



From follower to leader:

Digital transformation and the road to 5G in southern Asia-Pacific

A briefing paper in association with



Preface

To produce this study, MIT Technology Review Insights conducted a review of the digital transformation agenda in Asia-Pacific and the impact of 5G. Our research was based on a survey of 191 senior technology and strategy executives in Singapore, Malaysia, Indonesia, Philippines, Australia, and New Zealand as well as a series of interviews during July and August 2018 with experts from around the region. The report, which is sponsored by Huawei, is editorially independent and the views expressed are those of MIT Technology Review Insights.

We would like to thank the following interviewees for generously sharing their expertise:

Mark Beder, Technology Director, **Spark**

Niels de Boer, Programme Director for Future Mobility Solutions, **Nanyang Technological University**

Marcus Burke, Project Director, Compliance and Technology, **National Transport Commission, Australia**

Anup Changaroth, Senior Director, APAC Chief Technology Officer, **Ciena**

Renald Gallis, Vice President for Ecosystem and Marketing, **Thinextra**

Hazami Habib, Chief Executive Officer, **Malaysian Academy of Sciences**

Kevin Kettler, Corporate Chief Technology Officer, **Flex**

Dr Andreas Müller, Head of Communication and Network Technology, **Bosch Corporate Research**

Arleen Paulino, Vice President, **Amgen Singapore Manufacturing**

Scott Vandonkelaar, Co-founder and Chief Executive Officer, **Zero Latency**

Dieter Wegener, Head of External Cooperation, Corporate Technology, **Siemens**

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1. Executive summary

Over the past decade, Asia-Pacific has transitioned from being the world's factory to a leading developer of next-generation technologies, such as artificial intelligence (AI) and automation, big data, blockchain, cloud computing, connected devices, robotics, and virtual/augmented reality. Robotics and advanced manufacturing, well-established in East Asia, are fanning out into Singapore and Malaysia as R&D clusters and government innovation strategies help firms push deeper into AI, smart manufacturing, and IoT. In emerging markets like Indonesia and the Philippines, consumer apps are booming, thanks to widening access to the internet and the success of home-grown firms.

As the 5G era dawns, the promise of massive bandwidth, lower latency, and large connected device ecosystems is prompting an R&D flurry across the region as companies explore new use cases. From smarter cities to futuristic factories, immersive entertainment and holographic conferences to autonomous vehicles, all technology categories will be upgraded by 5G. And, as with smartphones and streaming, which emerged in the 3G to 4G shift, new use cases will surely emerge.

This report combines a survey of six countries, Malaysia, Singapore, Philippines, Indonesia, Australia, and New Zealand, which we will call "southern Asia-Pacific" or "the region", with wide-ranging expert interviews, to chart the digital transformation to date and examine 5G as an opportunity to consolidate the region's gains. The key findings of the report are as follows:

- **Southern Asia-Pacific is a front-runner in the digital era.** After decades as the world's factory and industry follower, the region is today a competitor, and sometime leader, in the fusion of digital and physical systems. AI, autonomous vehicles, robotics, IoT, and connected devices are evident throughout these countries. Our survey shows that 40% of companies will roll out AI in the next 12 months, with 36% to deploy automation. The 5G transition provides an opportunity
- for southern Asia-Pacific to compete for the leadership podium for the first time.
- **Homegrown companies are solving unique regional challenges.** Across each of the countries, next-generation technologies are being deployed to solve unique challenges, from 'care-bots' and service robots to deal with ageing populations, to geoscience and environmental monitoring. Deep knowledge of local consumers and their needs helps home-grown companies excel and fight off overseas competitors.
- **Asia-Pacific is already a test-bed for 5G.** From early demonstrations at the Olympics and Commonwealth Games in South Korea and Australia, to innovation hubs exploring use cases like immersive entertainment and AI-based drones, Asian countries are already tinkering with 5G. Experts expect immediate impact in manufacturing first, and later in mass IoT, smart cities, and autonomous vehicles.
- **Companies expect 5G within two to three years.** The majority of companies (65%) across the six surveyed markets expect 5G to be launched by 2020, with 18% by 2021; fewer than 8% believe it will take as long as 2022. Some 47% believe 5G will boost efficiency, and 44% are discussing how their business will be affected. Fifty-one per cent are investing in technologies that can be deployed when 5G is launched.
- **Regulatory reform, data security, and organizational stasis are obstacles to digital transformation in the 5G era.** The world over, the digital economy is outgrowing regulatory frameworks in areas like monopoly, tax, privacy, and security. Clear, robust rules are needed to put digital innovation on a sound footing as 5G intensifies challenges like data privacy. Companies also need to overcome internal hurdles; lack of organizational agility and slow pace of change is voted a top obstacle by 38% of firms.

2. Digital transformation, Asia style

The Fourth Industrial Revolution (4IR) is fusing digital and physical technologies as data, automation and connectivity are wired into everything from vehicles to home appliances. While manufacturing is the landing site of 4IR, the blurring of boundaries between software and the physical world means these same tools are reaching the pocket, the home, the street and the farm, from consumer devices to smart cities and even agriculture. One forecast predicts that there could be 200 billion ‘connected objects’ by 2020, up from 2 billion in 2006, equating to around 26 per person.¹





Western manufacturers have been the most prominent voices in the 4IR discussion. It was the Geneva-based World Economic Forum (WEF) that coined the phrase, and German manufacturers developed the linked ‘Industry 4.0’ concept to convey the shift from automated to digital production. But unlike the three previous waves of technological change, this time Western firms are not alone. Companies and governments in Asia are competing - and in some domains, leading - the development and deployment of next-generation technology.

The markets explored in this report are diverse, and so are the ends to which 4IR and digital

transformation is being applied. Geographically, this region runs from the city-state of Singapore to the sprawling landmass of Australia. Economically, those two are far removed from emerging markets like the Philippines, where 22 million people still live near the poverty line.² In Singapore and Malaysia, digitization and automation are re-shaping biomanufacturing and electronics, while in Indonesia and the Philippines, 4IR is making the biggest difference in the app economy, in segments like on-demand services.

Blurring boundaries between sectors, reducing costs, and enabling the leapfrogging of infrastructure constraints, the digitalization era coincides with the emergence of home-grown Asian mega startups like Grab and Go-Jek. Even agriculture and the environment are part of the digital era as farmers, governments, and companies use sensors, machine learning and satellites for ecological monitoring, water management and field optimization. Rich or middle income, in the factory or in the field, one thing is clear: digitalization is driving innovation across the region. One forecast predicts that 60% of the wider Asia-Pacific region’s GDP will be derived from digital products or services by 2021.³

Figure 1: Four waves of change

<p>First Industrial Revolution (1760-1840)</p>	<p>Used water and steam power to mechanize production, beginning in Britain’s textiles industry</p>	
<p>Second Industrial Revolution (late 19th-early 20th century)</p>	<p>Harnessed electric power to enable mass production, including internal combustion engines and modern communications</p>	
<p>Third Industrial Revolution (1970s)</p>	<p>Applied electronics and IT to manufacturing</p>	
<p>Fourth Industrial Revolution (now)</p>	<p>Fusion of digital and physical spheres, evidenced by robotics, IoT, artificial intelligence, and automation</p>	

¹www.intel.co.uk/content/www/uk/en/internet-of-things/infographics/guide-to-iiot.html

²www.worldbank.org/en/news/press-release/2018/05/30/philippines-poverty-rate-declines-more-well-paying-jobs-and-opportunities-needed

³news.microsoft.com/apac/2018/02/21/digital-transformation-to-contribute-more-than-us1-trillion-to-asia-pacific-gdp-by-2021-ai-is-primary-catalyst-for-further-growth/

Methodology

MIT Technology Review Insights polled 191 senior executives in Singapore, Malaysia, Indonesia, the Philippines, Australia, and New Zealand, at companies with global revenues ranging from \$100m to over \$5 billion. Chief information officers and chief technology officers accounted for a third of the respondents, a quarter were heads of data, analytics, network or digital transformation. The largest share, some 38% were senior executives including CEOs and managing directors.

The responses were drawn from a wide range of industries—financial services, manufacturing, and healthcare were the among the sectors represented most strongly, followed by real estate, hospitality, and transportation. Companies were

of varying sizes, but large companies with over \$1 billion in revenues accounted for close to 60%.

Progress against peers

The findings show that companies are already making strong progress with digital transformation. Respondents largely describe their organizations as keeping pace with industry peers, particularly in products and services. The area of greatest progress is in transforming enterprise technology and internal systems; some 45% report being ahead of industry peers in this area. Manufacturing and supply chain processes present more of a gap, with 36% of respondents being either behind the industry or unsure of how their business compares to peers.

Figure 2: Survey demographics

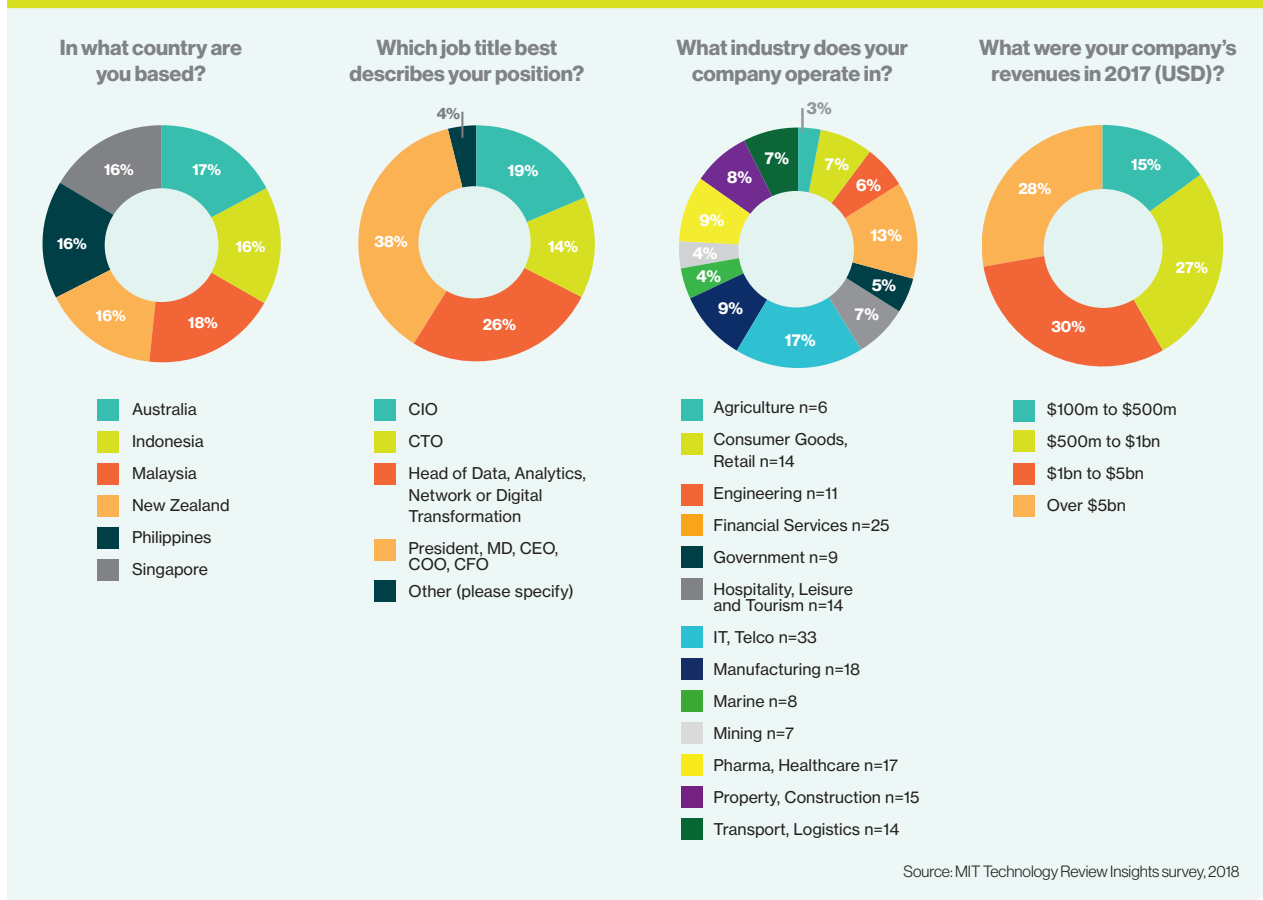
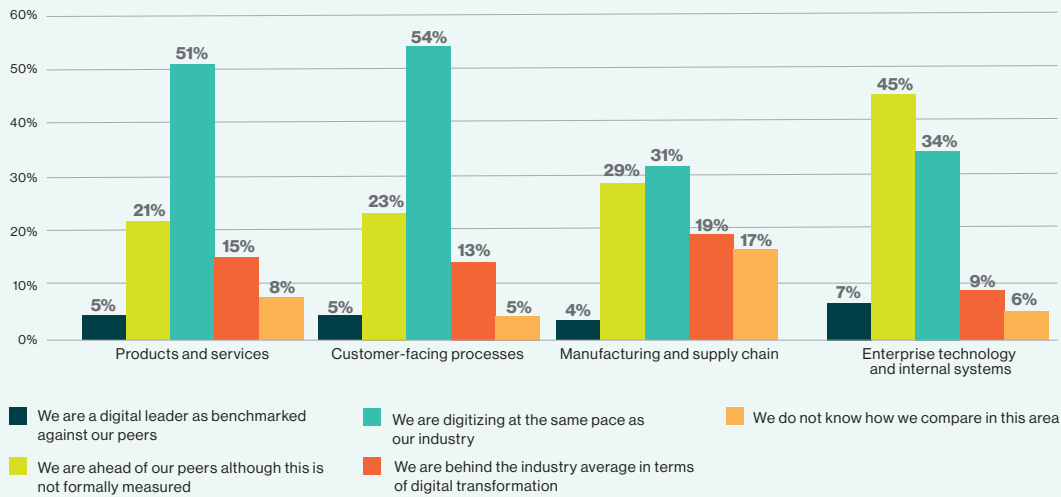


Figure 3: Progress on digital transformation

Describe your stage of digital transformation in each of the following areas of your business relative to peers in your industry.



Source: MIT Technology Review Insights survey, 2018

Executives surveyed also report broad adoption of 4IR and next-gen technologies. Cloud and the Internet of Things (IoT) are somewhat established, deployed by around a third of companies. AI, automation and big data are heading out of the hangers, with just over a third expecting rollout in the next year. Technologies seeing more limited adoption so far such as blockchain and virtual/augmented reality, will figure in some companies' plans in the medium-term. The survey found that:

- Cloud and IoT are the most established next-gen technologies, with 29% and 34% of respondents having already deployed these for one year.
- AI, automation and big data are set for the greatest deployment increase over the next 12 months, with 39% and 36% expecting to roll these out.
- Longer term deployments, measured over the next two years, are blockchain and VR: 48% and 41% plan to deploy these over the next two years, and around a third have no plans to deploy VR, robotics, or blockchain.

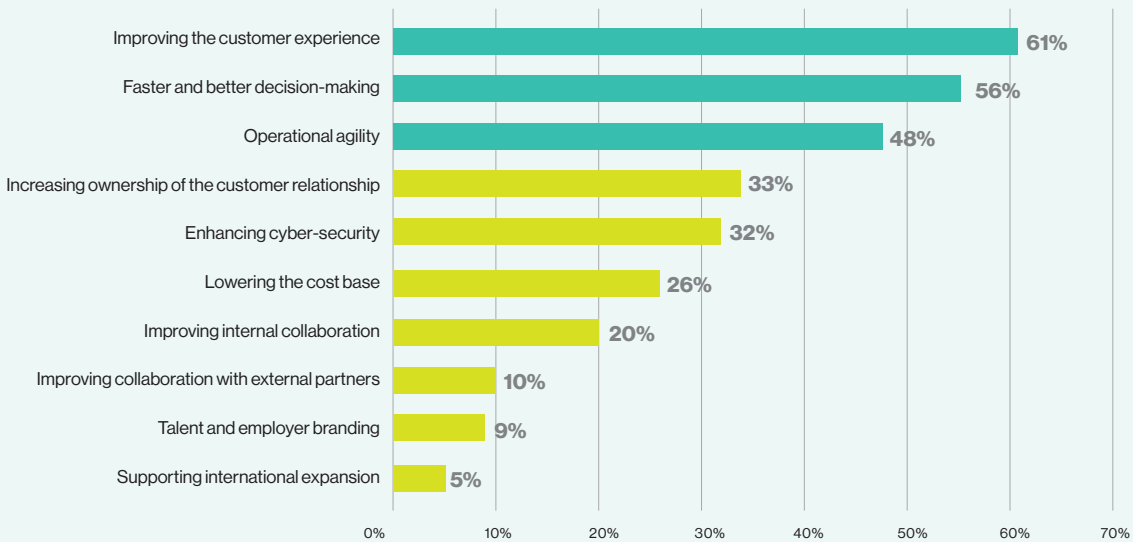
In terms of the business drivers for digitalization, improved customer experience and improved decision-making were the two most-commonly selected motivating factors for the adoption of next-gen technology followed by efficiency and cost-cutting.

Companies in southern Asia-Pacific have already made the greatest headway in transforming enterprise technology and internal systems, followed by customer-facing processes and products and services. The lag is in manufacturing and supply chain with 36% being either behind the industry or unsure of how their business compares to peers.



Figure 4: Drivers for technology adoption

What are the top three business drivers for the deployment of next-generation technologies?*



*AI, automation, big data/analytics, blockchain, cloud computing, IoT, robotics, virtual/augmented reality

Source: MIT Technology Review Insights survey, 2018

Automating Asia

Autonomous systems, from robots to self-driving vehicles, are undergoing rapid performative improvement thanks to the data explosion of the digital era, technical advances in deep learning and neural networks, and a competitive race set off by cash-rich tech companies and governments.

Survey participants see AI and automation as future-critical: 57% and 46% put AI and automation, respectively, in their top three technologies in terms of business-transforming potential. The wider region is already a front-runner in industrial robotics, with the International Federation of Robotics forecasting Asia and Australasia to ship 354,400 industrial robots by 2020, compared to 73,300 from the Americas and 82,600 from Europe. China, South Korea, and Japan are the top producers globally.

“Each country has their own priorities they are trying to achieve with automation so there will be different paths that countries follow,” says **Markus Burke**, project director for compliance

and technology at **Australia’s National Transport Commission**, a policy body which advises government. ‘Care-bots’ and service robots are helping the elderly, or working in food and beverage services, alleviating labor shortages and ageing population dynamics in Singapore and Japan.^{4,5}

Autonomous transport is also solving local dynamics: in ageing economies, it could support mobility for the elderly outside of cities. Meanwhile in Australia, mining and natural resources provide the more prominent use case so far, with the world’s first driverless freight train, led by the likes of Rio Tinto.⁶

Singapore and Malaysia have the strongest autonomous systems R&D profile of this report’s set of countries. The former recently formed the Launchpad Robotics Centre for start-ups, and Nanyang Technological University is running autonomous vehicle trials in the country’s first test center in the Jurong Innovation District.⁷ **Niels de Boer**, programme director for Future Mobility Solutions at **Nanyang Technological University**,

⁴www.theguardian.com/world/2018/feb/06/japan-robots-will-care-for-80-of-elderly-by-2020

⁵www.reuters.com/article/us-singapore-robots/can-singapores-labor-crunch-spark-a-robot-revolution-idUSKCN10P0YU?il=0

⁶www.afri.com/business/rio-rolls-out-worlds-biggest-robot-in-rail-freight-gamechanger-20180713-112n64

⁷www.channelnewsasia.com/news/singapore/autonomous-vehicle-ntu-smart-campus-10142506

says R&D in Asia for autonomous vehicles is not at the leading edge globally, but is highly application-focused to local challenges. “Singapore and China are looking at how autonomy can be used in public transport and there is a high level of focus on port and airport efficiency and how autonomous systems can enable that,” says de Boer. Regional collaboration is a further feature of the automation R&D agenda in Asia, notably between Malaysia and China with the recent signing of cooperation agreements between Johor Corporation and China’s Siasun Robot Investment to develop a large-scale robotics R&D center, dubbed Robotic Future City, in west Johor Bahru.

While automation is often framed as a job threat, the data seems rosier in Asia-Pacific; the Asian Development Bank estimates that rising demand arising from automation created 134m new jobs in the region between 2005 and 2015, more than compensating for the 101m displaced through technology. Clearly, however, there are risks, especially for routine and manual jobs. Electronics assembly, by dint of the hard materials and fixed sizes of parts, has proven far easier to automate

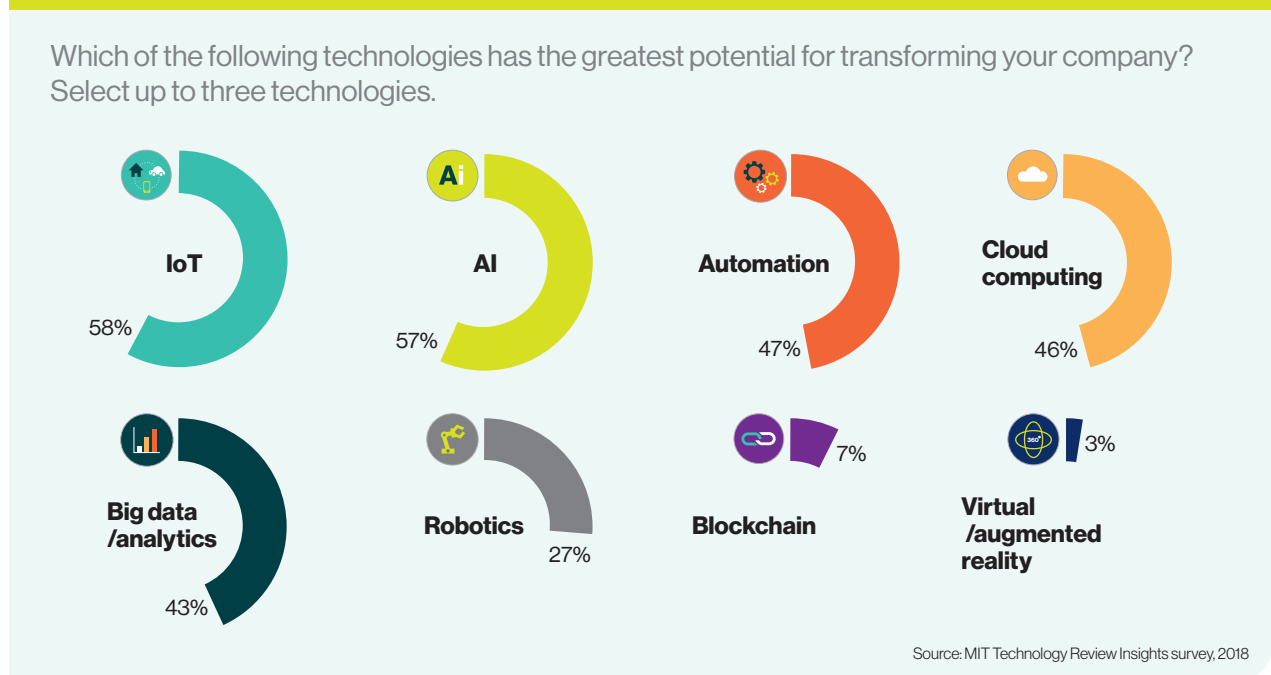
than garments where materials are soft and unpredictable. Business process automation and customer services, a vital industry in the Philippines, is another high-risk sector.

The connected consumer

While industrial production is where robotics and autonomous systems penetrate first, digital transformation has reached the consumer market in areas like fintech, media, devices, gaming, and ‘on-demand economy’ apps like ride-hailing, which rely on geo-positioning systems, strong connectivity, low latency and smartphone devices. Consulting firm Bain & Company estimates that Southeast Asia’s digital economy overall—including e-commerce, ride-hailing, and gaming—is worth around \$50 billion.

Business-to-consumer interaction is a major driver of digital transformation, according to the survey. Improved customer experience was a top driver of tech adoption in five out of six countries. Expanded access to the internet and digital services, and falling costs of digital devices and services, make Asian consumers a reachable market

Figure 5: Technologies with the greatest potential to transform



with plenty still outside the system in populous Indonesia and the Philippines. The healthy GDP growth rates of the region's emerging markets also bode well for the consumer digital market, led by the likes of Vietnam (6.8%), the Philippines (6.7%), and Malaysia (5.9%).⁸ Even Indonesia, growing more modestly at around 5%, is investing heavily in growth-generative sectors like infrastructure.

Taking advantage of growing digital access, home-grown players have dominated consumer-facing digital segments including fintech, e-commerce and logistics. Malaysia-born Grab, now valued at around \$11 billion, is on an aggressive expansion plan across Southeast Asia with aims to enter Indonesia, the region's largest economy, supported by \$1 billion from a fresh funding round in August 2018.⁹ Its list of backers includes Softbank, Didi Chuxing, and Australia's Macquarie Capital, as well as US-based Vulcan Capital, the fund started by Microsoft co-founder Paul Allen. Grab's immense backing combined with their acquisition of Uber's regional business, is a strong sign that local players are leading the consumer space. Indonesia's Go-Jek, the ride-hailing app, is a second big success story. The country's first 'unicorn', a private startup valued at over \$1 billion, is reportedly embarking on a \$500m expansion into Vietnam, Thailand, Singapore, and the Philippines.¹⁰

Figure 6: Internet access, southern Asia-Pacific

Country	Number of internet users (m)	% of population
New Zealand	4.1	89%
Singapore	4.6	81%
Australia	21	88%
Malaysia	25	79%
Philippines	57	56%
Indonesia	66	25%

Source: International Telecommunications Union, 2017

⁸data.worldbank.org/indicator/ny.gdp.mktp.kd.zg

⁹www.reuters.com/article/us-grab-fundraising/grab-raises-additional-1-billion-funds-from-financial-firms-idUSKBN1KN05L

¹⁰techcrunch.com/2018/08/01/go-jek-vietnam-launch/

3. The road to 5G

To date, Asia-Pacific's digital transformation has been enabled by steadily widening access to the internet, falling hardware costs, especially mobiles, and the emergence of plucky home-grown companies with a deep understanding of local tastes and needs. Unlike Asia's industries of old like manufacturing, digital sectors have lower physical capital entry barriers, relying more on technical skills and entrepreneurship. Asian global firms of the past have often been large corporations, while the continent's 'start-up' era of today is made possible by digital.

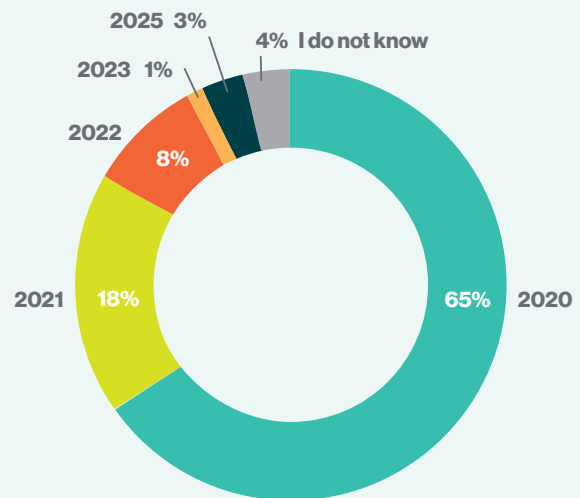
As the 5G era dawns, how will each country's digital transformation agenda be impacted? The agreement of technical standards in the summer of 2018 by 3GPP, the international standard-setting group, has sparked a rapid phase of commercialization as network operators, software and technology companies, and government regulators explore use cases.¹¹ Each connectivity shift—from 2G (1990s) to 3G (2000s) to 4G (2010s), prompted wider changes in the tech ecosystem, enabling new product and service categories like smartphones, streaming, mobile e-commerce and the on-demand economy, bringing new players to market. What will the 5G chapter bring, and how will it impact Asia's digital transformation?

Experts expect 5G to become a reality in two to four years, depending on the market and geography, and it will expand out into the wider connectivity system rather than being a 'switch'. A multi-path approach could see consumers drawing on both Wi-Fi and non-Wi-Fi 5G or 4G. One billion people are expected to be 5G-connected within five years globally, leading to an estimated \$12.3 trillion in economic output by the mid-2030s.¹²

There are three main use-case categories: enhanced mobile broadband (eMBB), massive IoT, and critical communications.¹³ The value

Figure 7: Expected year of launch for 5G

When do you expect 5G to be available in the country where you are based?



Source: MIT Technology Review Insights survey, 2018

In the years ahead, Asia could be at the heart of 5G. It is already home to advanced 4G markets, and is expected to be world's largest 5G region by 2025, accounting for more than half of the global total.¹³



¹¹www.3gpp.org/release-15

¹²wcdn.ihs.com/www/pdf/IHS-Technology-5G-Economic-Impact-Study.pdf

¹³www.gsma.com/newsroom/press-release/gsma-asia-set-to-become-worlds-largest-5g-region-by-2025/

proposition of 5G will be “significantly increased bandwidth, lower latency, the ability to attach significant larger number of devices compared to LTE and new use case models, where you can use low energy or low power consumption,” says Kevin Kettler, corporate chief technology officer at **Flex**, a high-tech manufacturing firm, present across Asian markets including China, Singapore, and Malaysia, which counts Nike among its clients.

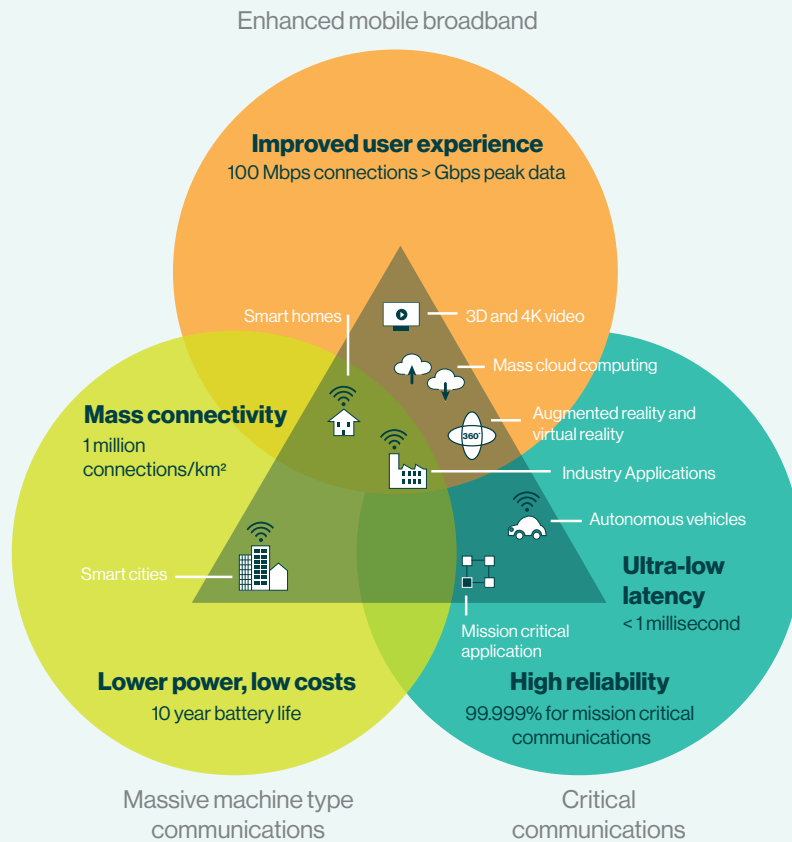
Smart cities, machine-to-machine communication, autonomous vehicles, and advanced manufacturing are all use cases, as are entertainment and media segments like immersive sporting holographic conferences, and VR-based

social gaming. “Immersive technology delivering virtual and augmented reality, IoT bringing smart cities to life, and the massive demand for richer content while people are on the move are all 5G use cases we can envisage in the future,” says Mark Beder, technology director at New Zealand telecommunications operator, **Spark**. “But what we really know is that creating the environment and the platform for innovation will bring many uses we haven’t even thought of yet,” he says. “We saw this with 4G with the rise of video and audio streaming services.”

Survey respondents see 5G as imminent. The majority, some 65%, expect it in their country by

Figure 8: Industry applications stemming from 5G

Outline of the relationship between the technical requirements of 5G and expected services and applications it will deliver



Compiled by MIT Technology Review Insights from Figure 1, 5G-Enabling the Future Economy, Australian Department of Communications and the Arts, 2017

Deep dive: 5G demos, pilots, and innovation hubs



In the years ahead, Asia could be at the heart of 5G. It is already home to advanced 4G markets, and its emerging economies are quickly accelerating to 4G. It is expected to be world's largest 5G region by 2025, accounting more than half of the global total, according to GSMA, led by the likes of Australia, China, Japan, and South Korea.

Following a long history of using sporting mega-events as exhibitions for new tech, dating to the high-speed train demo at the 1964 Tokyo Olympics, South Korea hosted the first open deployment of 5G during the winter Olympics in February 2018 both for operational reasons, as part of an alert system to ward off the wild boars that roam Pyeongchang, and partly for consumer demonstrations, via real-time 360-degree video of competing athletes, impossible to render on 4G. Australian telco

company Optus followed suit, trialing 5G at the Commonwealth Games in April. The 2020 Tokyo Games will, media reports suggest, be 'awash' with 5G connectivity.¹⁴

Test centers and hubs are springing up. Spark launched a 5G lab in Auckland's Wynyard Quarter Innovation Precinct, allowing companies to develop applications in autonomous shuttles, using features like low latency to improve accuracy; security drones for 5G-streaming 4K video, and VR/AR for immersive music and sports events, according to Beder. Telstra has a 5G innovation center in Australia's Gold Coast, carrying out demonstrations of download and upload speeds—3Gbps and 300Mbps respectively—over millimeter wave spectrum, and trials of 5G for autonomous driving, and AI-enabled drones for ocean lifesaving.

2020, with the next highest proportion believing 2021 a more likely arrival date (18%). Less than 8% think it would take until 2022. Clearly the higher income economies will lead; Australia's cities could have 5G as early as January 2019, even though 5G smartphones are not expected until later half of the year.¹⁵ And they expect direct benefits. Nearly half (47%) believe 5G will boost efficiency, some 44% are now discussing how their business case will be affected by 5G and 51% are investing in technologies that can be deployed when 5G is launched. What will be the use cases for Asia-Pacific companies and consumers?

Intelligent manufacturing

Manufacturers are among the first adopters of 5G with 61% of survey respondents saying that this sector will benefit the most. "5G will become the central nervous system of the 'factory of the future' and will have a disruptive impact on industrial production," says Dr. Andreas Müller,

head of communication and network technology at **Bosch Corporate Research**.

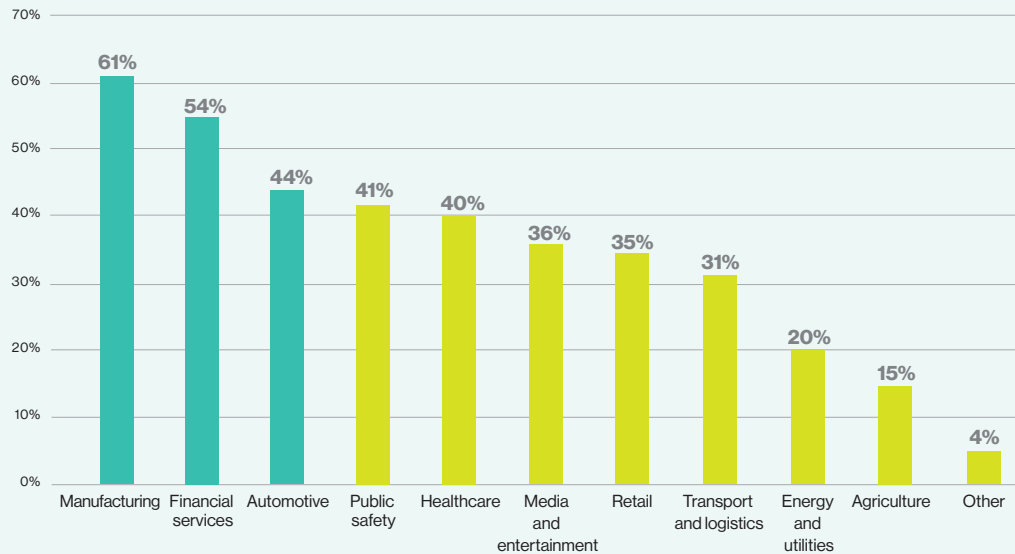
Device-to-device communications can rewire industrial production, or get rid of the wires completely. "When you go to higher bandwidth, you create the ability for 5G to displace what was historically a wired internet connection. Some of the first examples of 5G usage that we've worked with have been around fixed wireless equipment, where bandwidth is now sufficiently high you can remove what used to require cabling into a building and now runs off wireless setup," says Kettler at Flex.

Dieter Wegener, head of external cooperation at **Siemens Corporate Technology**, describes two use cases. "You can connect a forklift truck by 5G with other machine tools in the factory so they are in real-time communication; they can interact on logistics like delivering materials to the machine tools, or taking machine products from the tool to forklift to another place."

¹⁴qz.com/1215328/mwc-2018-5gs-coming-out-party-will-be-the-tokyo-2020-olympics-according-to-intel/
¹⁵www.gsmaintelligence.com/research/?file=28401018963d766ca37d014fa9cbffb1&download

Figure 9: Industry sectors that will benefit most from 5G

Which sectors would benefit the most from the rollout of 5G in the country in which you are based? Select up to five sectors.



Source: MIT Technology Review Insights survey, 2018

In the process industry, he says, 5G could connect large areas without cabling. “You can have a sensor in a faraway location that you connect to a 5G router so the sensor can give information to automation equipment in the control center, which could be 3 kilometers away. Today you would have to make a wire all the way from the control center. If you have 10 sensors, you have to make a wire for each one, which is a high investment.”

This will affect Asia’s manufacturing and electronics sector, especially in Singapore and Malaysia, both pushing into higher value segments. Singapore’s Economic Development Board is working to bring the country’s manufacturing sector into the Industry 4.0 era by enabling digitization and automation, including through its ‘Smart Industry Readiness Index’ against which companies can evaluate their digital transformation agenda. “Future possibilities, such as the use of unmanned video drones for manufacturing, security, traffic, accident and fire monitoring, could be in the works and potentially see us leveraging 5G connectivity to deliver a dynamic,

on-demand stream of content-rich applications that are ubiquitous and available across a range of portable devices,” says [Arleen Paulino](#), vice president at **Amgen Singapore Manufacturing**.

Autonomous vehicles

Autonomous vehicles (AVs) are constantly exchanging data with external environments, which means that 5G could materially impact the industry. That is a longer term prospect though, say experts.

Niels de Boer, for instance, sees limited direct use cases for 5G currently, because AVs are lagging behind 5G in terms of commercialization and rollout. “Internet connectivity can be a bottleneck for autonomous vehicles,” he says. “When you look at Asia-Pacific, there are a wide variety of operating environments. Singapore, Japan, South Korea, and areas in China have good 4G connectivity, but in other places this is not the case. Connectivity in general cannot be taken for granted in places like Indonesia and the Philippines.”

Today, there are limited AV fleets and almost no use of online high definition maps. “Whatever connectivity there is, it can therefore be managed through 4G. This will change in the future when large fleets of highly connected autonomous vehicles become operational, but they are still a while away and 5G rollout will most likely be ahead of AV roll-out,” says de Boer. But eventually, the two will interweave.

Other experts agree that 5G will be critical enabling infrastructure for the kinds of data expected in the smart transport age. “AVs can generate and consume multi-gigabytes of bandwidth, albeit not all of that bandwidth is necessarily transmitted over the air, but once 5G networks become pervasive, an increasing amount of over-the-air data exchange is expected,” says Anup Changaroath, chief technology officer for APAC at **Ciena**. Low latency could be particularly important. Kettler at Flex agrees; “You need low latency connection if you are going to be passing extremely important situational data. Say a car is driving down the road and a fridge falls off a truck. If one car discovers that, you don’t want the next 10 to discover that on their own, if that information can be passed to them quickly.”

The region’s automotive industry could also, in an optimistic scenario, be part of the AV push in terms of product development. Research by the ILO has flagged Southeast Asia’s automotive sector, with its 800,000-strong

workforce, as a sector that is going to see increased robotic automation as well as R&D in electric vehicles, hybrid electric vehicles (HEVs), lightweight materials and AVs. But this landscape is making the region competitive globally, particularly as non-traditional firms from Tesla to Google/Waymo and Uber enter car-making. Asian automotive manufacturers, and the supply chain participants, will need to play an active role in the 5G era to compete as makers of tomorrow’s vehicles.

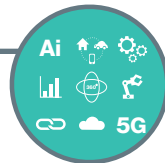
Everyday IoT

While futuristic factories and autonomous vehicles might seem confined to high-income economies, experts see wider 5G use cases. By bringing instantaneous high-powered connectivity to billions of devices, it could be an ‘inflection point in the future of communications’.¹⁶ “In Asia, 5G is really the first wireless technology that has the potential to literally bring broadband to the mass market,” says Changaroath from Ciena. “While 4G has already begun democratizing broadband to some extent, there still exists a significant difference in access speeds between fixed broadband access and 4G access,” he says. “With 5G, such differences will be a thing of the past when users can get as much as 1Gbps of speeds from 5G access devices, be they consumer 5G handsets, or Enterprise 5G Fixed Wireless Access (FWA) devices.”

Renald Gallis, vice president of ecosystem and marketing at **ThinXtra**, says that currently the 5G focus is the “Internet of Complex or high data things, or high value assets.” In three to five years, it could reach maturity for what Gallis terms the ‘Internet of Simple Things’ which he describes as “low cost IoT solutions to connect the unconnected from water meters to smoke alarms to pallets or shopping trolleys.”

Mass-market IoT will benefit from 5G networks even though individually, the devices involved do not use data very intensively. Rather, it is their collective integration which will be made possible by 5G. “Many of the initial IoT applications that we expect to see rolled out as part of the 5G

While 4G has already begun democratizing broadband to some extent, 5G is really the first wireless technology with the potential to bring broadband to the mass market.



¹⁶www.gsmaintelligence.com/research/?file=0efdd9e7b6eb1c4ad9aa5d4c0c971e62&download

revolution aren't necessarily data-intensive, meaning they don't necessarily consume massive amounts of bandwidth individually, however in aggregate, they would generate massive quantities of big data," says Changaroth.

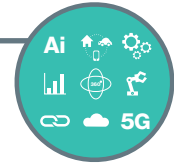
Smart city projects would stand to benefit from the data, notes Kettler at Flex. "In areas like IoT and smart cities, where there is a lot of data traffic, which is small in nature, information can be passed from device to device, aggregated and then there can be a higher-level intelligence to determine how to interpret that data."

Agriculture and environmental services are a further, less commonly discussed use case critical to a region which is both a major food producer and climate-vulnerable. Sensors can communicate data on factors like moisture, fertilization and nutrition, and weather patterns, which could improve crop management. In India, a project is underway using high-end sensors to track the flow of the Godavari river, to better distribute water from the river to farmers. and minimize flooding.¹⁷ A discussion paper from the Australian communications department also said 5G could

provide the supporting infrastructure needed for precision agriculture tools, including data analysis, sensor networks and geographical information systems to improve its agricultural output while minimizing environmental damage and water wastage.¹⁸

"In areas like IoT and smart cities, information can be passed from device to device, aggregated and then a higher-level intelligence can determine how to interpret that data."

Kevin Kettler,
Corporate Chief Technology Officer,
Flex



Deep dive: VR and the (long) wait for 5G

Entertainment, gaming, and virtual/augmented reality could also take advantage, as 5G momentum builds. 5G could be 100 times faster than 4G, for instance, allowing movie downloads in seconds.²² Consumer VR would be helped by low latency, but connectivity alone is not enough: innovation among device-makers will also be key. "The real turning point [for our business] came about when Virtual Reality Head Mounted Displays (HMD) started becoming popular," says [Scott Vandonkelaar](#), co-founder and CEO of Brisbane-headquartered **Zero Latency**, which specializes in warehouse-scale free-roam virtual reality where participants, armed with headsets, play together in VR social gaming environments.

"There was a lot of technology which needed to be developed and refined to make free roam VR possible," says Vandonkelaar, "but the HMDs were key to kicking off this process. This really started in 2012 when Oculus announced their first developer kit." Zero Latency build their HMDs from open source VR, modified for intense high throughput use. "We added fans, improved hygiene face masks, rigid and comfortable head straps and our custom tracking bracket going over the player's head." Vandonkelaar says network connectivity is a bottleneck to entering some markets. "The advent of 4G/5G technology provides an opportunity for us to better reach some of the more difficult locations around the world."



¹⁷economictimes.indiatimes.com/tech/internet/how-5g-technology-can-play-crucial-role-in-agricultural-growth-and-smart-cities-initiative/articleshow/63649045.cms

¹⁸www.computerweekly.com/news/252443547/How-Australia-is-gearing-up-for-5G

4. Country profiles

Australia

With 88% of citizens using the internet, Australia is a digital leader in Asia-Pacific, reflective of its high-income economic status and efforts by the government to embed digital solutions across the public sector. Australia's government has actively deployed digital innovation across public services, including adopting biometric identification in airports, automating back-office services and using digital platforms to simplify citizen's interactions with public services. The country is embracing autonomous vehicles as well, with a wide-ranging industry consultation, led by the National Transport Commission, geared to

a comprehensive autonomous vehicles law. The government is also investing in AI capabilities with the federal budget of 2018-2019 earmarking AU\$29.9m (US \$21.2m) over the next four years.¹⁹

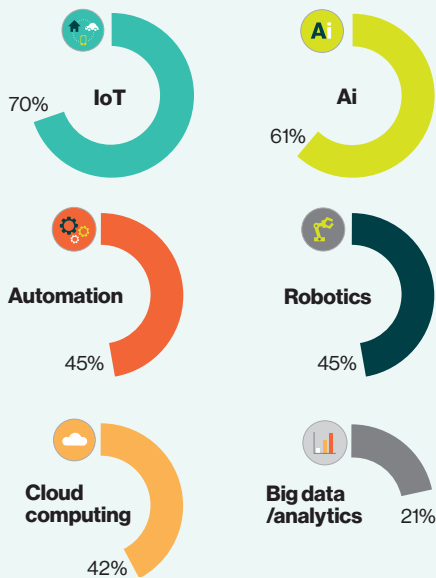
Australian companies are taking advantage of next generation technologies. Commercial spending on public cloud services is tipped to reach \$4.6 billion this year, an 18.5% increase on 2017, mostly in software-as-a-service.²⁰ Use of cloud computing grows as companies do, from 25% for small businesses with four or fewer employees to 60% for those with 200 or more staff. Software is the most common cloud service (85%), followed by storage (60%), according to government data.²¹

The survey shows that 42% of companies have deployed cloud computing in the last 12 months, and 30% have deployed for over a year. The next-gen technologies expected to increase in the near term are AI and automation: 48% of respondents plan to deploy AI in the next 12 months, with 38% planning to rollout automation; 37% have already utilized robotics. Respondents most commonly picked IoT and AI as the most business-transforming technologies overall, selected by 70% and 60% respectively. One challenge for adoption of next generation technologies, however, remains the lack of relevant use cases, the third most commonly cited obstacle.

The country's progress towards 5G is strong, with predictions it could be arriving in Australian capitals by 2019. The survey showed manufacturing, automotive and financial services as the three sectors expected to benefit the most from 5G and the majority, 67%, expect it to be available by 2020.

Figure 10: Technologies with the greatest potential, Australia responses

Which of the following technologies has the greatest potential for transforming your company? Select up to three.



Source: MIT Technology Review Insights survey, 2018

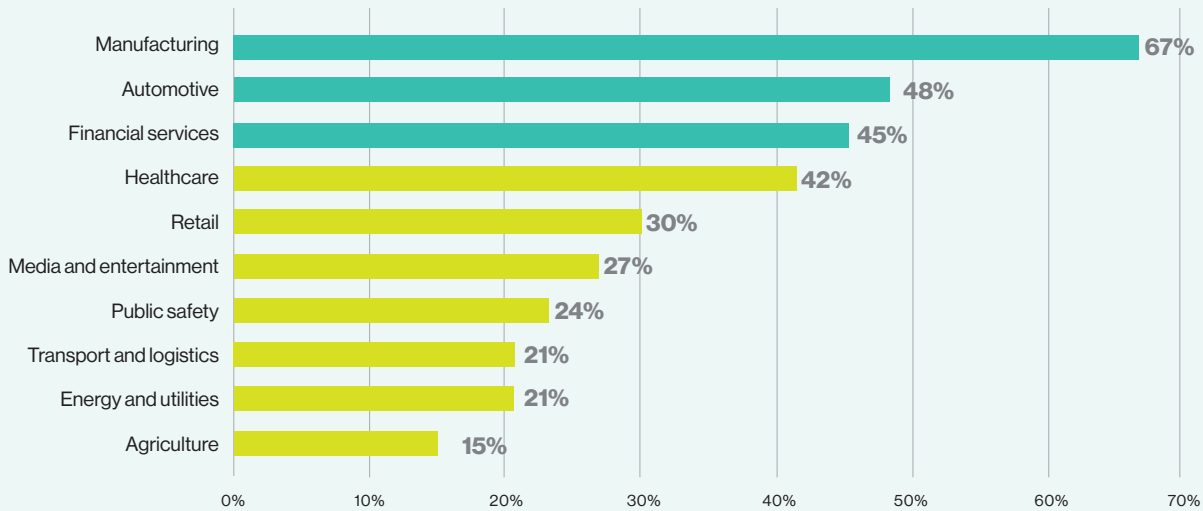
¹⁹www.computerworld.com.au/article/640926/budget-2018-government-seeks-boost-australian-ai-capabilities/

²⁰www.computerworld.com.au/article/636118/australian-cloud-spend-will-hit-4-6-billion-year-says-gartner/

²¹www.abs.gov.au/ausstats/abs@.nsf/mf/8129.0

Figure 11: Industries that will most benefit from 5G, Australia responses

Which sectors would benefit the most from the rollout of 5G in the country in which you are based? Select up to five sectors.



Source: MIT Technology Review Insights survey, 2018

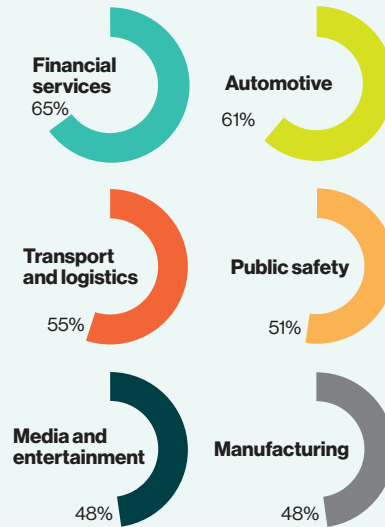
Singapore

Singapore is a digital leader not just regionally but globally, with 91% of households having internet access at home.²² The country ranked second in the world after Sweden in the Inclusive Internet Index, and places in the ‘stand out’ category in the Mastercard Digital Evolution Index which measures both access to digital and the level to which value and utility is derived from it. Singapore also ranked third in a recent Economist Intelligence Unit Automation Readiness Index, which measured a wide-ranging set of indicators including how well education and curriculum design were adapting for the skills needed in the ‘automation era’. The country is an active adopter of ‘innovation clusters’; infrastructure facilities attracting national and global brands working on contemporary fields like health informatics, biotechnology, robotics and advanced manufacturing.

Singaporean survey respondents showed that large companies—86% worked in organizations with above \$500m annual revenue—are well-advanced in their adoption of next-generation technologies.

Figure 12: Industries that will benefit most from 5G, Singapore responses

Which sectors would benefit the most from the rollout of 5G in the country in which you are based? Select up to five sectors.



Source: MIT Technology Review Insights survey, 2018

²²www.imda.gov.sg/industry-development/facts-and-figures/infocomm-usage-households-and-individuals

Over a third, 38%, have deployed AI for more than a year already, and IoT has been in the field for the same period for 39% of respondents. They are not unquestionable next-gen adopters, though; a majority, 55%, say they have no plans to deploy blockchain and 52% do not plan to roll out VR/AR. Companies are preferring information and data-centric innovations—cloud and AI—selected as the top two ‘transformative’ technologies by 65% and 58% of respondents, while physical innovations like robotics came in third place with 22%.

The country is moving quickly towards the 5G era, launching its first pilot network this year with plans to explore drones and autonomous vehicles, at one-north, the country’s science, business and IT hub. Industries highlighted by Singtel as potential beneficiaries of 5G vary by application; in augmented reality, it includes healthcare, education and retail, especially in areas requiring remote assistance. Others include cloud gaming and autonomous transport.

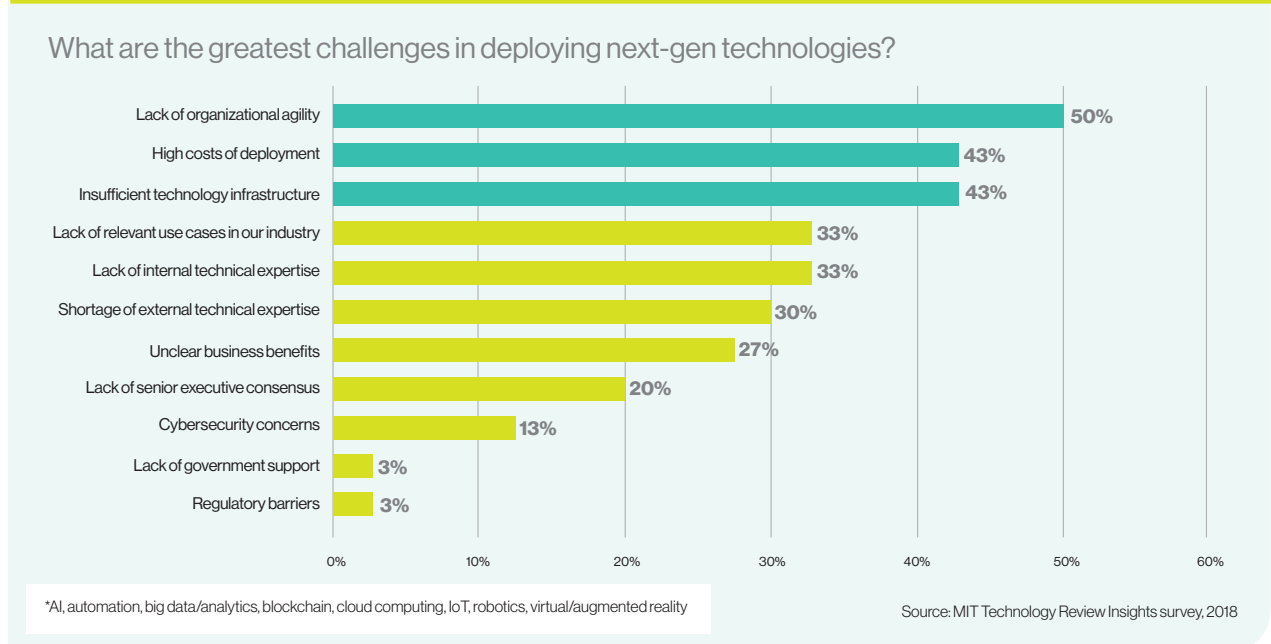
The survey showed that eighty per cent of respondents expect 5G to be available by 2020, with financial services, healthcare and transport and logistics expected to benefit most. The latter will be helped by the country’s interest in autonomous

transport. Nanyang Technological University (NTU) and commercial partners are working on the rollout of autonomous rapid transit in the ‘NTU Smart Campus’ by 2019 and are using a test circuit to develop and iterate the technology ahead of a wider rollout in the country.²³

New Zealand

New Zealand is a small, digitally-savvy economy, with almost 90% of individuals using the internet. Along with Singapore and the UAE, it was one of the three ‘stand-out’ category countries in MasterCard’s Digital Evolution Index 2017 on account of its policy-led digital transformation agenda. While New Zealand is alike to Singapore and the UAE in terms of its small population in one respect it is strikingly different. The latter two have emphasized their connectivity to the rest of the world as a means of attracting talent, whereas New Zealand has used its remoteness, and its physical beauty, as part of its effort to garner technology talent. The initiative LookSee Wellington, led by the capital’s economic development board to attract overseas tech talent, was oversubscribed with 48,000 applications, against an expected draw of 2,500.²⁴

Figure 13: Challenges to technology adoption, New Zealand responses*



²³www.channelnewsasia.com/news/singapore/autonomous-vehicle-ntu-smart-campus-10142506
²⁴www.nytimes.com/2017/04/14/technology/new-zealand-tech-industry.html

Figure 14: Industries that will benefit most from 5G, New Zealand responses

Which sectors would benefit the most from the rollout of 5G? Select up to five sectors.

Manufacturing	77%
Retail	40%
Public safety	37%
Automotive	37%
Financial services	30%
Healthcare	27%
Media and entertainment	27%
Energy and utilities	23%
Transport and logistics	13%
Agriculture	7%

Source: MIT Technology Review Insights survey, 2018

Next-generation connectivity could help multiple segments of the economy, including agriculture, a major export for the country. The survey showed strong adoption trends; 71% expect to rollout AI in the coming year, with 25% deploying over the preceding 12 months. Just over a third (38%) expect to utilize automation, with the same percentage having already done so in the last year. Like Australian respondents, AI and IoT are the two most business-transforming next-gen technologies with IoT voted most commonly as a top three technology by 77% of respondents.

New Zealand firms are also more bullish about technologies which other country respondents see limited use for: 67% expect to deploy VR in the next 2 years, and 80% expect to deploy blockchain over the same period, a higher score than the survey average (42% and 48% respectively). The biggest challenge for firms in adopting next-gen technologies is lack of organizational agility and slow pace of institutional change, cited thus by 50% of respondents. That is despite a reasonable level

of senior executive support: only 20% said they had a lack of senior support for deploying next-gen technologies. There are also structural obstacles. Only 13% of respondents think New Zealand has sufficient infrastructure, in terms of regulation, connectivity and public services, to support digital transformation.

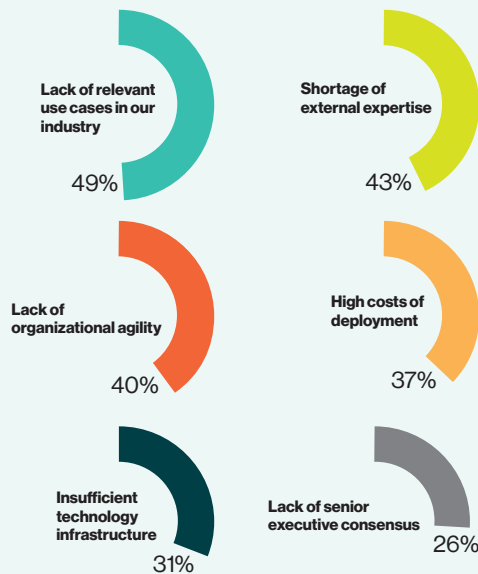
The country has already trialed and run demonstrations of 5G, led by Spark, and the survey shows the majority of companies looking to the 5G era positively; 66% think their business efficiency would be increased by 5G and 86% are actively discussing how their business will be impacted by 5G. Views differ on 5G rollout schedules; 70% expect it by 2020, with the rest expecting 2021 a more realistic date.

Malaysia

Malaysia is a well-connected digital economy, with 80% of people using the internet according to the ITU. It has built a value-added manufacturing

Figure 15: Challenges to technology adoption, Malaysia responses

What are the greatest challenges in deploying next-gen technologies?* Select your top three challenges.



Source: MIT Technology Review Insights survey, 2018

and tech sector that is thriving in an increasingly tech-centric global economy; Malaysia's index of technology shares grew nearly 80% last year, its firms building everything from light-emitting diodes to precision-machined aerospace parts.²⁵

Digital indices capture the country's progress; Malaysia ranked 16th in the Economist Intelligence Unit's Automation Readiness Index, which measures countries' preparedness to access the opportunities, and fend off the challenges, of automation. The country had particular strengths in areas like start-up support and innovation-generating investment; gross expenditure on R&D was 1.3% compared to 1.7% in the UK and 1.6% in Canada. Unique features of Malaysia's digital transformation include its burgeoning partnerships with China, the regional powerhouse, notably collaborations with Alibaba in AI-driven congestion and traffic partnership in Kuala Lumpur. It was also the test-bed for Tencent as it begins exporting its WeChat digital wallet.

Malaysian respondents were among the most senior of the survey, with 43% at president, managing director or CEO, COO and CFO positions, providing a high-level perspective on digital evolution. The consensus view about next-generation technologies' impact was favorable with only 3% believing these tools lacked a business case, although relevant use cases are still unclear to 49% of respondents.

AI was picked as a top three 'transformative' technology by 63% of respondents, followed by IoT at 57%, mirroring responses in Australia and New Zealand. The latter is well-embedded; 49% have deployed IoT for over a year already. Blockchain and virtual reality, in contrast, are peripheral; only 11% of respondents entered either in their top three for business-transforming potential. In the year ahead, the main deployment surge is automation, which 49% expect to rollout, a higher share than any other tech category in our survey, followed by big data, which 40% plan to deploy. Malaysia's challenges include the lack of relevant use cases (49%) and talent ecosystem; shortage of technical expertise is as a 'top three' problem for 43% of respondents.

Malaysia's 5G progress is already in evidence, with trials in May 2017 showcasing robotic control,

Figure 16: Industries that would benefit most from 5G, Malaysia responses

Which sectors would benefit the most from the rollout of 5G? Select up to five sectors.

Manufacturing	66%
Financial services	57%
Public safety	49%
Healthcare	43%
Automotive	43%
Media and entertainment	37%
Energy and utilities	26%
Retail	26%
Agriculture	17%
Transport and logistics	17%
Other (please specify)	3%

Source: MIT Technology Review Insights survey, 2018

connected environment, virtual reality, IoT and 4K streaming. Industry forecasts envisage 5G rollout by around 2022 although survey respondents were more bullish; the vast majority, 68%, expect 5G to be available by 2020.²⁶ **Hazami Habib**, CEO of the **Malaysian Academy of Sciences**, sees a number of use cases for 5G when it does arrive. "Remote control of robotics in healthcare and manufacturing can be the future for Malaysia once 5G is in place," she says. "There are pockets of AI initiatives and testbeds for IoT, and with 5G these can be launched and applied. The development of IoT systems for food traceability and halal logistics are all in the works." The halal economy is a major global segment, with 1.5 billion consumers, set to rise to 2.2 billion by 2030, says Habib.

Survey respondents are aware of the 5G transition, with 65% actively discussing how it will impact their business, and 54% investing in technologies that can be deployed when 5G has been launched. But there are some uncertainties

²⁵bloomberg.com/news/articles/2017-10-22/hidden-in-the-tech-supply-chain-a-malaysian-stock-surges-400

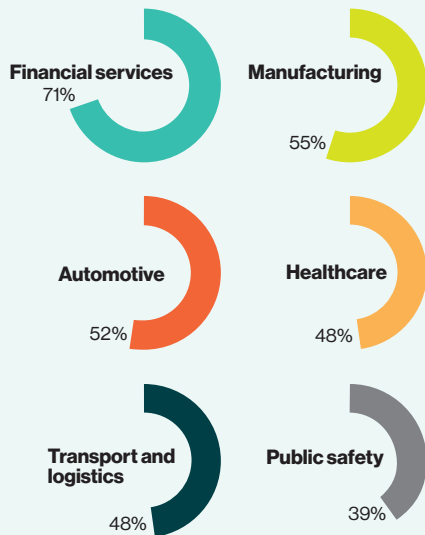
about the benefits of the transition still; 73% were either 'neutral' or disagreed that their product development would be accelerated by 5G, and 37% were not convinced that business efficiency would be increased.

Indonesia

Indonesia, Southeast Asia's most populous country, is less connected than Asia-Pacific's high-income group with only 25% enjoying internet access. But this was an increase of 40m since 2010, showing rapid progress, and the government has taken measures to balance internet access geographically, with a 2018 announcement by the communications ministry to improve access in the less-developed eastern region. For those who are online, digital engagement is arguably higher than in some high-income countries. A 2016 McKinsey analysis found that Indonesians spent 3.5 hours on their devices per day compared to 1.9 hours spent

Figure 17: Industries that will benefit the most from 5G, Indonesia responses

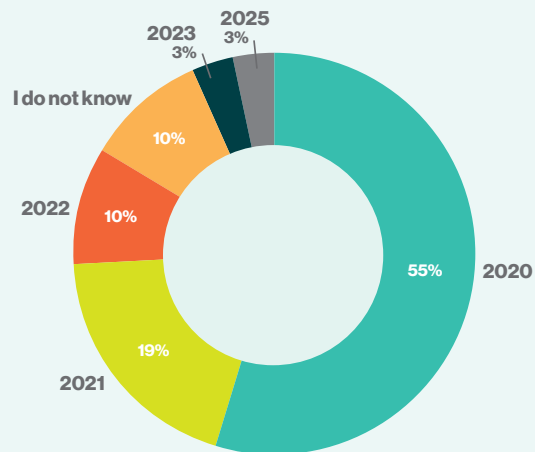
Which sectors would benefit the most from the rollout of 5G in the country in which you are based? Select up to five sectors.



Source: MIT Technology Review Insights survey, 2018

Figure 18: Expected year of 5G launch, Indonesia responses

When do you expect 5G to be available in the country where you are based?



Source: MIT Technology Review Insights survey, 2018

by those in the US, and 2.9 hours per day on social media, compared to 1.7 in the US, with 78% of the population purchasing goods or services online in the previous month, compared to 75%. Digital innovation to meet the needs of the country's online population is one driver of Indonesia's economic growth, best evidenced by homegrown start-ups like Go-Jek.

While its connectivity levels lag overall, Indonesia has been a test site for 5G, led by South Korea's KT. Corp. which showcased its next-generation wireless technology during the recent 2018 Asian Games, the largest sports event in the continent, held in Indonesia with tablets and virtual reality systems offering sports fans experiences including stereoscopic vision of real time shots in badminton and basketball.²⁷

However, there has been limited digital transformation to date in the real economy, the survey finds. Only 7% have deployed AI so far, with only 16% adopting automation. More actively pursued technologies are cloud computing and IoT, deployed by 28% and 27% of companies respectively. In the year ahead, automation is set

²⁶www.thestar.com.my/business/business-news/2018/01/19/5g-in-malaysia-by-2022-2023-says-ericsson/

for the largest uptake with 42% expecting rollout, although sizeable shares have no plans to use next-gen technologies; 30% do not envisage AI in their future, for instance, and 19% have no plans to roll out automation.

Against that context, 5G has some exposure at the senior level but not a large majority: 41% are discussing how their business will be impacted and 54% say they have a ‘good understanding’ of the benefits and opportunities stemming from 5G. Forty-two per cent are investing in technologies that can be deployed once 5G is launched. The consensus forecast is for 5G to be available by 2020 (55%) although 30% think it could take until 2021 or 2022. The most impacted sectors, survey respondents think, is financial services followed by manufacturing and automotive. Retail, energy, and agriculture are expected to benefit least.

The Philippines

The Philippines is a healthily-growing economy, notching 6% GDP growth in the first part of this year, and is a strong digital performer with 56% of its population accessing the internet, with 34 million people brought online since 2010.²⁸ The information economy is central to its growth model; outsourced business services, especially voice-based customer engagement, has leveraged the population’s strong English language skills and friendly customer service culture. The segment is forecast to reach \$1 billion in revenue this year, adding up to 70,000 new jobs, with global brands Accenture and Visa among those opening or expanding offices of late.²⁹

Conscious of the rising power of AI in business services, though, the Philippines needs to build its talent ecosystem in areas like mathematics,

Figure 19: Challenges to technology adoption, Philippines responses

What are the greatest challenges in deploying next-gen technologies?* Select your top three challenges.

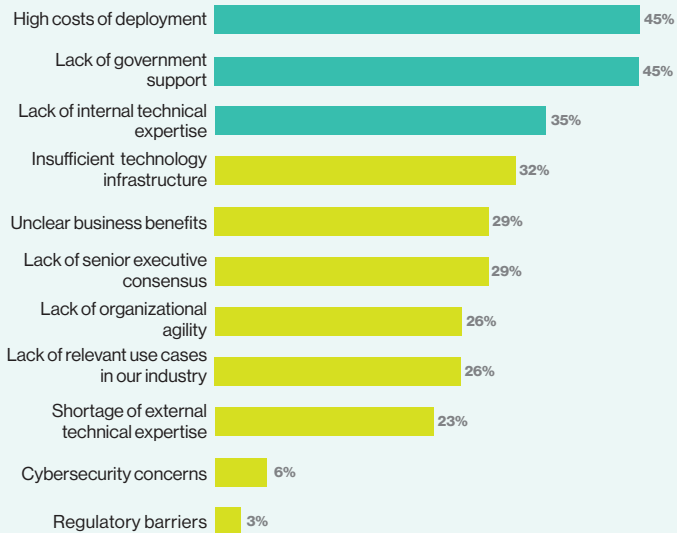
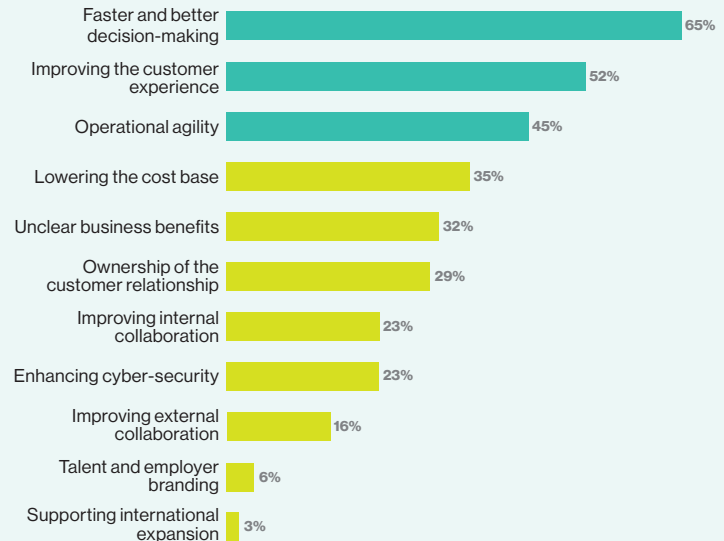


Figure 20: Drivers for technology adoption, Philippines responses

What are the top three business drivers for the deployment of next-generation technologies?*



*AI, automation, big data/analytics, blockchain, cloud computing, IoT, robotics, virtual/augmented reality

Source: MIT Technology Review Insights survey, 2018

²⁷ www.zdnet.com/article/kt-showcases-5g-tech-at-jakarta-asian-games/

data analytics, and statistics as customer services are vulnerable to automation. Consulting firm AT Kearney suggests that there are 110,000 vulnerable jobs, which amount to 16% of the country’s business process outsourcing (BPO) sector, as too few domestic companies will benefit from the new jobs that are created by automation.

As digital consumers, Filipinos are highly engaged online, spending an average of nearly four hours a day on social media compared to 3 hours and 10 minutes (Thailand) according to one estimate.³⁰ However, companies need to do more to build their digital presence so as to tap these markets; IDC, a technology consultancy, says the majority of Philippines’ companies are still ‘digital resisters’ or ‘digital explorers’. The country’s future digital innovation trends may also be shaped by its global diaspora, that could drive innovation in remittances and payments.

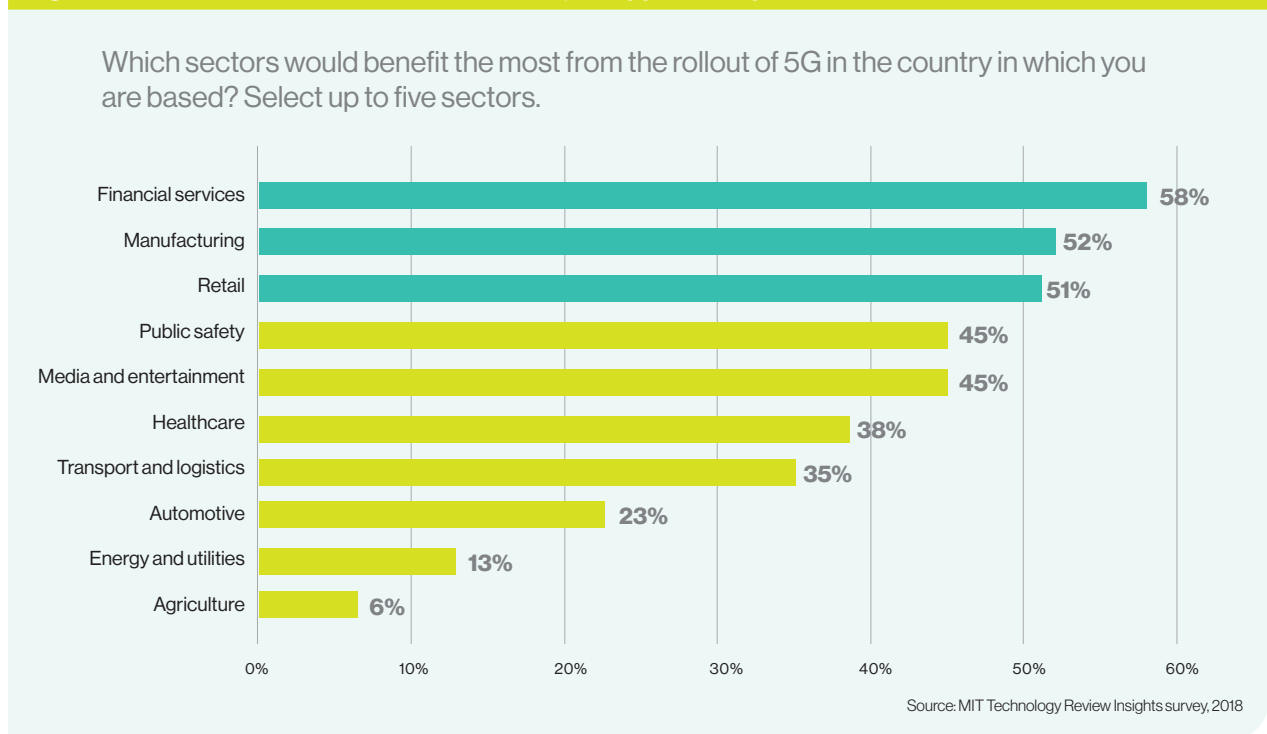
The survey shows adoption of next-generation technologies related to information services. Data analytics, cloud, AI, and automation were the technologies most frequently ranked in the ‘top

three’ in terms of business-transforming potential.

In terms of actual technology adoption, the most active domain has been cloud, with 42% having already deployed and 45% expecting to in the coming year. There has been more limited deployment of AI to date; only 6% have deployed for more than a year, with the same percentage over the last 12 months. Appetite going forward is stronger with 45% expecting AI deployment in the next year, and 19% in the next 2 years; only 23% have no AI plans. Automation is also set for an increase in usage: only 16% have deployed for over a year, and 29% over the last 12 months, but most of the rest, 35%, expect to deploy in the next year. Blockchain is a horizon technology but one that Philippines-based businesses see uses for; only 6% have deployed it to date, but 55% expect to in the next two years.

Promisingly, analytic quality was ranked a top three business driver of next-generation technology adoption overall by the majority: 65% ranked ‘faster and better decision-making’ a top business driver for adoption (improving customer experience was

Figure 21: Industries that will benefit from 5G, Philippines responses



²⁸data.worldbank.org/indicator/IT.NET.USER.ZS?locations=PH

²⁹ccap.ph/2018/06/19/call-center-industry-sees-1-b-additional-revenues-this-year/

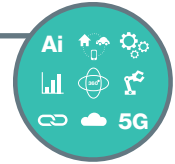
³⁰news.abs-cbn.com/business/05/30/18/70000-additional-bpo-jobs-seen-this-year-as-industry-braces-for-ai

the next most commonly selected motivator, at 51%). Key obstacles for deploying next generation technologies is lack of government support, cited by 45% of respondents. Meanwhile, respondents seem sanguine about the technical talent in the country as shortage of technical talent was only picked by 22% of respondents.

The country is actively moving towards the 5G era, which could improve the speed and power of its business services, and open new digital content and entertainment sectors for an online populace. Globe Telecom indicates that 5G wireless network services could be available by the second quarter of 2019.³¹ Smart, another Philippine telecommunications firm, has announced plans to deploy a 5G pilot network in the first half of next year, initially in Luzon, the country's largest and most populated island; the firm has been testing 5G since as early as 2016 and launched a 5G Technolab in June 2018.³² The company has pledged to develop a 5G-ready network by 2020.

Financial services, manufacturing, and retail are the segments most likely to benefit from 5G, the survey found. Respondents are somewhat optimistic about its relevance for them; 64% think their business efficiency would be increased by 5G and the same number are actively discussing how they will be affected by it. Only 33%, however, are investing in technologies that can be deployed for the 5G era. The mood is mixed on scheduling according to the survey. While almost half expect 5G to come to the Philippines in 2020, 35% think it could be 2021 or 2022.

By the end of 2019, almost 90% of survey respondents in the Philippines will be using cloud technologies, and a nearly half will launch artificial intelligence. Blockchain is a 'horizon technology' for the majority of firms.



³¹www.prnewswire.com/news-releases/globe-telecom-brings-5g-technology-to-the-philippines-300661639.html

³²smart.com.ph/About/newsroom/press-releases/2018/08/13/smart-and-ericsson-to-deploy-5g-in-ph

5. Keeping up the pace

Digital transformation is not just an opportunity, it is also a threat to established businesses and ways of working. Firms slow to recognize the tectonic shifts of the 3G-4G transition suffered for their sluggishness with diminishing market share, or worse. Those who foresaw new use cases, and built the platforms to deliver them, prospered. This inability to adapt fast enough is already cited among survey respondents as a common obstacle to next-gen tech adoption.

New partnerships and modes of collaboration

In some respects, the 5G era will build upon the current ecosystem and players: a majority of survey participants (53%) think original equipment manufacturers (OEM) should lead tie-ups within the industry in the 5G era, and 82% believe that telco operators will lead the 5G ecosystem. Yet this will challenge the different players to develop new methods of collaboration and vertical industry alignment, moving from a consumer-oriented approach to connectivity to providing sectoral solutions.

But 5G will also further blur boundaries between sectors, as top companies leap across commercial fences with ease, which could benefit Asian firms in particular. Australia has no car manufacturing industry to speak of, says Burke at Australia's National Transport Commission, but its expertise in wireless software and computer vision, as embodied in firms like Cohda wireless and Seeing Machines, could make it part of the autonomous vehicles ecosystem. Mobile commerce companies like Go-Jek, already enable transactions far beyond ride-hailing, and could go further into the on-demand economy. Device makers, from smartphones to sensors, will be essential participants in this process. The new era will also require greater use of code and algorithms. Wireless networks will entail more base stations to increase density of coverage,

The companies that were able to prosper from the transition from 3G to 4G were the ones that foresaw new use cases and built the platforms to deliver. The same will be true in the tectonic shift towards 5G.



for instance, but this can increase the number of 'cell borders' and thus increase interference.³³

New rules for mass data

All transformative technologies impact regulatory and legal structures. Across the world, lawmakers are now engaged in far-reaching legislative changes to organize and structure the digital economy, from the EU General Data Protection Regulation (GDPR) to the wave of new rules, restrictions, fines, and commercial limitations being levied on digital segments including ride-hailing, fintech, and the sharing economy. Asia is no exception. Singaporean lawmakers fined Grab and Uber S\$13m (US\$ 9.4m) in total over its merger deal for competition erosion.³⁴ Alternative payments, peer-to-peer financing, cryptocurrencies, and fintech are also coming under greater scrutiny. Governments are actively engaging in discussions about ethical frameworks governing robotics and AI. South Korea issued a 'Robot Ethics Charter' in 2012, covering factors like data-protection and prevention of illegal use, and Japan issued its own 'Robot Strategy', including ethics and safety standards, in 2015.

³³www.thefastmode.com/expert-opinion/11475-the-future-of-5g-networks-in-asia

³⁴www.channelnewsasia.com/news/singapore/grab-uber-fined-after-merger-deal-competition-watchdog-10751522

In some next-generation segments like AVs, deep reforms are needed. “We have found over seven hundred (regulatory) barriers in different state, territory and federal legislations, due to the fact that Australia’s legislation assumes a driver is a human being and as soon as you take that away, a whole range of things don’t work,” says Burke. “We put obligations on drivers that were not designed to be fulfilled by a machine.”

Data security is one emergent challenge that needs to be addressed. “Given the volumes of data that autonomous vehicles [would] produce, we need to ensure that they are not used as surveillance devices to track people around the network,” says Burke.

De Boer at Singapore’s NTU concurs, explaining that data and security are complex to regulate in a multi-stakeholder sector. “This is significantly underestimated not due to technical issues but due to organizational and policy issues. For example, if you have a vehicle from a reputable original equipment manufacturer, a fleet management system from a large systems integrator and data

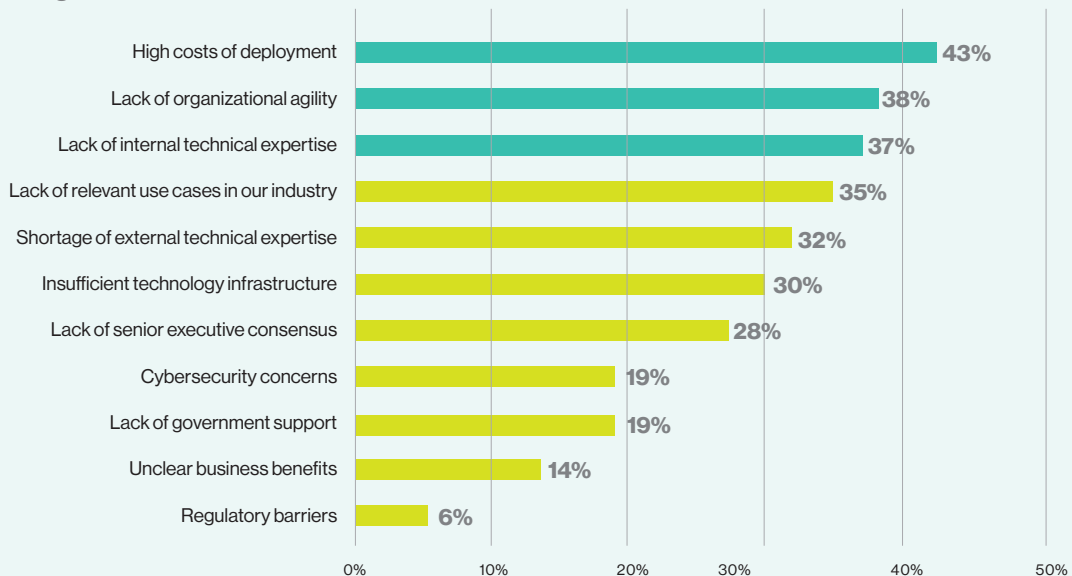
provided by the local government, how do you share effectively while abiding by security policies that are widely different?”

Data security challenges will intensify in the 5G era far beyond transport sector and smart cities. IoT creates openings for criminals, from smart home data which reveals when a house is vacant, to new hack targets like shopping avatars and personal assistants, an increasingly popular AI-driven tool which can give fraudsters insight into personal spending that they could mimic to avoid pattern recognition-based fraud detection software. No digital hole is too small for fraudsters to climb in: one group gained a foothold in a casino’s network by hacking into an internet-connected fish-tank thermostat.³⁵

Notably, cybersecurity does not appear to be an overwhelming concern among survey participants –only 19% ranked it as a top-three obstacle in their adoption of next-generation technologies but whether that is because they feel secure, or that they do not yet know how they are vulnerable, only time will tell.

Figure 22: Challenges to technology adoption, All responses

What are the greatest challenges in deploying next-gen technologies?* Select your top three challenges.



*AI, automation, big data/analytics, blockchain, cloud computing, IoT, robotics, virtual/augmented reality

Source: MIT Technology Review Insights survey, 2018

³⁵www.forbes.com/sites/leemathews/2017/07/27/criminals-hacked-a-fish-tank-to-steal-data-from-a-casino/#7da767f532b9

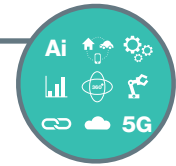
Transition costs

A final challenge for companies and digital economies as a whole are transition costs and upgrade complexities both to next-generation technologies and 5G. Moving from innovation to rollout is fraught with risks, as the colorful history of IT upgrades across public and commercial sectors show.

For survey participants, the biggest obstacle to next-generation technology adoption is the cost of deployment, cited as a top three obstacles by 43%, followed by a lack of organizational agility and slow pace of change within organizations, which 38% put as a top three obstacle. Eighty-two per cent of survey respondents think infrastructure upgrade costs are the key 5G hurdle for telecoms companies to overcome. “Like every new technology, there will be a steep learning curve for operators supporting 5G networks; it will take a number of years before there is sufficient network operations expertise around 5G,” says Changaroth at Ciena.

Lack of agility will be a concern to anyone surveying the history of connectivity upgrades, as companies that moved slowly found themselves edged out of their own markets and missing entirely new ones that they might have been expected to compete for. For firms in Asia this could provide an opportunity to consolidate the gains of the last decade’s digital transformation, or a risk they will lose ground.

Experts say that cybersecurity is an underestimated risk in the 5G era, with the blurring of industry lines and necessary transfer of vast amounts of data. Just 19% of survey respondents cited cybersecurity as a top three obstacle to adoption of next-generation technologies.



6. Conclusion

This report, *From follower to leader: Digital transformation and the road to 5G in southern Asia-Pacific* has examined the trends in digital transformation, technology adoption and preparation for the 5G era by companies in Singapore, Malaysia, the Philippines, Indonesia, Thailand, Australia and New Zealand. Despite the differences between the markets, there is rapid digitalization taking place right across the region as companies prepare to gain competitive advantage from emerging technologies such as IoT, cloud computing and artificial intelligence. From the survey findings and insights of the experts who contributed, the report makes the following conclusions:

- 1. Across southern Asia-Pacific, industry is gearing up for 5G.** Eighty-five per cent of companies surveyed across the region are digitizing internal platforms and systems at the same pace or ahead of industry peers. The next waves of digitalization are around products and services and customer facing processes. Improving customer experience is also the single biggest driver of technology adoption across the region.
- 2. Manufacturing is a gap and an opportunity.** Survey respondents reported the lowest level of digital transformation in their manufacturing and supply chain processes, with more than a third of respondents being behind the industry average or unsure how they compare. The survey also found that manufacturing would be the industry to benefit the most from 5G availability across the region. The technologies selected as having the greatest impact across the six countries were IoT, AI and cloud computing.
- 3. 5G is expected sooner rather than later.** Two-thirds of respondents report that there are active conversations taking place inside their organizations about the future impact of 5G, yet only 46% say that there is a good understanding of the benefits that 5G will bring. Nevertheless, 65% expect 5G to be available in 2020, with a further 18% anticipating 2021 as a more likely date.
- 4. Collaboration and ecosystem development will further fuel digital transformation.** It is clear that there is more to be done in supporting digital transformation across southern Asia-Pacific. Only 35% of respondents believe that there is sufficient infrastructure in terms of regulation, connectivity, and public services to support further digitalization. Some 83% believe that telecom operators will lead the 5G ecosystem, and a further 70% feel that governments should create a collaborative environment for 5G.

This survey has shown significant momentum in the current digital transformation taking place across the region. From AI and automation all the way to cloud computing and robotics, businesses are deploying the technologies that will provide an advantage both now and in the future. A collaborative 5G ecosystem will fuel the next waves of this transformation and enable many organizations to capitalize on the investments they have made.

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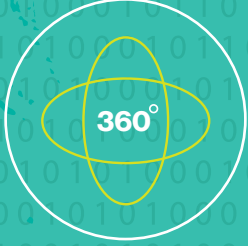
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