRI #08 IP Protection	CRI #09 Biz Sophistication	CRI #10 Freedom of Info.	TOTAL Cloud Infrastructure	TOTAL Cloud Security	TOTAL Cloud Regulation	TOTAL Cloud Governance	TOTAL All
Score	2.8	7.4	4.1	4.3	7.8	8.5	8.0	6.3	8.4	7.2	14.3	12.1	22.8	15.6	64.8
Ranking	8	3	8	5	7	5	2	10	3	4	6	7	7	3	7

Rising to the Challenge

South Korea's Cloud Computing Promotion Act of 2015 may not have had an immediate impact on the 2016 rankings, but it seems to have paid off in CRI 2018. It has made considerable progress in several Cloud Regulation and Governance parameters. It jumped to 2nd place in the Government Regulatory Environment parameter, and progressed three ranks in both Freedom of Information and Business Sophistication.

Despite these encouraging developments, South Korea slid in the aggregated Cloud Infrastructure segment. It dropped in both the International Connectivity and the Power Grid, Green Policy, and Sustainable Energy parameters. It also lost its footing in the Cybersecurity parameter, showing that much needs to be done to remain competitive with other high-performers.

Recent Digital Economy Regulation/Legislation and ICT Developments

- In May 2017, the Korea Communications Commission (KCC) unveiled its "Guidelines on the Right to Request Access Restrictions on Personal Internet Postings", giving consumers the right to be forgotten from online publications.[65]
- In June 2017, South Korea became the fifth economy to join the APEC's Cross Border Privacy Rules system, which aims to bolster privacy protections and diminish barriers to data flows among APEC member economies.[66]
- In July 2017, the Ministry of Science and ICT (MSIT) pledged a total of KRW1.7 trillion (USD1.6 billion) to grow the technologies that will fuel the fourth industrial revolution: Internet of Things (IoT), cloud computing, big data, and AI.[67]
- In January 2018, the MSIT and the Korea Internet and Security Agency (KISA) committed to create a conducive security and regulatory environment to drive cloud adoption by organisations in the health and financial sectors.[68]
- The 2018 Winter Olympics pushed South Korea to invest massively in intelligent technologies. Progress has been steady, with 5G a key focus of many recent innovations developed especially for the event.[69]

Recommendations

- South Korea should improve its International Connectivity and Access to Sustainable Power, two critical elements to the development of comprehensive cloud services.
- Recent attacks on South Korean banks and Bitcoin exchanges show that it should also reinforce its cybersecurity capabilities to ensure businesses are able to trust cloud technologies.
- South Korea should harness the influence of *chaebols* – large, family-owned industrial conglomerates – so that they support the advent of cloud-related innovations.

Taiwan #5 (+1)

Climbs from CRI 2016's 6th ranking

Table 24: Taiwan, scores and rankings

	CRI #01 Int'l Connectivity	CRI #02 Broadb. Quality	CRI #03 Power and Sust.	CRI #04 Data Cent. Risk	CRI #05 Cybersecurity	CRI #06 Privacy	CRI #07 Govt Reg. Env.	CRI #08 IP Protection	CRI #09 Biz Sophistication	CRI #10 Freedom of Info.	TOTAL Cloud Infrastructure	TOTAL Cloud Security	TOTAL Cloud Regulation	TOTAL Cloud Governance	TOTAL All
Score	6.5	6.5	4.5	4.2	8.1	7.0	7.1	7.4	8.0	7.6	17.5	12.3	21.6	15.6	66.9
Ranking	3	5	5	7	4	9	6	7	5	3	3	5	8	3	5

Adapting to Changing Conditions

As one of the Four Asian Tigers, Taiwan has long put emerging technologies at the forefront of its economic strategies. It has made some encouraging progress on several cloud parameters, making it one of three economies to have climbed one position since CRI 2016. It rose to 3rd in International Connectivity and 4th in Cybersecurity. The Government Regulatory Environment and Freedom of Information parameters have also both improved. Cloud Governance and Infrastructure were Taiwan's best performing segments, which means the foundations are in place for cloud adoption to increase.

Taiwan's weakness is Cloud Regulation, mainly due to lower-than-usual scores for the Data Privacy and Intellectual Property Protection parameters. It has also slumped in the Data Centre Risk and Power Grid, Green Policy, and Sustainable Energy parameters. Taiwan can make considerable improvements in the next CRI by tackling gaps in its privacy legislation.

Recent Digital Economy Regulation/Legislation and ICT Developments

- In March 2016, the Personal Data Protection Act was amended to include notice/consent requirements for the collection and use of sensitive personal data, as well as criminal sanctions for intentional breaches of data protections laws.[70]
- In September 2016, the Cybersecurity Management Bill was drafted to integrate and improve information security capabilities, promote cybersecurity laws, and provide the groundwork for the National Strategy for Cybersecurity Development Programme (2017-2020).[71]
- In December 2017, the Financial Supervisory Commission (FSC) amended the Law on Electronic Payment Authority Information System Standard and Security Control Practices to improve e-payment convenience and security.[72]
- In January 2018, the Taiwanese Telecommunications regulator announced it will not be renewing 3G licenses at the end of 2018. Existing 3G users will need to migrate to 4G by the end of the year to continue their service.[73]

Recommendations

- Taiwan should develop a 'Cloud First' policy for its government services. This will provide an overall direction while improving the efficiency of government services.
- It should also establish a national regulatory body for data privacy.
- Taiwan should continue to develop its cloud infrastructure to remain relevant in an increasingly competitive region.
- It should also see cloud technologies as an opportunity to move beyond its traditional role of supplier of component, semiconductor, and contract manufacturing services to the world's IT sector.

Thailand #10 (-)

Retains CRI 2016's 10th ranking

Table 25: Thailand, scores and rankings

	CRI #01 Int'l Connectivity	CRI #02 Broadb. Quality	CRI #03 Power and Sust.	CRI #04 Data Cent. Risk	CRI #05 Cybersecurity	CRI #06 Privacy	CRI #07 Govt Reg. Env.	CRI #08 IP Protection	CRI #09 Biz Sophistication	CRI #10 Freedom of Info.	TOTAL Cloud Infrastructure	TOTAL Cloud Security	TOTAL Cloud Regulation	TOTAL Cloud Governance	TOTAL All
Score	2.7	6.9	2.2	3.8	6.8	4.5	5.4	5.0	7.7	5.5	11.8	10.7	14.9	13.3	50.6
Ranking	9	4	11	11	9	12	14	14	8	10	10	9	13	8	10

Turning Challenges into Opportunities

CRI 2018 has mixed results for Thailand. It has held its 2016 rank and seen considerable improvements in Cybersecurity, Business Sophistication, and Broadband Quality. The Freedom of Information parameter has also improved albeit much more moderately. Cloud Governance was Thailand's strongest segment, while Regulation and Infrastructure were its weakest.

Thailand has fallen several ranks in key parameters: Data Centre Risk, International Connectivity, and Power Grid, Green Policy, and Sustainable Energy. Data Privacy and Government Regulation rankings, meanwhile, stagnated at their 2016 levels.

Recent Digital Economy Regulation/Legislation and ICT Developments

- In September 2016, the National Broadcasting and Telecommunications Commission (NBTC) drafted a five-year telecom master plan to promote the use of new technologies and infrastructure-sharing among telecom operators.[74]
- Also in September 2016, the government officially announced the 12th National Economic and Social Development Plan 2017-2036 (also known as Digital Thailand 4.0), and the Digital Government Plan 2017-2021, which aim to strengthen the digital infrastructure of the public sector.[75]
- In December 2016, Thailand adopted its first national government procurement law, which eliminates privileges and directs government to use a "value-for-money" approach to procurement.[76]
- The Ministry of Digital Economy and Society (MDES) is currently reviewing the draft National Cybersecurity Bill, which gives the Office of the National Cybersecurity Committee broad powers to access confidential and sensitive information.[77]
- The MDES is also spending more than THB20 billion (USD614 million) rolling out a national broadband network to connect the nation's 74,965 villages by the end of 2018.[78]
- In March 2018, the MDES announced the creation of a committee for big data, data centres, and cloud computing. It will steer the rest of the government's digital transformation process.[79]

Recommendations

- Thailand should accelerate the implementation of the Digital Economy Bill to help reduce the level of legislative and regulatory uncertainty for cloud and technology users.
- It should also prioritise cloud infrastructure, making it a critical part of future national digital policies.

Vietnam #14 (-)

Retains CRI 2016's 14th ranking

Table 26: Vietnam, scores and rankings

	CRI #01 Int'l Connectivity	CRI #02 Broadb. Quality	CRI #03 Power and Sust.	CRI #04 Data Cent. Risk	CRI #05 Cybersecurity	CRI #06 Privacy	CRI #07 Govt Reg. Env.	CRI #08 IP Protection	CRI #09 Biz Sophistication	CRI #10 Freedom of Info.	TOTAL Cloud Infrastructure	TOTAL Cloud Security	TOTAL Cloud Regulation	TOTAL Cloud Governance	TOTAL All
Score	3.6	5.3	2.1	3.9	2.5	3.5	5.7	5.1	6.8	2.6	11.0	6.3	14.4	9.4	41.0
Ranking	5	10	12	9	14	14	11	13	10	13	11	14	14	13	14

Overcoming Major Obstacles

CRI 2016 noted Vietnam's potential but also highlighted the limiting impact of its weak basics. This remains the case in CRI 2018, as it ranks last or next-to-last in almost all segments and parameters. One bright spark was that it rose to 10th position in Business Sophistication as well as in Government Regulatory Environment, possibly due to focused improvements made before and during 2017 when Vietnam was the hosting economy for the APEC 2017 meetings. The Data Centre Risk parameter also improved with a jump to 9th. Vietnam's ranking in International Connectivity also jumped from 11th to 5th, constituting its greatest success in CRI 2018.

Unfortunately, Vietnam is plagued by poor scores in the Data Privacy, Intellectual Property Protection, and Freedom of Information parameters. It fell to 12th in the Power Grid, Green Policy, and Sustainable Energy parameter, while stagnated at 10th in the Broadband Quality parameter. Cybersecurity is by far Vietnam's biggest weakness.

Recent Digital Economy Regulation/Legislation and ICT Developments

- In May 2016, the Ministry of Information and Communications (MIC) released the Law on Network Information Security, which detailed regulations around the use of ICT, its requisite responsibilities, and obligations.[80]
- In March 2017, the Ministry of Industry and Trade (MoIT) and the Ministry of Natural Resources and Environment (MoNRE) signed an IT Collaboration agreement with Microsoft to improve technologies and skills.[81]
- In May 2017, the Information and Network Security Incident Response Coordination Plan was released, setting out reporting and coordination mechanisms in case of network attacks.[82]
- In November 2017, the Ministry of Information and Communications (MIC) released a summary document on 10 years of implementation of the IT Act 2006, as a prelude to a review of the Act.[83]
- In January 2018, the Ministry of Public Security (MPS) released an updated version of its draft Law on Cybersecurity. It no longer contains server localisation provisions, but does outline several requirements for offshore entities that provide telecommunications and Internet services within Vietnam.[84]

Recommendations

- Vietnam should prioritise its IT infrastructure and develop quality broadband access, reliable power supplies, and international connections.
- It should also tackle its cybersecurity problems if it wants both private- and public-sector leaders to trust cloud services.
- Vietnam should strengthen the enforcement of intellectual property and freedom of information laws to create a conducive environment for homegrown creators and innovators.

V. Conclusions

The CRI 2018 reveals four key areas in which several APAC economies underperform: Energy Sustainability, Cybersecurity, Data Privacy, and Freedom of Information:

Improve Energy Sustainability: The APAC region performed weakly in terms of energy security and sustainability, making its rapidly growing energy demand and import dependence a key concern.[85] APAC policymakers should coordinate efforts to improve energy security, rein in excessive energy consumption, and encourage the use of energy-saving goods and services.[86] In this context, wind, solar, and biomass sources represent a major opportunity for emerging APAC economies to sustainably meet energy demands.[87]

Strengthen Cybersecurity Frameworks: The combination of high digital connectivity and growing cross-border data transfers makes the APAC region attractive for cyber-criminals.[88] While a number of APAC economies have national cybersecurity strategies in place, supporting institutions and organisations operating in the region remain largely under-equipped.[89] APAC policymakers are urged to strengthen cybersecurity regulations and laws, which will provide clarity and reassurance to businesses.

Ensure Global Data Privacy Interoperability: Data privacy legislation is evolving rapidly in the region, but most initiatives remain fragmented and unevenly controlled by different jurisdictions.[90] Given the urgent need to enable cross-border data flows globally, APAC policymakers are urged to consider developing and/or updating their data privacy laws and regulations to ensure interoperability with regional and global frameworks, such as the APEC Cross-Border Privacy Rules (CBPR) framework, and the EU's General Data Privacy Regulations (GDPR). APAC policymakers are urged to address this major challenge in a coordinated manner, as the region's success in the digital age is inextricably tied to individual economies' ability to keep data safe.[91]

Encourage Freedom of Information: Media freedom has somewhat retreated in APAC, with the principles of non-interference, sovereignty, or even national security often brandished to control the flow of information.[92] The flow of digital information is also declining worldwide, and APAC economies run the whole gamut of best- and worst-case scenarios.[93] APAC policymakers are urged to facilitate the circulation of information to ensure consumers, businesses, and governments can fully benefit from and contribute to the global digital economy.[94]

VI. Looking Ahead: Unlocking Digital Opportunities

ICT policies that enable cloud technologies to grow and prosper are key to seizing the business models and opportunities of the future. From the Internet of Things to artificial intelligence, cloud computing fuels today's advancements in automation, interconnectivity, and interoperability – effectively defining what it means to succeed in the digital age.

This is especially true in the APAC region, where the rise of mobile technologies, rapid urbanisation, and the emergence of the millennial workforce are shifting the way organisations and societies operate. This shift is taking place at an unprecedented pace – pushing the region's economies to arm themselves with the digital skills, tools, and frameworks that will help them stay relevant and competitive in the face of worldwide digital transformation.

Ranking high in the Cloud Readiness Index is a great advantage. But to harness the full potential of cloud technologies, the region's economies must go beyond readiness. They must build their competitiveness by anticipating trends and opportunities and identifying emerging business models. From a regulatory perspective, this means building a conducive environment that enables long-term innovation and sustains multi-faceted dynamism.

To achieve this, policymakers must be able to measure the way economies actually put their readiness to use. We cannot improve what we do not measure, and thus globally-comparable metrics to assess cloud adoption and usage are needed to effectively succeed in today's data economy.

Moving Beyond Readiness

The results of the CRI 2018 paint a useful picture for cloud policymakers and practitioners alike. But they also raise some interesting questions that make it necessary to start thinking beyond simple readiness.

India and China, for instance, have both made significant progress in driving the region's adoption of cloud-driven technologies. From mobile banking and cashless payment applications to pilot smart cities, they both play central roles in the region's technological development. Yet at 12th and 13th positions respectively, they both remain at the bottom of the index rankings.

Likewise, Indonesia, Malaysia, and the Philippines have recently launched a number of forward-looking policies that will undoubtedly make them attractive investment destinations for both emerging and established digital economy players. But because these are policy-driven changes, it will be some time before their impact can be felt or even measured. This makes it difficult for the CRI – or any other composite index – to accurately capture economies' progress, which is why their position in the rankings has not changed since 2016 despite notable policy shifts since then.

Measuring Cloud Impact

The ACCA believes that some of these information gaps are due to the lack of publicly-available metrics on cloud adoption and application. As such, more insight can be gained if we can obtain additional dimensions around cloud usage and business potential. For example, should metrics be available across economies, a new Cloud Impact segment could be included, involving a number of indicators such as: Number of smart cities, Mobile adoption and growth, Number of locally-developed apps, Fintech presence and growth, Attractiveness to tech start-ups, IoT usage in industries, etc.

To verify the statistical impact of such a segment, we built a new Cloud Impact dimension based on the following publicly-available indexes:

- **2016 Mobile Connectivity Index, developed by the GSMA** – Measures the four key enablers of mobile internet adoption – infrastructure, affordability, consumer readiness, and content.[95]

- **2017 Global Innovation Index, developed by Cornell University, INSEAD, and the World Intellectual Property Organisation (WIPO)** – Quantifies the multi-dimensional facets of innovation by measuring seven pillars.[96]

- **2017 FinTech adoption Index, developed by Ernst & Young** – Captures the proportion of regular FinTech users based on 17 distinct services offered by non-traditional providers.[97]

Using the same methodology as the other CRI parameters, the following 10-point scores were obtained for the economies for which data was available:

Table 27: Measuring Cloud Impact

	CRI #11 Mobile Connectivity *(normalised score out of 10)*	CRI #12 Fintech Adoption *(normalised score out of10)*	CRI #13 Social & Technological Innovation *(normalised score out of 10)*	TOTAL CLOUD IMPACT *(total score out of 30)*
Australia	**8.7**	**3.7**	**5.2**	**17.6**
China	**7.1**	**6.9**	**5.3**	**19.2**
Hong Kong	**8.0**	**3.2**	**5.4**	**16.6**
India	**4.9**	**5.2**	**3.6**	**13.6**
Indonesia	**5.3**	**..**	**3.0**	**8.3**
Japan	**7.9**	**1.4**	**5.5**	**14.8**
Malaysia	**7.0**	**..**	**4.3**	**11.3**
New Zealand	**8.5**	**..**	**5.3**	**13.8**
Philippines	**6.2**	**..**	**3.3**	**9.4**
Singapore	**8.3**	**2.3**	**5.9**	**16.5**
South Korea	**8.2**	**3.2**	**5.8**	**17.2**
Taiwan	**..**	**..**	**..**	**..**
Thailand	**6.8**	**..**	**3.8**	**10.6**
Vietnam	**6.0**	**..**	**3.8**	**9.8**

When combined to the existing CRI scores, the composite Cloud Impact score noticeably changes some of the CRI rankings:

Table 28: CRI 2018 scores and rankings, with and without Cloud Impact

	CRI 2018 Total Score	New Total Score (with Cloud Impact)	CRI 2018 Rankings	New Rankings (with Cloud Impact)
Australia	66.3	64.5	6	5 (+1)
China	43.1	47.9	13	10 (+3)
Hong Kong	74.1	69.8	2	2 (-)
India	47.4	46.9	12	12 (-)
Indonesia	49.4	44.4	11	13 (-2)
Japan	67.1	63.0	4	7 (-3)
Malaysia	61.0	55.6	8	8 (-)
New Zealand	71.1	65.3	3	4 (-1)
Philippines	53.6	48.5	9	9 (-)
Singapore	76.6	71.6	1	1 (-)
South Korea	64.8	63.1	7	6 (+1)
Taiwan	66.9	66.9	5	3 (+2)
Thailand	50.6	47.1	10	11 (-1)
Vietnam	41.0	39.1	14	14 (-)

The new totals show that Singapore and Hong Kong remain in the top two positions, while Taiwan replaces New Zealand in 3rd. Australia, China, South Korea, and Taiwan move up in the rankings, suggesting that cloud technologies are having a great economic impact despite some of the structural weaknesses that can be observed. China stands out with a three-position advance, from 13th to 10th. Conversely, the new scores lead to Indonesia, Japan, New Zealand, and Thailand losing one to three positions. Japan's tumble from 4th to 7th suggests that it can achieve much more considering its great potential.

While incomplete, this statistical exercise demonstrates the need for additional metrics that measure economies' actual ability to prosper and innovate through cloud technologies. Moving further into the Fourth Industrial Revolution, cloud-based technologies will continue to drive intelligent innovation that connects people, products, and platforms. In this context, APAC economies must seek methods and means to measure new aspects of their technology policies; not only their implementation, but also their actual impact on people's lives.

This data should be made publicly available so that government policymakers and policy support organisations such as the ACCA may provide accurate insights and timely perspectives on regional and global technology trends.

Appendix: Methodology and Data Sources

The 10 parameters of the Cloud Readiness Index are sourced from publicly-available sources, which have been referenced. Below are some added details on data aggregation and normalisation.

a) Normalisation

The indicators used have different units and scales. Any indicator that does not use a 10-point scale is normalised to make the indicator values comparable, as well as to construct aggregate scores for each economy. For example, indicators such as the Global Cybersecurity Index already use a percentage (100-point) scale, so these did not need to be normalised, and were simply adjusted to fit a 10-point scale. Indicators not based on a 100-point scale were systematically normalised. The Intellectual Property Protection measure, for instance, was normalised from a 7-point to a 10-point scale.

b) Minimum-Maximum Method

Some numerical indicators require more complex normalisation. Internet speed indicators, for instance, are measured in absolute values with no minimum or maximum value limitations. Where applicable, absolute values were transformed into natural logarithmic values. Minimum and maximum values were then set to transform the logarithmic values into scores comprised between 0 and 10. The following formula was used wherever necessary:

$$Normalised\ value = \left(\frac{actual\ value - minimum\ value}{maximum\ value - minimum\ value}\right) \times 10$$

c) Treatment of Missing Values

Where indicated, some figures were missing values for certain economies. In order to avoid incomplete databases that may skew the results, it was decided to recreate the missing values using a clustering technique to group APAC economies according to the World Bank's income classification groups.[98]

The World Bank's income classification groups APAC economies as follows:

- High-income economies (GDP per capita of USD12,746 or more): Australia, Japan, New Zealand, Singapore, and South Korea.
- Upper-middle-income economies (GDP per capita of USD4,126 to USD12,745): China, Malaysia, and Thailand.
- Lower-middle-income economies (GDP per capita of USD1,046 to USD4,125): Indonesia and India.

The average of the data for each income group was calculated to estimate the missing values. For example, to estimate the missing value for Hong Kong, an average of the normalised data for Australia, Japan, New Zealand, Singapore, and South Korea (high-income economies) was used.

d) CRI Parameter #04 – Data Centre Risk

Cushman & Wakefield's *Data Centre Risk Index 2016* identifies risks likely to affect the successful operation of a data centre. It applies an individual weight to different types of risks to create a balanced view and ranking of selected economies. To avoid an incomplete dataset, the index was recreated using world-renowned and peer-reviewed secondary databases.

The table below indicates the original indicator, its weight, as well as the secondary sources that allowed to calculate the recreated index:

Table 29: ACCA Data Centre Risk Score (2018 Update)

Original Cushman & Wakefield Indicator	Weight	CRI 2018 Database and Indicator	Source / URL
Energy (Cost per Kwh)	8.97%	Several national statistical and energy organisations, Cost per Kwh (domestic and household use)	- The Philippines: www.doe.gov.ph/sites/default/files/pdf/electric_power/development_plans/pdp_2016-2040.pdf (p.17, domestic electricity rates). - Taiwan: http://web3.moeaboe.gov.tw/ecw/english/content/ContentDesc.aspx?menu_id=1539 (p.97 of the statistics handbook). - Vietnam: http://en.evn.com.vn/d6/gioi-thieu-d/RETAIL-ELECTRICITY-TARIFF-9-28-252.aspx (retail price for households). - Hong Kong, Malaysia, Singapore, Thailand, United Arab Emirates: Energy Use Calculator, http://energyusecalculator.com/global_electricity_prices.htm (consulted January 2018). - All others: World Energy Council (2017), *Energy Trilemma Index database*, https://trilemma.worldenergy.org/#!/energy-index.
International Internet Bandwidth (Mbit/s)	11.54%	- ITU, ICT Development Index (International Internet bandwidth, Bit/s per Internet user) - The Global Economy, online database	- Taiwan: www.theglobaleconomy.com/Taiwan/Internet_bandwidth (consulted January 2018). - All others: ITU (2017), *Measuring Society Report*, www.itu.int/en/ITU-D/Statistics/Documents/publications/misr2017/MISR2017_Volume1.pdf (p. 138).
Ease of Doing Business (World Bank Ranking)	11.54%	World Bank, Ease of Doing Business database	www.doingbusiness.org/data (Distance to Frontier score, out of 100)
Corporation Tax	6.41%	KPMG, Corporate Tax rate table (2017)	https://home.kpmg.com/xx/en/home/services/tax/tax-tools-and-resources/tax-rates-online/corporate-tax-rates-table.html (normalised score)
Political Stability (EIU Instability Index)	12.82%	Institute for Economics and Peace, Global Peace Index 2017	- Hong Kong: Missing value is estimated as the average of Australia, Japan, New Zealand, Singapore, and South Korea. - All others: http://visionofhumanity.org/app/uploads/2017/06/GPI17-Report.pdf (p.18 of the report).
Sustainability (% Energy from Alternatives)	8.97%	- World Bank, Energy & Mining database (2017 or latest year available) - Enerdata, Global Energy Statistical Yearbook 2017	- Taiwan: https://yearbook.enerdata.net (Share of renewables in electricity, production, %). - All others: https://data.worldbank.org/topic/energy-and-mining (Alternative and nuclear energy, % of total energy use).
Natural Disasters	15.38%	Stuttgart University, World Risk Index (2016)	- Hong Kong and Taiwan: Missing values are estimated as the average of Australia, Japan, New Zealand, Singapore, and South Korea. - All others: http://weltrisikobericht.de/english, risk component.
Energy Security	12.18%	United Nations, Sustainable Development Goals database (2016 or latest year available)	- Taiwan: Missing value is estimated as the average of Australia, Japan, New Zealand, Singapore, and South Korea. - All others: https://unstats.un.org/sdgs/indicators/database (average of three main SDG 7 components; Proportion of population with access to electricity, Proportion of population with primary reliance on clean fuels and technology, and Renewable energy share in the total final energy consumption).
GDP per Capita	5.77%	CIA World Factbook, GDP per capita (PPP, 2017 USD) (2017 or latest year available)	www.cia.gov/library/publications/the-world-factbook/fields/2004.html
Water (Availability per Capita)	6.41%	CIA World Factbook, improved drinking water source (% of population) (2015 or latest year available)	- Hong Kong and Taiwan: Missing values are estimated as the average of Australia, Japan, New Zealand, Singapore, and South Korea. - All others: www.cia.gov/library/publications/the-world-factbook/fields/2216.html

e) CRI Parameter #06 – Privacy

The Business Software Alliance's (BSA) *Cloud Computing Scorecard 2016* uses a "data privacy scorecard" to assess economies' ability to safeguard and protect data privacy.[99] The scorecard comprises 10 questions, five qualitative and five quantitative. The ACCA's scoring mechanism was used to score the five quantitative questions, with the following values:

- Q1: Are there laws or regulations governing the collection, use, or other processing of personal information? 30% of privacy score (max value = 3)
- Q2: Is there an effective agency (or regulator) tasked with the enforcement of privacy laws? 25% of privacy score (max value = 2.5)
- Q3: Are data controllers free from registration requirements? 20% of privacy score (max value = 2)
- Q4: Are cross-border transfers free from registration requirements? 15% of privacy score (max value = 1.5)
- Q5: Is there a breach notification law? 10% of privacy score (max value = 1)

Scoring guidelines
Q1: Yes = 3, Partially = 1.5, No = 0
Q2: Yes, NR (National Regulator) = 2.5, Yes, SR (Sectoral Regulator) = 1, None = 0
Q3: No = 0, Partially = 1, Yes = 2
Q4: No = 0, Partially = 1, Yes = 1.5
Q5: Yes, compulsory = 1, Partially – no enacted law, but recommendations or guidelines issued or pending full enactment = 0.5, No – no law, and no mention of breach notification = 0

Below is a summary table recreating the score based on data privacy policies and regulations found in DLA Piper's *Data Protection Laws of the World* handbook.[100] The ACCA is considering an alternative method of assessing privacy in future iterations of the CRI. We welcome any inputs and suggestions.

Table 30: ACCA Data Privacy Score (2018 Update)

ECONOMY	*30% of privacy score (max value = 3)*	*25% of privacy score (max value = 2.5)*	*20% of privacy score (max value = 2)*	*15% of privacy score (max value = 1.5)*	*10% of privacy score (max value = 1)*	DATA PRIVACY SCORE (max value = 10)
	Q1: Are there laws or regulations governing the collection, use or other processing of personal information?	**Q2: Is there an effective agency (or regulator) tasked with the enforcement of privacy laws?**	**Q3: Are data controllers free from registration requirements?**	**Q4: Are cross-border transfers free from registration requirements?**	**Q5: Is there a breach notification law?**	
Australia	3.0	2.5	2.0	1.0	0.5	**9.0**
China	1.5	0.0	1.0	1.0	0.5	**4.0**
Hong Kong	3.0	2.5	2.0	1.0	0.5	**9.0**
India	1.5	0.0	2.0	1.5	1.0	**6.0**
Indonesia	1.5	1.0	2.0	1.0	1.0	**6.5**
Japan	3.0	2.5	2.0	1.0	0.5	**9.0**
Malaysia	3.0	2.5	1.0	1.0	0.0	**7.5**
New Zealand	3.0	2.5	2.0	1.0	0.0	**8.5**
Philippines	3.0	2.5	1.0	1.0	1.0	**8.5**
Singapore	3.0	2.5	2.0	1.0	0.5	**9.0**
South Korea	3.0	1.0	2.0	1.5	1.0	**8.5**
Taiwan	3.0	1.0	1.0	1.0	1.0	**7.0**
Thailand	1.5	1.0	1.0	1.0	0.0	**4.5**
Vietnam	1.5	0.0	1.0	1.0	0.0	**3.5**
Brazil	*1.5*	*1.0*	*0.0*	*1.0*	*0.5*	***4.0***
Germany	*3.0*	*2.5*	*2.0*	*1.0*	*1.0*	***9.5***
South Africa	*3.0*	*2.5*	*1.0*	*1.5*	*1.0*	***9.0***
United Arab Emirates	*1.5*	*1.0*	*1.0*	*1.0*	*0.5*	***5.0***
United Kingdom	*3.0*	*2.5*	*2.0*	*1.0*	*0.5*	***9.0***
United States	*3.0*	*1.0*	*1.0*	*1.0*	*1.0*	***7.0***

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Our primary mission is to accelerate the growth of the cloud market in Asia, where we promote the growth and development of cloud computing in Asia Pacific through dialogue, training, and public education.

Through regular meetings, we also provide a platform for members to discuss implementation and growth strategies, share ideas, and establish policies and best practices relating to the cloud computing ecosystem.

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