



Quantifying the Value of Digital Infrastructure Development

How APEC economies can slow
and close the growing digital divide

Contents

01

Executive Summary

Economies should embrace digital transformation to achieve more rapid inclusive growth.

04

Research Consensus and Methodology

All economies recognize the importance of digital infrastructure, and are in need of an objective measurement standard.

07

APEC Economies: GCI Ranking and Changes

Economies that emphasize digital infrastructure investment and use policy to guide its development have made significant progress.

10

The Challenge: The Matthew Effect – The Digital Divide Has Become a Digital Chasm

Competition between economies has intensified, and unbalanced growth continues to worsen.

14

The Solution: Digital Infrastructure Causes a Chain Reaction in Digital Transformation, and Cloud is a Potent Catalyst

Although there are no shortcuts to digital transformation, investing in and using new technology can help economies enter new stages more quickly.

19

Digital Pioneers: Indonesia, Papua New Guinea, the Philippines, Malaysia, and the US

Digital technology helps drive economic transformation.

24

Pioneering in Practice: An In-depth Look at Malaysia's Digital Transformation

Digital infrastructure is a key enabler of Malaysia's Vision 2020.

33

Call for Action

Economies should actively embrace digital transformation to foster an environment of fair competition and inclusive growth, and to tap into new opportunities.

Executive Summary

Economies should embrace digital transformation to achieve more rapid inclusive growth.

In keeping with global trends, economic development in the Asia-Pacific region has changed course from a state of scarcity towards one of relative surplus. The simultaneous existence of scarcity and surplus is particularly distinct in APEC economies. For some decision-makers, figuring out the best way to fully leverage global resources – and reap the dividends of a growing digital economy – has become a matter of great importance. They no longer recognize broadband connectivity as the ultimate goal of digital transformation. Instead, they have set their sights on rolling out a full stack of digital infrastructure, including cloud, big data, and the Internet of Things (IoT), and have begun increasing their investments accordingly, both in 2017 and in the foreseeable future.

A growing number of APEC economies have reached the same conclusion: Digital transformation and the new digital economy are hurtling forward like an unstoppable bullet train, and economies need to hop on board or get left behind – embrace these trends, or lose out on rapid growth opportunities. The only ticket aboard this train is developing more solid digital infrastructure, which will lay the foundation for a more efficient and intelligence-driven model of social development. By leveraging digital resources from around the world to hone their own inherent strengths, and by increasing collaborative investment and services both within APEC and on a global scale, APEC economies can drive ongoing innovation and achieve inclusive, sustainable growth.



Some economies leverage guiding policies and concentrated investment in digital infrastructure to reap digital dividends. For example, Indonesia has identified e-commerce growth as a strategic way to drive economic expansion and increase exports. They have also been working to improve the quality and coverage of high-speed broadband to promote international trade. In Malaysia, growing investment in digital infrastructure has increased the percentage of information and communication technology's (ICT) contribution to GDP. In 2014, ICT accounted for 17% of Malaysia's GDP, later jumping to 17.8% in 2015. Furthermore, ICT professionals in Malaysia make 1.5 times more than the average national income.

Different research institutes are all exploring ways to quantify the impact that digital infrastructure has on economic growth in APEC economies. According to a report by the ITU, in 2016 there were still more than 3.9 billion unconnected people in the world, even though 95% of the global population (seven billion people) are within the range of existing 2G network coverage areas. The 2016 Global Connectivity Index (GCI) reveals that broadband penetration in developing economies leveled off at 66%, whereas high-speed broadband penetration lingered at a mere 8%. And the World Bank's World Development Report shows that a 10% increase in Internet use can drive a 0.4% rise in total international trade volume.

Huawei's Global Connectivity Index employs a research methodology that measures 40 different indicators across four major economic factors and five enabling technologies. We applied these 40 indicators to objectively analyze the current state of APEC economies and predict future development trends. Based on this assessment, we dove into the main factors that are widening the gap between developing and developed economies, and give targeted recommendations for quantifying the construction and development of digital infrastructure. The four major economic factors we measured are supply, demand, experience, and potential. The five key enabling technologies are broadband, data centers, cloud, big data, and IoT.



GCI research shows that APEC economies are experiencing the Matthew effect – or the effects of accumulative advantage – in the process of digital transformation. Mature economies at the forefront of digital transformation are experiencing vibrant local growth by virtue of new business models enabled by advanced ICT technology. In contrast, a lack of resources is causing problems for underdeveloped economies as they seek to build out their own digital infrastructure. They are in need of an effective approach to identify how ICT can grow the economy, upgrade industries, and cultivate new talent, thereby maximizing its economic value. They need a fast track to digital dividends, one that will help them get a jumpstart on global economic competition.

Generally speaking, APEC economies need to make a greater contribution to the evolution of social structures and innovation in society as a whole. In the digital era, they must also strive to drive the development of humanity, and create communities that are both inclusive and sustainable.



Research Consensus and Methodology

All economies recognize the importance of digital infrastructure, and are in need of an objective measurement standard.



Research on the economic impact of digital infrastructure has reached a general consensus across major statistical reports around the globe and, through correlation analysis, has sought to reveal the effect that ICT technology has on GDP, employment, innovation, and competitiveness.





A report by the Organisation for Economic Co-operation and Development (OECD) shows that a 10% increase in broadband penetration raises per capita GDP growth by 0.9 to 1.5 percentage points. Another report by the International Telecommunication Union (ITU) finds that, on average, the overall employment multiplier for broadband investment on directly created jobs is 1.55; on indirectly created and induced new jobs, the multiplier is 2.77. The data is clear that, for developed and developing economies alike, digital infrastructure is an engine for new economic growth.

While policymakers in all economies are interested in the results of digital infrastructure development, they are perhaps more interested in identifying their current state of digital transformation, their inherent strengths, and the opportunities available to them. This information can then serve as a reference in the development of their own digital transformation roadmap. The research framework behind Huawei's Global Connectivity Index (GCI) benchmarks economies across four economic pillars and five major technology enablers, for a total of 40 different indicators. Based on these 40 indicators, the report comprises a comprehensive and objective set of evaluations, analyses, and forecasts for 50 different economies. The research aims to quantify the development of each digital economy, and provide policymakers with intelligence and actionable insight that can inform the digital transformation of their economy and industry.

The following aspects of the GCI report are of particular significance for the APEC region:

- Based on an analysis of a wide set of data samples, the GCI scores each economy across 40 indicators relative to 2020 development goals. This enables even top-performing Frontrunner economies to identify room for improvement, and encourages all economies to narrow the gap between their peers.
- GCI measurements reflect the long-term development of digital technology, not just broadband and data centers, but also cloud technology, big data, and the Internet of Things (IoT). Digital infrastructure investment and development doesn't only focus on ubiquitous connectivity, but also leverages cloud as a catalyst for new technology that enables the leapfrog development of under-developed economies.
- The GCI maps the digital economy progress of 50 target economies based on the impact of ICT development on their overall GDP. They are plotted along an S-curve that reveals three different clusters: Starters, Adopters, and Frontrunners. This enables all economies to clearly locate their own position along the S-curve, thereby gaining insight into their digital transformation progress, strengths, and gaps.

Four Pillars

Five Technology Enablers		SUPPLY 	DEMAND 	EXPERIENCE 	POTENTIAL 
	FUNDAMENTALS	ICT Investment Telecom Investment ICT Laws International Internet Bandwidth	App Downloads Smartphone Penetration eCommerce Transactions Computer Households	E-Government Service Telecom Customer Service Internet Participation Broadband Download Speed	R&D Expenditure ICT Patents IT Workforce Software Developers
	BROADBAND	Fiber Optic 4G Coverage	Fixed Broadband Subscriptions Mobile Broadband Subscriptions	Fixed Broadband Affordability Mobile Broadband Affordability	Broadband Potential Mobile Potential
	DATA CENTERS	Data Center Investment	Data Center Equipments	Data Center Experience	Data Center Potential
	CLOUD	Cloud Investment	Cloud Migration	Cloud Experience	Cloud Potential
	BIG DATA	Big Data Investment	Analytics Data Creation	Big Data Experience	Big Data Potential
	IoT	IoT Investment	IoT Installed Base	IoT Experience	IoT Potential



Based on GCI 2017 research, despite an overall increase in digital infrastructure investment among APEC economies, the gap between developed economies and developing economies has widened, both in terms of their own digital divide, and also the benefits that they can derive from ICT investment. As a result, digital economic and socioeconomic growth is becoming more unbalanced. With their sights set on more equitable distribution of the benefits of digital infrastructure investment and finding the path sustainable, inclusive growth, figuring out how to slow down the expansion of this gap has become a key concern for decision-makers in all APEC economies.

This is the inspiration behind ABAC's 2017 development theme, "Creating New Dynamics, Fostering a Shared Future in the Asia-Pacific."

This report uses GCI research methodology as a starting point to perform an analysis of APEC economies across a combination of economic and technological dimensions, present data findings, and give recommendations for further development.

APEC Economies: GCI Ranking and Changes

Economies that emphasize digital infrastructure investment and use policy to guide its development have made significant progress.

Based on an analysis of 40 indicators, the GCI 2017 ranking table plots the digital transformation of 50 global economies over a period of three years. In this time, all APEC economies measured in the report made progress in their digital transformation journey.

GCI Rankings and Changes over Three Years

APEC Economies	APEC Ranking	Global Ranking	GCI Score	Change in Rank from 2015	Change in Score from 2015	Digital Transformation Cluster
United States	1	1	77	–	+7	Frontrunner
Singapore	2	2	75	–	+7	Frontrunner
Japan	3	8	64	+1	+5	Frontrunner
South Korea	4	9	64	–4	+1	Frontrunner
Australia	5	11	62	–	+5	Frontrunner
New Zealand	6	13	61	+3	+7	Frontrunner
Canada	7	14	60	–2	+4	Frontrunner
China	8	23	47	–	+6	Adopter
Malaysia	9	24	46	+5	+7	Adopter
Chile	10	25	46	+3	+5	Adopter
Russia	11	26	45	–2	+4	Adopter
Mexico	12	32	41	+2	+6	Adopter
Thailand	13	33	39	–	+3	Adopter
Peru	14	37	36	+1	+3	Adopter
Philippines	15	38	34	+2	+4	Starter
Indonesia	16	40	33	+1	+3	Starter
Vietnam	17	41	33	+2	+4	Starter

*Note: GCI data was not collected for Hong Kong, Chinese Taipei, Brunei, and Papua New Guinea for the full three years covered by the report, therefore the above table does not include relevant ranking and GCI score data for these economies.

Overall, the GCI scores of APEC economies across a three-year span are rising steadily, which indicates that the digital infrastructure development in the APEC region is maturing. At the same time, however, most APEC economies are still in the early stages of digital transformation, and it's clear that the overall development of APEC's digital infrastructure is not yet complete. Continued investment and steady improvement are necessary.

In the APEC region, the top three developed economies in the GCI are: the USA (global ranking: #1), Singapore (global ranking: #2), and Japan (global ranking: #8). The top three developing economies are: China (global ranking: #23), Malaysia (global ranking: #24), and Chile (global ranking: #25).

Malaysia climbed five ranks in three years, demonstrating the fastest progress among all economies, which should come as no surprise. The government has invested aggressively in improving its international broadband bandwidth, 4G coverage, and cloud capabilities over the past three years. The federal government has also worked closely with telecom service providers to improve network coverage and affordability. Malaysia's significant improvement can be attributed to increased use of ICT among citizens, as well as an improvement in overall user experience.

Additionally, Malaysia has also prioritized initiatives to encourage the development of smart cities that encompass a broad range of digital transformation activities, including government services, education, and transportation. At the same time, policymakers have initiated a range of programs that target local enterprises to promote the use of cloud computing. The overarching ICT strategy that brings these activities together has enabled Malaysia to increase the contribution of its digital economy to account for 17% of its overall national economy in 2016 – one of the highest percentages in the world, according to the Department of Statistics of Malaysia. More information on Malaysia's digital transformation journey can be found in the Pioneering in Practice section towards the end of this report.





Chile is also a fast climber in the GCI ranking table, having jumped up by three ranks. In Chile, they made major improvements in international broadband bandwidth, 4G coverage, fiber optics and cloud, which were driven by priorities outlined in its National Digital Plan and government collaboration with telecom service operators to expand coverage. As part of their plan to advance digitization, the government is aiming for full e-procurement and e-invoicing for all companies and citizens by 2018. This will enable companies to upload monthly documents to a government e-portal hosted on a government cloud services platform, creating a volume of valuable data and making Chile an attractive location for big data services. Chile is one of the most technologically advanced nations in Latin America; as such, it has become

an attractive base of operations for local start-ups to develop apps and ICT solutions. This is an example of how investing in ICT supply enhances the experience, productivity, and global economic participation of local businesses.

In New Zealand, another fast climber up the GCI ranks, policymakers have focused on improving mobile broadband coverage with 4G deployment, while at the same time driving cloud migration and the use of big data. Investment in these initiatives has resulted in significant improvement of New Zealand's GCI score, which helped them rise by three positions in the list.

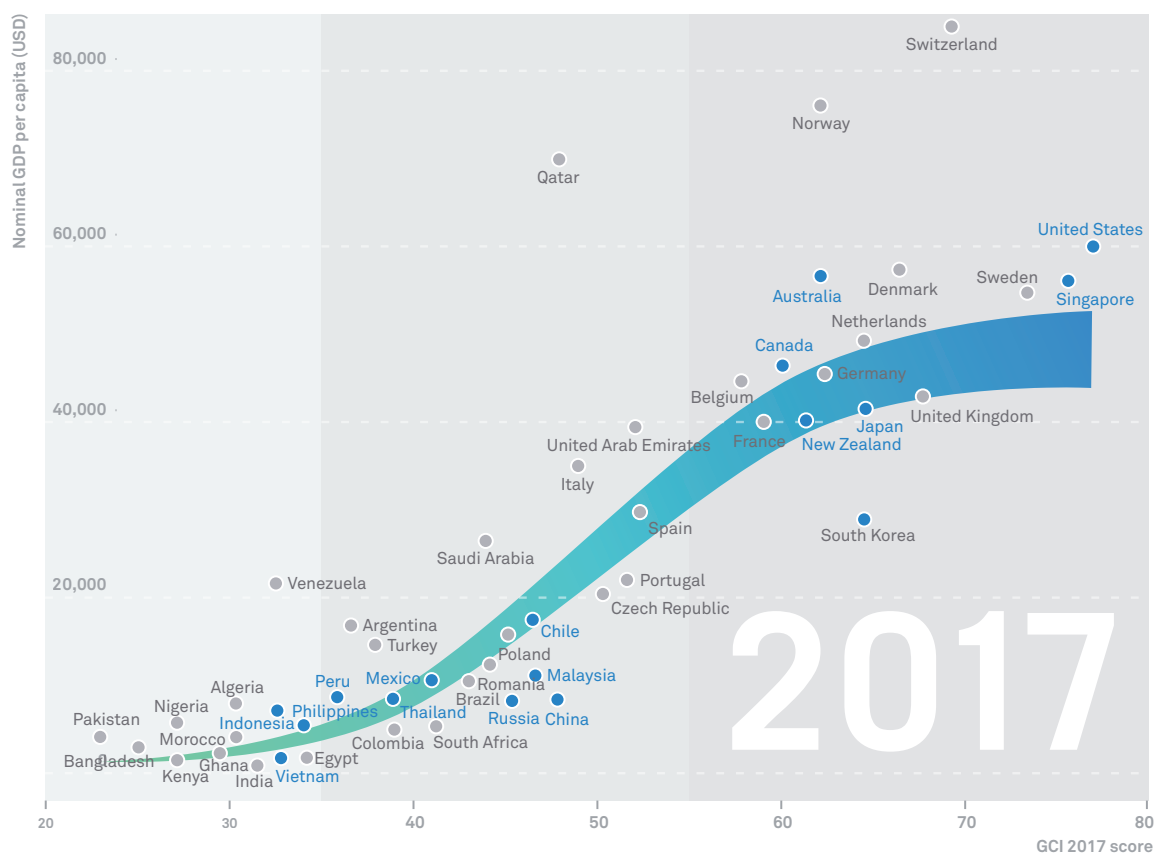
New Zealand has also developed an experience-focused ICT vision for 2017 that covers building a more robust digital economy, in which all services will be delivered digitally and where information will be managed as an asset with economic value. They have identified international broadband bandwidth and network reliability as potential bottlenecks for the program, so network quality is a key area of focus. New Zealand's efforts to digitize services have generated a significant amount of valuable data, which is proving to be fertile ground for businesses to monetize data assets and drive new forms of innovation.

The common thread between these economies is that their governments continue to increase digital infrastructure investment and adoption, with a strong focus on broadband and cloud. By creating favorable laws and regulations, as well as providing financial support, they have built a rich data environment that provides strong support for investment in and deployment of high-speed broadband and cloud services. This approach is a valuable consideration for economies in the APEC region, as well as global economies with a desire to tap into digital dividends.

The Challenge: The Matthew Effect The Digital Divide Has Become a Digital Chasm

Competition between economies has intensified, and unbalanced growth continues to worsen.

The Digital Transformation Journey of Global Economies



STARTERS



Average GDP Per Capita:
US\$3,000
GCI range: 20 - 34

These nations are in the early stage of ICT infrastructure build-out. Their focus is on increasing ICT supply to give more people access to the Digital Economy.

ADOPTERS



Average GDP Per Capita: US\$15,000
GCI range: 35 - 54

Nations in this cluster experience the biggest GDP growth from ICT Infrastructure. Their focus is on increasing ICT demand to facilitate industry digitization and high-quality economic growth.

FRONTRUNNERS



Average GDP Per Capita: US\$50,000
GCI range: 55 - 85

These nations are mainly developed economies. They continually boost user experience, and use Big Data and IoT to develop a smarter and more efficient society.

Compared with the 2015 GCI, the average global GCI score increased by four points, and the average score of APEC economies went up by 4.9 points. This suggests that APEC economies are progressing along their digital transformation journey at a pace that exceeds the global average. At the same time, however, the benefits they derive from digital transformation are different.

The 2017 GCI expands on research into the economic impact of ICT technologies, and illustrates the positive correlation between GCI score and an economy's GDP. Fifty economies at different stages of digital transformation are plotted along an S-curve that reveals three different clusters: Starters, Adopters, and Frontrunners.

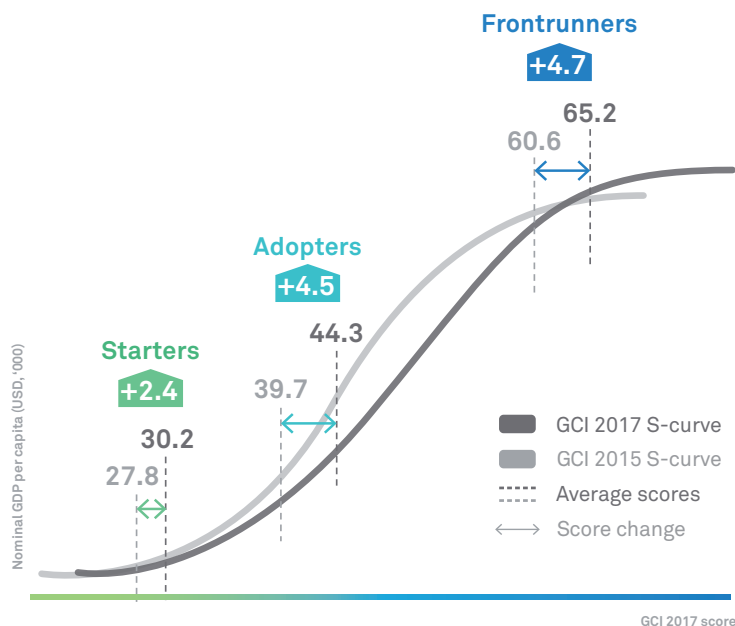
Seven developed economies (the United States, Singapore, Japan, South Korea, Australia, New Zealand, and Canada) are the Frontrunners of the digital transformation journey. These economies pay greater attention to building more robust digital infrastructure as a means to achieve more efficient, intelligence-driven social development. Seven developing economies (China, Malaysia, Chile, Russia,

Mexico, Thailand, and Peru) are the Adopters, who aim to explore the use of digital infrastructure to effectively accelerate industry transformation and bolster the quality of their economic growth. Three other developing economies (the Philippines, Indonesia, and Vietnam) are at the beginning stages of their digital infrastructure investment.

GCI research shows that after a nation's GCI score crosses the threshold of 35 points, they yield a proportionately greater rise in GDP with every increase in ICT investment. If they continue to enhance their digital infrastructure, Starters in the APEC region will be capable of crossing this tipping point, putting themselves on the fast track to the Adopter cluster. Not unlike a race, some economies are left behind, while others are ahead, which leads to fiercer competition. Underdeveloped economies face the risk of elimination, and those in the lead have begun to launch new projects, promote innovation, and pave the way for their future digital transformation journey.

A three-year observation of GCI data reveals a widening S-curve, which indicates more pronounced inequality. The numbers tell the story. Frontrunners have pulled far ahead, improving their GCI scores by 4.7 points, and Adopters by 4.5 points. But Starters remain behind, improving their GCI scores by an average of only 2.4 points. We see growing inequality, an ICT version of the Matthew effect, the sociological theory that posits that "the rich get richer and the poor get poorer." As the Mathew effect suggests, groups or individuals with an accumulated advantage over time not only succeed, but leverage their initial advantage to pull farther ahead of competitors.

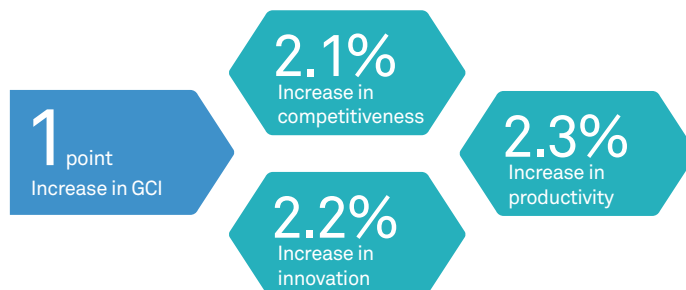




An expansion of the S-curve (GCI score vs. GDP) shows the widening inequality between Starters, Adopters, and Frontrunners

Government policymakers should be aware that GCI scores are not abstract numbers, but have a real-world effect on economic growth. If the change in these scores seems less than dramatic, consider that a one-point increase in GCI score correlates with: a 2.3% increase in productivity, a 2.2% rise in innovation, and a 2.1 % increase in national competitiveness.

The significance of ICT Infrastructure investment

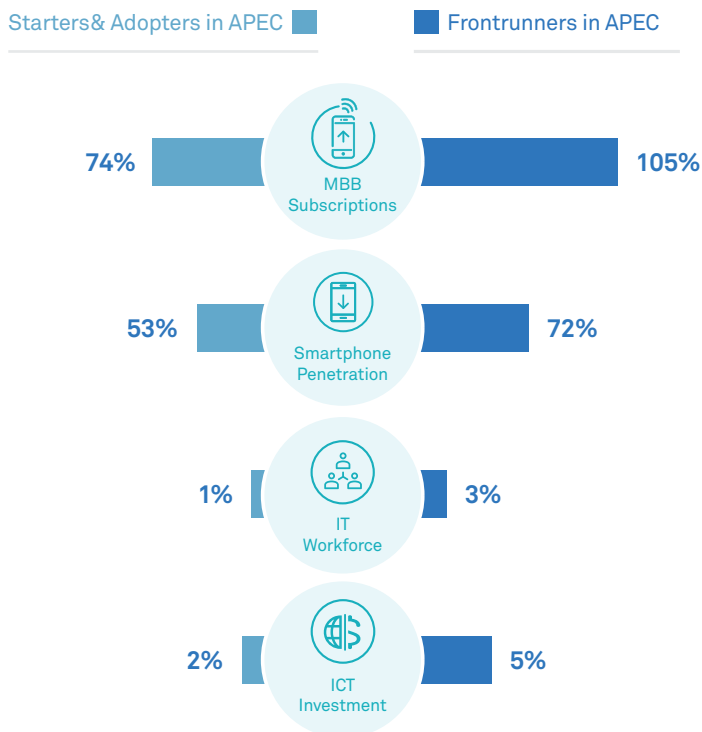


APEC region data also shows a similar trend. APEC Frontrunners improved their GCI scores by 4.9 points while Starters lagged farther behind, improving their GCI scores by an average of only 4 points. Meanwhile, Adopters picked up the pace along their digital transformation journey, improving their GCI scores by 5.1 points, higher than the average Frontrunner increase. This means that APEC Adopters have begun to reap the benefits of digital infrastructure investment, which helps promote more rapid inclusive growth.

Nevertheless, the digital divide remains a prominent issue for performance along key indicators between developed economies and developing economies.

Research for the 2017 GCI revealed that only 74% of the population in developing APEC economies has broadband access. The ratio of ICT Investment to GDP is just 2%. In developed economies, the ratio is 2.5 times higher at 5%.

Compared to mature economies, where everyone enjoys mobile broadband access, only 52% of people in developing economies have access to mobile broadband connections, and the gap in knowledge, skills, and economy is widening.

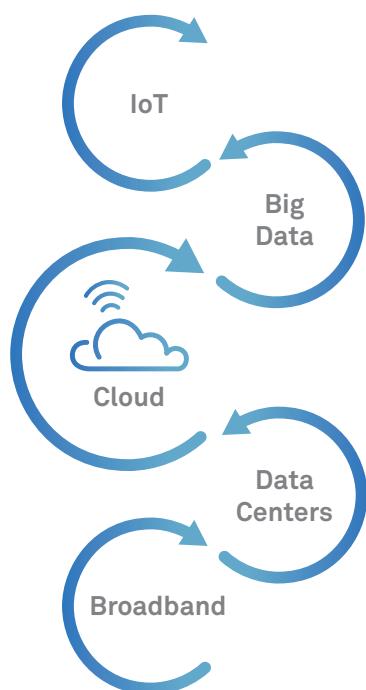


The Solution:

ICT Infrastructure Causes a Chain Reaction in Digital Transformation, and Cloud is a Potent Catalyst

Although there are no shortcuts to digital transformation, investing in and using new technology can help economies enter new stages more quickly.

In the last section, we explored the growing inequality that separates Frontrunners from Adopters and Starters as they advance through the digital transformation process. GCI data shows that investment in ICT infrastructure initiates a chain reaction that drives the digital transformation forward, which can level the playing field for all economies. By definition, digital infrastructure is comprised of five technology enablers: broadband, data centers, cloud, big data, and IoT.



(Note: All enablers are tied to the cloud)

Building strong digital infrastructure is the first step in realizing effective economic transformation. Economies need to move up the technology stack to drive further GDP gains.

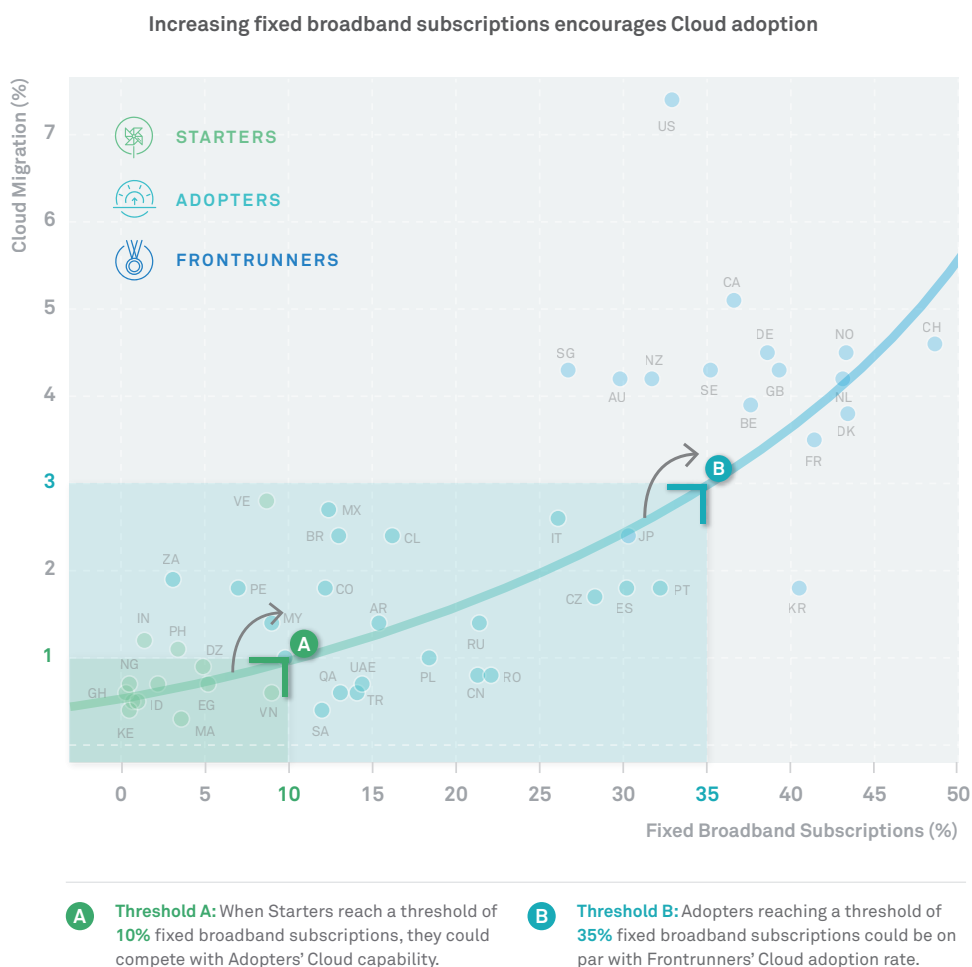
Starters: Economies in this stage are still in the process of building out their foundations. The focus of investment remains on data centers and broadband. Innovation is limited by factors such as financial resources and public policy. Starters are in the foundation innovation stage.

Adopters: Economies in this stage have already invested in information and connectivity technology. Their ongoing focus is on cloud migration and driving cloud adoption. Greater broadband connectivity helps drive innovation. Adopters are in the internet innovation stage.

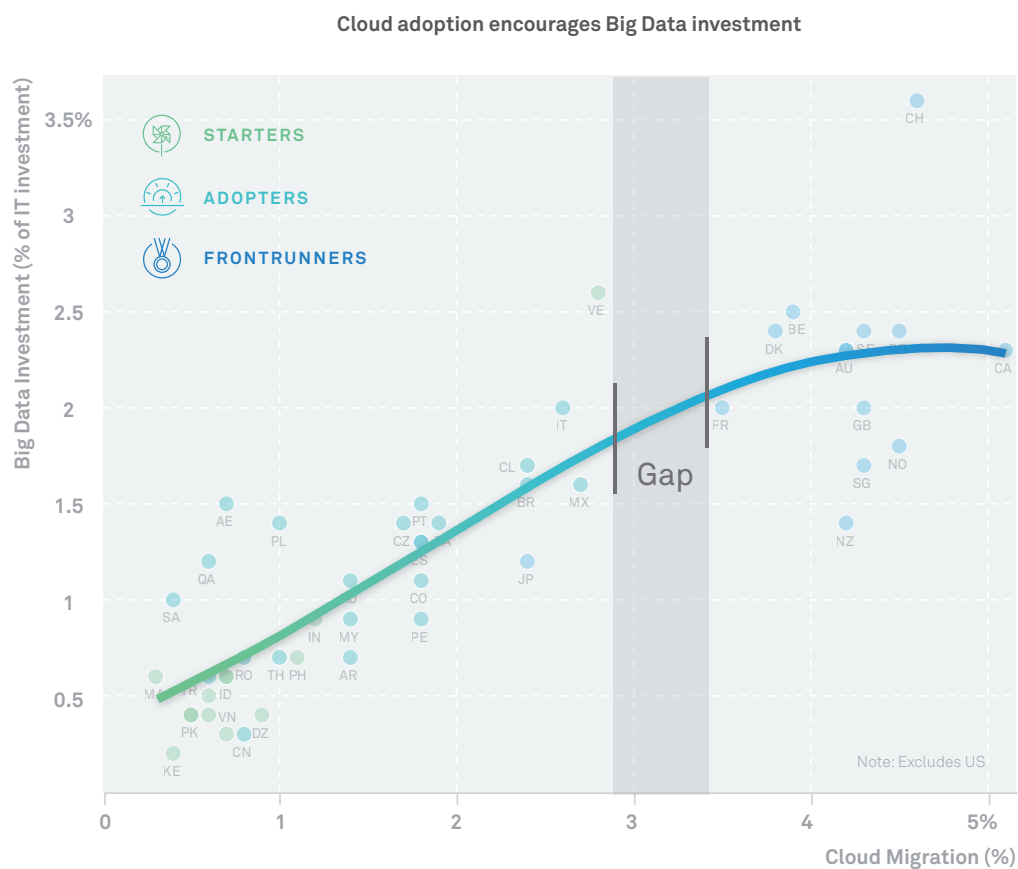
Frontrunners: These economies are the leaders in the current GCI. Their focus is on big data and the drive towards IoT adoption. Data innovation drives economic growth. Frontrunners are in the data innovation stage.

Broadband is the first line of defense against the inequality gap, because cloud adoption requires a strong and accessible broadband network to be in place. Through correlations in GCI data, we have observed the following thresholds:

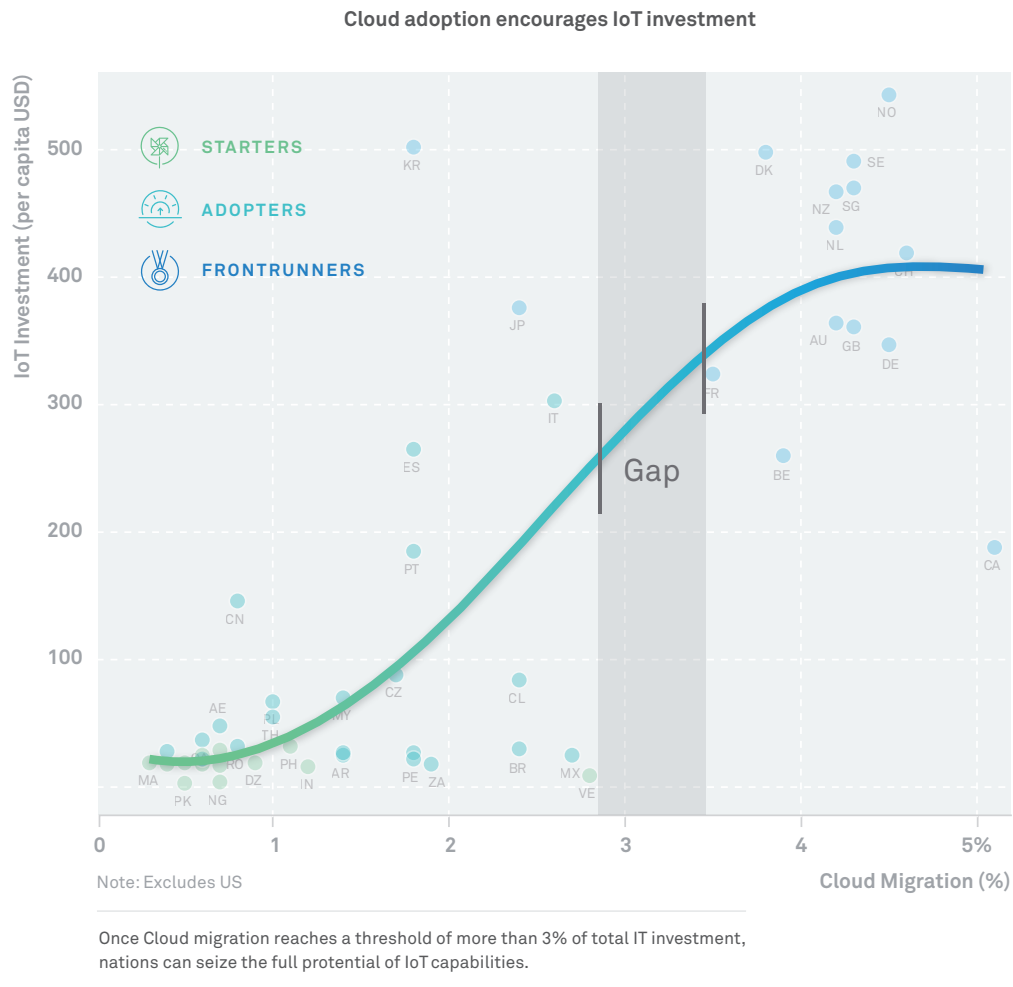
Fixed Broadband Subscriptions: As fixed broadband subscriptions in Starter economies reach 10%, the Starter economies begin to compare with Adopters in terms of cloud capabilities. As the fixed broadband subscriptions in Adopter economies reach 35%, they match Frontrunners in terms of cloud adoption rates.



Cloud: Once deployed, the cloud acts as a catalyst that enables economies to more readily tap the economic benefits of big data and IoT, ultimately leading to greater economic growth and prosperity. According to GCI data, when cloud accounts for 3% of an economy's total IT spend, then the economy typically reaches a stage where it can seize the full potential of its big data and IoT capabilities. This is a threshold that separates the Frontrunners from the rest.



Once Cloud migration reaches a threshold of more than 3% of total IT investment, nations can seize the full potential of Big Data capabilities.



This pronounced gap between Frontrunners and Adopters echoes a recent study on IoT adoption barriers, which reveals that 95% of government authorities noted lack of funding as a major or very major barrier to IoT adoption in economies across all stages of development.

Imagine an economy that is still in the Starter or Adopter stage of digital transformation. This economy recognizes the potential opportunities inherent in new digital technology, so it optimizes its portfolio of investments in digital infrastructure. While upping broadband speeds, it increases its investment in computing and storage infrastructure, and provides individuals and small and medium-sized enterprises with equal access to digital infrastructure so they can develop and market digital content at a reasonable cost.

China, Malaysia, and a portion of Adopters are already experimenting with just such an approach, and they have met with positive results. At the same time, they are also driving the transformation and upgrade of local industry, going from traditional agricultural and manufacturing towards more knowledge-oriented industries. They are evolving from labor-intensive programming services and information technology outsourcing (ITO) towards business process outsourcing (BPO) and even knowledge process outsourcing (KPO). Vietnam, China, India, and the Philippines are all engaged in this transformation process.

The Philippines, for example, has a natural advantage in the English language capabilities of its population. This advantage, in combination with its investment in digital infrastructure (especially its investment in cloud), led IT

BPO to contribute USD\$22 billion to the Philippine economy in 2015, creating 1.2 million knowledge-based jobs in the process. The Central Bank of the Philippines estimates that, in 2018, the amount of overseas revenue from BPO services will surpass the amount of annual remittances from overseas Filipino workers. This goes to show that the Philippines can position itself to produce enough revenue locally without the need to send workers abroad.

As cloud gains universal adoption, if Starters and Adopters are able to see the sheer monetary value produced by strong cloud infrastructure, they can consider prioritizing its development on top of their existing broadband rollout efforts. This will enable them to achieve leapfrog growth in the digital transformation journey.



Digital Pioneers: Indonesia, Papua New Guinea, the Philippines, Malaysia, and the US

Digital technology helps drive economic transformation.

Indonesia: Expanding e-trading through digital infrastructure



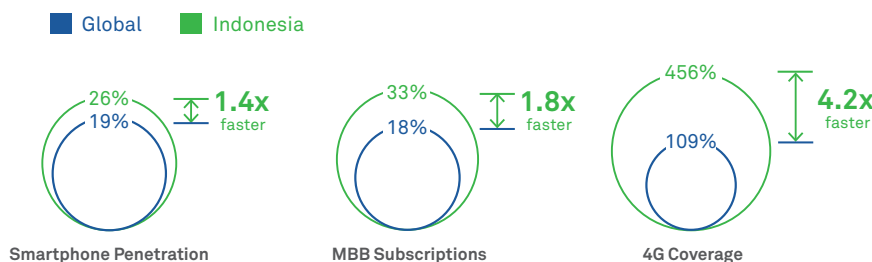
With a widely dispersed population of about 250 million people, Indonesia has tremendous e-trading potential, which currently only accounts for less than 1% of economic retail volume. According to a 2016 survey by DI-Marketing, almost two thirds of shoppers in Indonesia use their mobile phones to shop.

To capitalize on this business potential, the Indonesian government, in its latest plan for Acceleration and Expansion of Economic Development, declared that digital

infrastructure is a critical enabler and announced that it will be a major area of investment. Indonesia is focused on building the largest e-trading market in Southeast Asia, and is seeking to build and expand its national broadband networks. In addition, the government is subsidizing computing devices for companies and helping them sell online to promote participation in global trade and digital transformation.

Indonesia has seen considerable improvements in its 4G, mobile broadband, and smartphone penetration over the last three years, which has given rise to explosive growth. Its mobile broadband subscribers have grown to two-thirds of the population, a rate of growth 1.8 times greater than the global average. With over 12% of subscribers on 4G broadband networks, Indonesia is growing at 4.2 times faster than the global average, and its smartphone penetration is now close to reaching 50% of the population, resulting in a CAGR of 26%.

Indonesia: Expanding mobile computing to become the largest e-trading nation in Southeast Asia



Indonesia's 3-Year average CAGR for smartphone penetration, mobile broadband subscriptions, and fixed broadband subscriptions vs. global average

Papua New Guinea: Benefits of the National Identity Program

The Papua New Guinea National Identity (PNGNID) project was launched in 2013, and enables the government to know where people live and where more government services are needed. For example, the government introduced a pension program for people with disabilities and residents over the age of 65, and the PNGNID project means that authorities know where these residents live.

Since the launch of the PNGNID project, the government has issued over 300,000 ID cards, and aims to introduce features that will assist residents to open a bank account, access free education and health services and also vote in elections.



The Philippines: Cloud leads to a boom in IT BPO



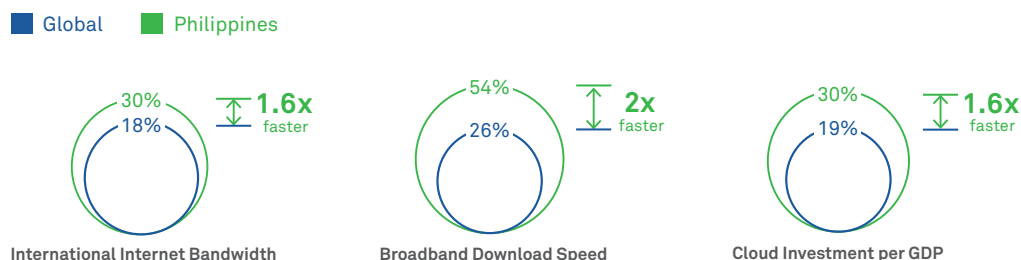
In the Philippines, they are using ICT Infrastructure to leverage the economy's large population of English speakers and its ties with the US to create a thriving knowledge-based industry. Improvements in its international bandwidth, broadband download speeds, and cloud initiatives have combined to create a thriving

IT business process outsourcing (BPO) sector. In 2015, according to the IT and Business Process Association of the Philippines (IBPAP), IT BPO contributed US\$22 billion to the economy and supported 1.2 million knowledge-based jobs.

More importantly, the Central Bank of the Philippines projected that, by 2018, revenue from this sector will surpass the value of annual remittances of overseas Filipino workers, which is already a vital source of revenue for the nation.

As shown in the following figure, the Philippines has increased its cloud investment, broadband download speeds and international bandwidth, which has helped to develop a knowledge economy.

Philippines: Transforming into a knowledge-based economy through Cloud and broadband



Philippines' 3-Year average CAGR for international internet bandwidth, broadband download speed, Cloud investment per GDP vs. global average

Malaysia: Moving Up the Value Chain



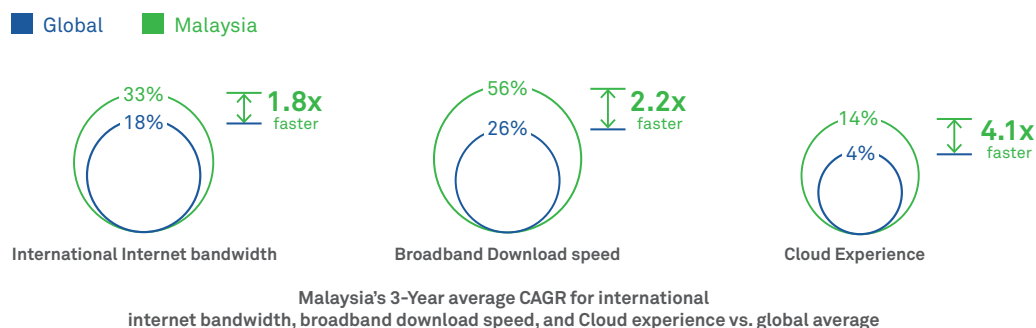
Malaysia managed to transform its industry from low-cost manufacturing to higher-value services by actively implementing a visionary ICT master plan over the past 15 years.

The Department of Statistics of Malaysia (DOSM) reported that the digital economy now accounts for 17% of its

economy – which is extremely high, considering that most nations are at a single-digit digital share. The ICT services sector, which includes ITO, BPO, and KPO, has grown to account for 40% of the ICT sector, contributing more to the national economy than manufacturing. Relative to overall GDP performance, ICT services have grown at a CAGR of 9%, contributing 4.8% in 2010 and 5.4% in 2015.

Policymakers in Malaysia have managed to help cultivate a substantial ICT sector by focusing on digital infrastructure investment to transform the whole economy. As shown in the following figure, Malaysia's improvements in international bandwidth and download speeds are impressive, and are the building blocks for its successful transformation to a digital economy.

Malaysia: Riding on Cloud to build a Digital Economy



The United States: Building the US\$1 Trillion Gig Economy



The US is seeing growing exports of professional expertise in what is commonly known as the "gig economy."

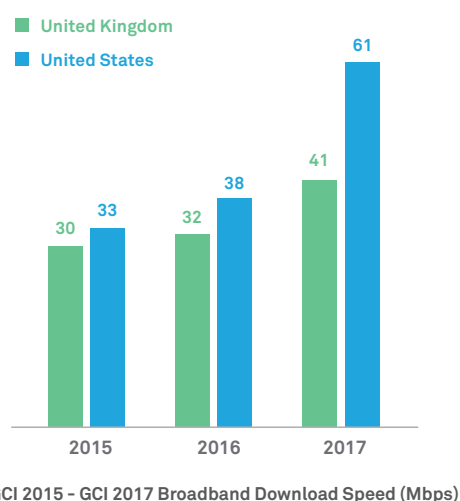
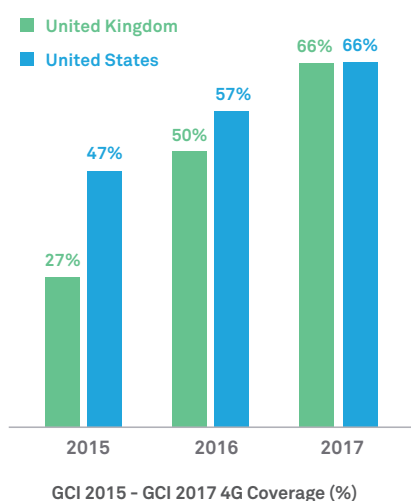
Workers in the gig economy benefit from ultra-high-speed mobile and fixed broadband as well as cloud services at affordable market rates. In contrast to other nations, Frontrunners have invested heavily in digital infrastructure to ensure the availability of these services throughout the entire nation, not just limited to urban areas. They have also focused on open competition in the cloud market, and have promoted standards and policy frameworks for cloud that ultimately make it more secure.

Professionals in these economies are no longer tied to corporate institutions. They are free to start their own small businesses or work as independent contractors. According to the Upwork report, Freelancing in America:

2016, the gig economy is already generating US\$1 trillion for the US, allowing 55 million people to work as freelancers with increased workforce satisfaction and higher income. Tax and corporate lawyers in the US can consult and advise clients in Japan or China who are looking to enter the US market; architects in London can work with firms in the UAE to design the next architectural masterpiece; engineers in Germany can guide technicians in Africa to repair power generators; and surgeons sitting in the safety of their own economies are able to guide nurses through emergency operations in armed conflict zones.

In low-income economies in the US and Western Europe, digital infrastructure enables individuals to upskill themselves and increase their income by providing a service to high-income regions. Professionals in this category are not freelancing as temporary workers. Instead, these highly specialized individuals free themselves from the confines of corporations and offer their services to a wider market. The top-paying jobs for freelancers are professional jobs in the areas of legal advisory, IT, and engineering. According to Upwork, about 78% of freelancers in the US earn a higher income in this new work model than in previous jobs.

USA & UK: Improving 4G coverage and broadband download speed year-over-year to support the gig-economy



Pioneering in Practice: An In-depth Look at Malaysia's Digital Transformation



Malaysia's Vision 2020: ICT is a Key Enabler

Malaysia is a leading economy in Southeast Asia, with a population of more than 30 million people and an estimated per capita GDP of US\$10,756 in 2017¹, second only to Singapore. In 2015, the digital economy in Malaysia contributed an astounding 17.8% to its total GDP (one of the highest percentages in the world). This remarkable achievement is a direct result of the Malaysian government's proactive ICT strategy. From 2010 to 2015, mobile broadband penetration in Malaysia reached 144%, with fixed broadband penetration at 77.3%. This economy is a prime example of how proactive strategies can drive a massive increase in ICT investment, leading to measurable economic and competitive gains.

Stirring up demand and improving user experience to grow the digital economy

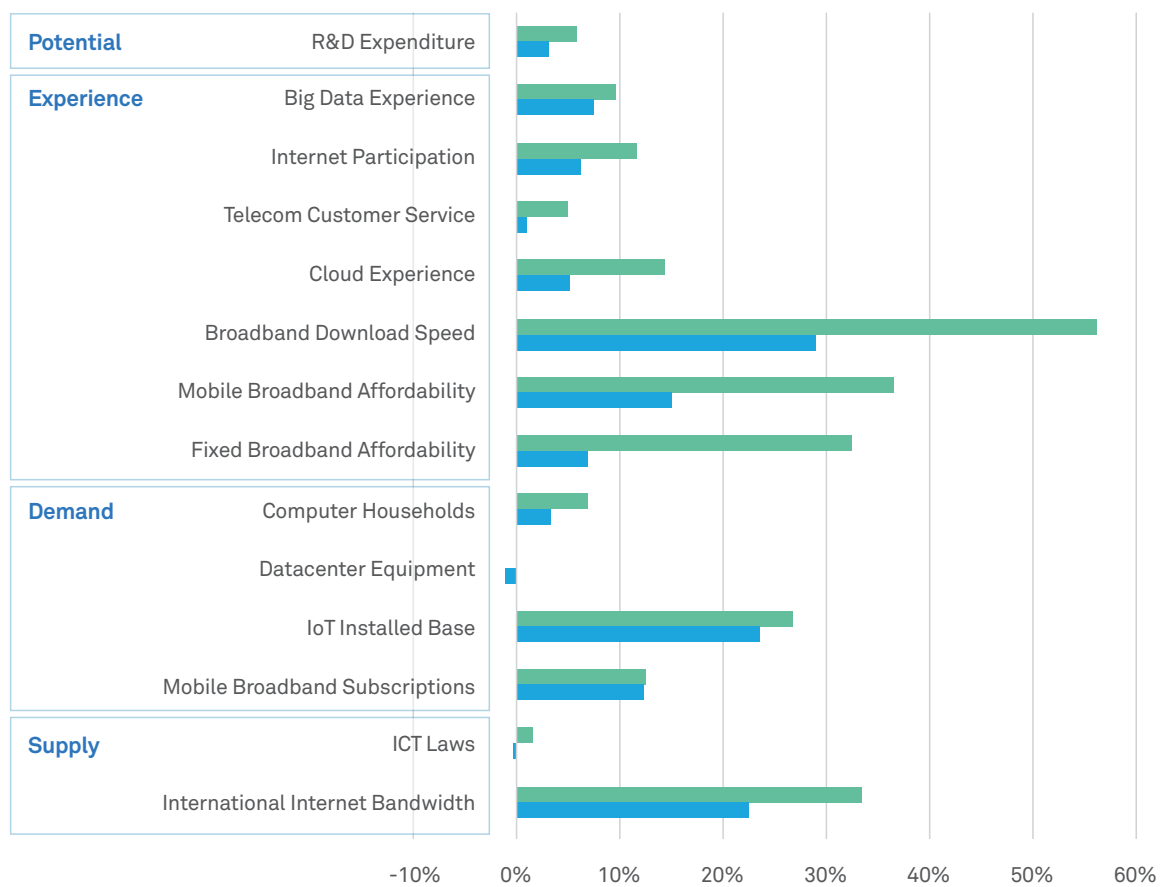
The Global Connectivity Index (GCI) is a report that tracks and compares the progress of digital economy development. It objectively measures the effect and contribution of ICT infrastructure to the digital transformation of 50 different global economies. The report shows that a one-point increase in a country's GCI rating correlates to a 2.1% increase in competitiveness, a 2.2% increase in innovation, and a 2.3% increase in productivity.

According to the 2017 report, Malaysia experienced a rapid increase in its GCI score, causing it to climb five ranks between 2015 and 2017 – the fastest jump among the 50 economies featured in the analysis. The report measures the development of five technology enablers (namely broadband, data centers, cloud, big data, and the IoT) across four main pillars: supply, demand, experience, and potential. Its findings show that, over the past three years, the growth in demand and experience for these five technology enablers in Malaysia has been lightning-fast relative to other APEC economies.

¹ Report for Selected Countries and Subjects. World Economic Outlook Database, International Monetary Fund, April 2016. Accessed on July 3, 2017.

The GCI also takes a look at 40 different indicators related to ICT development. Among them, Malaysia surpassed other economies across a number of indicators, including home computer ownership, per-capita data center equipment, broadband quality and speed, broadband affordability, and cloud experience.

14 indicators which Malaysia grew faster compare to APEC



Vision 2020 - How Malaysia is leveraging digital infrastructure to realize its long-term goals

Malaysia's government recognizes the importance of digital transformation, and has planned for it accordingly, which has enabled its digital economy to rapidly take shape.

In 1991, the Malaysian government released its Vision 2020 initiative, which rallies the Malaysian people to establish a prosperous economy and contribute to the scientific and technological civilization of the future. This vision includes a roadmap of nine strategic challenges that Malaysia must address to achieve its goals, among which include the conversion to a value-added, knowledge-based economy. Building on this vision, the government released a series of transformation initiatives such as the Government Transformation Program (GTP) and the Economic Transformation Program (ETP). Digital

transformation is the tie that binds these transformation programs together.

Back in 1996, the government established an agency called the Malaysia Digital Economy Corporation (MDEC) to "pioneer the transformation of Malaysia's digital economy," and "pursue a digital future that unlocks significant economic, environmental, and social value."

In 2016, this agency drafted new targets for its Digital Malaysia initiative:

- for ICT to contribute 17% of the country's GDP in 2020
- for Malaysia to be ranked among the top 10 in the IMD's world competitiveness scoreboard
- for Malaysia to be included among the top 20 performers in the Economist Intelligent Unit's Digital Economy Rankings

TARGETS BY 2020

ICT contribution to GDP from 9.8% in 2010 to

17%

#16 in the IMD 2011 World Competitiveness Scoreboard to

TOP10

#36 in 2010 in Digital Economy Rankings to

TOP20



Achieving Digital Malaysia's 2020 Targets

In addition to initiatives that help grow local digital business and promote digital literacy, the Malaysian government is keenly aware that building out ICT infrastructure and capabilities are key to digital transformation. ICT is not just an enabler of other industries, but also an important factor in new economic growth. The GCI 2017 report found that every additional US\$1 invested in ICT infrastructure can yield up to \$5 in additional GDP by 2025.

For this reason, the Malaysian government has placed a clear and unmistakable focus on ICT supply, demand, and experience in its tenth and eleventh five-year plans.

For example, the Tenth Malaysia Plan includes designs for the Multimedia Super Corridor (MSC) to stimulate the development of a robust industrial ecosystem in the information age. Chapter Seven of the Eleventh Malaysia Plan further highlights the importance of physical infrastructure and connectivity, with a focus area specifically designed to "improve coverage, quality and affordability of digital infrastructure." Specific strategies include:

- **Strategy C1:** Expanding and upgrading broadband infrastructure through deploying broadband as an essential service, improving international to last-mile connections, and integrating digital infrastructure planning
- **Strategy C2:** Increasing affordability and protection for consumers through an improved Access Pricing Framework (APF) and setting standards for consumer protection
- **Strategy C3:** Migrating to DTT by implementing the second phase of Malaysia's DTT and introducing value added services
- **Strategy C4:** Strengthening infrastructure for smart cities through better connectivity and seamless integration of urban services



² About MDEC – Building Malaysia's Digital Future. Malaysia's Digital Economy Corporation, 2017, <http://www.digitalmalaysia.my/about-mdec>. Accessed on July 3, 2017.

Accomplishments and Best Practices: ICT enables digital transformation for individuals, industries, and economies

I. National High-Speed Broadband (HSBB): Building out high-speed broadband to drive inclusive economic growth

Broadband infrastructure plays an indispensable role in Malaysia's Vision 2020. Specifically, the government recognizes broadband's potential in growing the economy and raising the income of its citizens.

In 2008, the Malaysian government signed a public-private partnership agreement with Telekom Malaysia to provide the High Speed Broadband (HSBB) which was integrated with the National Broadband Initiative (NBI) and Economic Transformation Program (ETP). Under the agreement, the telecom operator must give other service providers open access to their broadband networks to maintain fair market competition. As a result of this partnership, in which all parties collaborate openly, sharing both the risks and benefits of infrastructure development, broadband penetration tripled in only three years' time.

As the project continues to move forward, the results speak for themselves: From 2009 to 2014, Malaysia's GDP grew by 64%, making it one of the fastest-growing economies after the financial crisis. This growth also created over 100,000 new employment opportunities.

II. The Multimedia Super Corridor: Supportive tech industry policies drive the upgrade of industry structure

The Multimedia Super Corridor (MSC) is a government-planned 750km² high-tech business park that stretches from the Kuala Lumpur International Airport to the Petronas Twin Towers. It serves as the center of Malaysia's ICT industry – an important part of its strategy to accelerate industry upgrade and drive economic development. After over a decade of development, the MSC has proven enormously successful, and is widely recognized as an important driving force behind Malaysia's steady economic growth. Some MSC achievements include:

- **Total Sales:** In 2015, total sales in the MSC rose 9.3% from 2014, a solid growth rate with a CAGR of 7.3% over a period of five years.
- **Employment Performance:** 2015 witnessed a 7.4% increase in employment over 2014, which rounded off at 158,549 jobs, with 10,981 new jobs. This growth is testament to a healthy job market in MSC Malaysia, especially in value-added occupations. This aligns with Malaysia's goal to become a high-income economy led by skilled knowledge workers by 2020.
- **The status of active MSC Malaysia companies in 2015:** Malaysian-owned companies account for 75%, foreign-owned companies account for 23%, and 50-50 joint ventures account for the remaining 2%.

III. Universal Service Provision (USP): Universal broadband, inclusion, and improving digital literacy

The Malaysian government believes that all people should share equally in the dividends of digital economy. Regardless of whether they're in cities or in remote regions, everyone should be able to enjoy the basic right to broadband connectivity. The government believes this is critical to stimulating economic growth and honing Malaysia's competitive edge in the global market.

In 2003, the Malaysian Communications and Multimedia Commission (MCMC) launched the Universal Service Provision initiative to provide universal broadband services to all Malaysian citizens, with a special focus on strengthening investment in telecommunications infrastructure in underserved regions with penetration below 20%. Other objectives include encouraging the use of ICT technology to build a knowledge-based society, contributing to the socio-economic development of local communities, and bridging the digital divide. The MCMC has a number of initiatives for encouraging broader adoption of ICT in remote rural regions. One example is providing subsidies for smart device and Internet users in target locales.

ICT Implementation: Promoting planning, budgeting, policy, and ecosystem development

When implementing its ICT strategy, Malaysia focuses on driving the program forward at all levels, connecting the dots between planning, budgeting, policy, and ecosystem development. The ICT plan belongs to the Communications Content and Infrastructure (CCI) National Key Economic Area (NKEA), one of 12 economic areas that make up Malaysia's Economic Transformation Program (ETP). The CCI NKEA has identified 10 specific entry point projects, adopting a dual strategy for both infrastructure and digital content, which focuses on

simultaneously creating demand for digital content and improving end user experience.

The government has a clear set of economic and livelihood targets for 2020. The ETP website lists the 10 entry point projects for Communications Content and Infrastructure, including 2020 targets for average income, GNI, and job creation, and the ETP Annual Report 2014 shows the status of all KPIs for each entry point project, including annual targets and actual results.

10 entry point projects for
Communications Content and Infrastructure

<div> <div>LEGEND</div> <div> <div>Operational</div> <div>Work in Progress</div> <div>Not Started</div> </div> </div>					
Communications Content & Infrastructure					
No	EPPs	2020 GNI (millions)	Jobs	Location	Status
EPP 1	Nurturing Malaysia's Creative Content	3,014.91	10,422	Nationwide	Operational
EPP 3	Connecting 1Malaysia	1,783.15	2,056	Nationwide	Operational
EPP 4	Establishing e-Learning for Students and Workers	1,487.35	800	Nationwide	Operational
EPP 5	Launching e-Healthcare	1,402.45	250	Nationwide	Operational
EPP 6	Deepening e-Government	1,100.06	1,000	Nationwide	Operational
EPP 7	Ensuring Broadband for All	1,691.74	5,468	Nationwide	Operational
EPP 8	Extending Reach	2,406.54	2,090	Nationwide	Operational
EPP 9	Offering Smart Networks	847.67	1,950	Nationwide	Operational
EPP 13	Extending the Regional Network	2,289.78	1,220	International	Operational
EPP 11	Track and Trace	183.22	384	Nationwide	Operational

2014 Key Performance Indicators

COMMUNICATIONS CONTENT AND INFRASTRUCTURE NKEA		KPI (Quantitative)							
No.	KPI	Target (FY)	Actual (YTD)	Achievement					
				Method 1		Method 2		Method 3	
				%		%			
Demand	EPP #1	Revenue of export from Creative Content (RM mil)	600	608.71	101	●	100	●	1.0
		Total estimated production spending under the "Film in Malaysia Incentive" (RM mil)	200	335.03	168	●	100	●	1.0
Experience	EPP #4	Percentage of schools with high-speed Internet connection achieving a minimum of 4Mbps and adheres to the Service Level Agreement terms	100%	99.9%	100	●	100	●	1.0
	EPP #6	Agencies adopting Digital Document Management System (unit)	1	2	200	●	100	●	1.0
		Utilisation of MyGovernment Portal ~ Number of Logins (units)	300,000	352,709	118	●	100	●	1.0
Supply	EPP #7	Percentage completion of Year 1 implementation of high-speed broadband project expansion	25%	0%	0	●	0	●	0
		Access to LTE wireless broadband ~ supply (% population coverage)	25%	25%	100	●	100	●	1.0
	EPP #8	Number of new programme sites commission	1,250	1,225	98	●	98	●	0.5
	EPP #10	Percentage of implementation of submarine cables (linking Sabah, Sarawak and Peninsular Malaysia) rollout	100%	15%	60	●	60	●	0.5
		Percentage of bandwidth wholesale price reduction	20%	34%	170	●	100	●	1.0
		Development of a national blueprint for international cable	100%	90%	90	●	90	●	0.5
					110%		86%		77%



Beyond planning, the central government strongly emphasizes the provision of a sufficient ICT budget. In the 2016 budget released by the Ministry of Finance, ICT infrastructure investment was included as the top-level, number-one priority for fueling further economic

development. In the 2017 budget, in addition to strengthening digital infrastructure, the government has also emphasized the importance of enhancing broadband quality and affordability to stimulate digital content development and build a robust industry ecosystem. At the national level, Malaysia has implemented policies and regulations aimed at stimulating ICT demand, improving user experience, and enhancing people's ability to use emerging digital technology. Furthermore, the government leverages forward-thinking policy frameworks to facilitate Right of Way in the rollout of network infrastructure, encouraging collaborative planning between municipal construction and network construction projects.

On the industry ecosystem front, the Malaysian government diligently nurtures local content production, determined to turn Malaysia into a digital content hub for the entire Asia-Pacific region. In order to achieve these objectives, the government has taken action across the entire ecosystem, stimulating the content market and content production, strengthening cooperation between the public and private spheres, encouraging entrepreneurship in content-related enterprises, cultivating talent, and forming industrial alliances.

Malaysia: Paving the road to success with ICT

Malaysia's ongoing success story shows that the development of ICT infrastructure can set off a chain reaction in the digital transformation process. By actively strengthening its ICT infrastructure throughout the entire economy, Malaysia has provided all of its industries with a solid foundation for going digital, while driving innovative potential and increasing the overall competitiveness of the economy as a whole.

Regardless of digital transformation status, active investment in ICT infrastructure and the development of cloud services can help economies get the most out of local talent and existing resources, thereby securing more economic growth potential and new business opportunities.



Call for action

Economies should actively embrace digital transformation to foster an environment of fair competition and inclusive growth, and to tap into new opportunities.

Economies should actively plan to improve their digital infrastructure, focusing on developing broadband and cloud to ensure fair competition and inclusive growth:

Digital infrastructure related-priorities:

Governments need to continuously enhance investment in digital infrastructure, especially the expansion of broadband coverage and the adoption of cloud technology, to ensure fair competition and inclusive growth in their own economies as the world around them goes digital.

Industry and enterprise related-priorities:

Economies need to integrate digital infrastructure development with local industrial strengths to expedite industry upgrade and enable key sectors to move up the value chain. Strong digital infrastructure (especially cloud) lowers costs associated with innovation for enterprises of all sizes, with the most noteworthy benefits going to small- and medium-sized enterprises, thereby bolstering overall competitiveness.



Priorities for people:

Governments need to work with educators, technology providers, as well as education and labor departments to ensure that digital resources are more widely and readily accessible to all citizens. In addition, governments need to improve the digital literacy of specific subsets of the workforce, and cultivate a group of exceptional talent that is well positioned to meet future needs.



Global Connectivity Index 2017 benchmarks where a country stands on the transformation journey into a digital economy. More importantly, it's a tool that will help you see the connections that matter, and empower you to take action based on that intelligence.

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