HUAWEI

FUTURE OF WORK

2022 Digital Talent Insight

Bridging the Gap: Matching Digital Skills and Employability Pipeline in Asia Pacific

Table of Contents

Preface by ASEAN Foundation

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The surging demand for digital skills has become a recurring theme in the current pandemic-laden IR 4.0 era. As organisations across Asia Pacific attempt to expand their digital talent pool in order to reap the full benefits of digital economy, most of them will come to realise that there isn't enough digital talent in the region.

The COVID-19 crisis has immensely altered the digital talent landscape in Asia Pacific. The pandemic's disruptive effect has caught most countries in the region unprepared as it widens digital skills and knowledge gap drastically. As the world is moving closer to digital future, a concerted effort from all key stakeholders of the region is urgently needed to come up with solutions to prevent the gap from ever-widening. One of the ways is by building a conducive learning ecosystem that focuses on digital talent cultivation.

The creation of a talent development-focused learning ecosystem will not only help prepare existing Asia Pacific's digital talent for the future, but also address the problem of digital skills shortage by grooming the next generation of digital talent. However, creating learning ecosystem that is both sustainable and inclusive will become an insurmountable task if not supported by comprehensive technical know-how of digital talent landscape. This is where Huawei's `2022 Asia Pacific Digital Talent Insights' comes in.

The `2022 Asia Pacific Digital Talents Insights' report serves as a go-to literature for those who are willing to take a leap of faith in building a learning ecosystem that can help foster digital talent. This report is intended to provide data-driven findings for visionary policymakers and leaders to pursue evidence-informed policy-making, which will go a long in contributing towards a more sustainable, inclusive recovery for Asia Pacific as a whole. It is also my belief that this `2022 Asia Pacific Digital Talents Insights' report encapsulates Huawei's commitment to support digital talent development in the region.

Foreword

With over 4.6 billion people, Asia Pacific represents the most diverse region in the world and includes economies at the forefront of digital transformation as well as those faced with extreme challenges in income distribution, geography and population. Asia Pacific currently boasts 1.78 billion Internet users representing 62% of the region and contributing 34% of global Internet users, comfortably marking its place as the fastest growing digital economy.

As organizations learn to take advantage of new ICT, Cloud and AI are becoming must-haves for all organizations. Currently, 81% of enterprises use cloud-based applications. The COVID-19 pandemic has further shown a spotlight on the importance of ICT investment to improve digital resiliency and spark economic recovery with data suggesting digital transformation has accelerated by about 7 years.

While consumers and businesses adopt innovative services like next-generation immersive experiences, automation of everything, and a world of connected devices that extends beyond people, the demand for talent increases.

Jeffery Liu
President for Asia Pacific

According to a study by Korn Ferry, we will face an estimated shortage of 47 million tech talents by 2030. A survey of CEOs by PwC found that more than 50 per cent of APAC CEOs say it's difficult to hire digital talent with the right skills.

To address current learning challenges from COVID-19 and combat this imminent talent shortage, we must continuously progress in talent cultivation. Based on a "leave no one behind" strategy, Huawei continues to push digital inclusion and invest in creating opportunities for digital talents through comprehensive training, competitions and job fairs. Programs like Seeds for the Future and Learning Academy leverage decades of experience and expertise and help tackle ICT workforce challenges in APAC. Huawei Certification provides an industry-leading ICT development standard and certification program covering 11 ICT technical fields. To date, we have certified more than 260,000 ICT professionals worldwide, including 19,000 in Asia Pacific, helping students and ICT practitioners become more competitive in their careers.

In 2013, we launched ICT Academy, a school-enterprise cooperation project that involves higher education institutions and industry-leading enterprises with presence in 72 countries globally and 103 ICT centers in Asia Pacific. These academies help empower universities to cultivate ICT talent that meets industry requirements through advanced courseware and hands-on training Training provides the foundation, but application and opportunity are even more important. Huawei's international ICT competition allows students to apply knowledge, improve problem solving skills and boost confidence. With strong cooperation across government, enterprise and academia, we most recently extended this competition to 100,000 students across 61 countries with 7,200 students from Asia Pacific.

Through our global TECH4ALL initiative, specifically targeted to drive digital inclusion, we expect to develop 2 million ICT professionals over the next 5 years. To achieve this we will need continued support from partners and universities to develop a leading ICT talent ecosystem in Asia Pacific. Leveraging shared experiences with win-win outcomes we can harness the power of new ICT to fly us into a digital tomorrow, and with adequate training and opportunity for future talent, we can find our pilots.

Executive Summary

Over the next decade, emerging technologies such as 5G, Cloud Computing, Big Data, AI, IoT, and Blockchain are poised to dramatically reshape the digital economy. Digital transformation will lead to significant changes in how people work, with existing job roles either becoming obsolete or requiring new skills. In this context, governments need to lead the way and work closely with industries (demand) and academia (supply) in terms of planning and development of their local talent population.

Recently, the Asian Development Bank (ADB) estimated that 65 million jobs will be created annually in the Asia Pacific (APAC) till 2025, resulting from the increased use of digital technologies amidst the COVID-19 pandemic. Meanwhile report by IDC points out APAC continues to leapfrog other regions in the IDC's five stages crisis to recovery framework. With accelerated Digital Transformation investments creating economic gravity, IDC predicts that the digital economy will accelerate, with over 65% of APAC GDP expected to be digitalized and spending to hit US$1.2 trillion between 2020 and 2023.

As many of the Industries across member of the Asia Pacific countries started embracing Digital Transformation to streamline their essential operation and to ensure their businesses to survive and thrive especially with the new normal (post pandemic), we are witnessing a rise in the demand of emerging technologies and digital talents.

Digital disruption has grown to become a major force across a broad number of industries. Thus, the vast majority of executives admit that their industries will be disrupted to a major or transformative extent. Upskilling, is about making sure that digital skills evolve at the same pace as industry opportunities. This is where the private sector can play the largest role. For example since 2019, Huawei ASEAN Academy has been working with local governments, enterprises, universities, operators, and industry organizations, training 23,465 ICT professionals from Malaysia, Thailand, Cambodia, and Indonesia. This will enable the digital transformation of local ICT industries, promote innovations within start-ups and SMEs, and facilitate the creation of a 5G-based innovation ecosystem.

This Report is a call to action for wide-scale digital upskilling through cooperation between Government, Industry and Academic Sector. It attempts to illuminate the issue through analysing government National Talent policies and initiatives, and digital talent hiring landscape trends in Asia Pacific to highlight the skills employers demand. It aims to provide an overview of digital skills demand and supply and provide a useful basis to inform an evidence-based skills development policy. At the end of the report, Huawei provides a National Talent Development framework with a 15-point actionable checklist that is based on regional and global best practices. The framework has benchmarked the countries into three distinct categories based on their relative stage of development The first one is 'Direct Recommendations', meaning reform areas that can be identified directly or which can be considered as being on the front burner. The second category includes 'Areas for Discussion', where reforms require further policy dialogue, data mining, discussions and consultations with relevant stakeholders in order to build strong public and private policies. We hope this provides fuel to every stakeholder involved in the development of our common future.

Shifting Paradigm in Asia Pacific Digital Talent Landscape

Asia Pacific has a population of 4.6 Billion and is one of the most diverse regions in the world, home to economies that are leading the digital growth. The Covid-19 Coronavirus pandemic has disrupted Digital Talent Landscape in Asia Pacific like never before. It has widen the digital skills and knowledge gaps and created more priority reasons for member countries of Asia Pacific, Industry Sectors, and Academia to meet the challenges of National Digital Transformation agenda and to strengthen the investment in the development of digital talent pipelines with digital upskilling and reskilling at the high end and across the board to drive transformation.

As the next wave of technology development will take place in Asia Pacific with resilient growth of the digital economies, Digital Technology cannot be viewed as isolation. Government from Asia Pacific member countries continue to explore the intersection between businesses, technology and society as Digital Talent remains one of the critical components in both National and Organization Digital Transformation strategy.

What will it take to prepare APAC Digital Talent for the future?

How should Government Policy Makers, Vertical Industry leaders, and Academician prepare for this great transition? This report is a call to action for wide-scale digital upskilling. It has become obvious that increase pace of automation and connectivity has made Digital Talent Development through upskilling an urgent priority especially in the process of rebound both economically and socially in the aftermath effect of the Covid-19 Coronavirus pandemic. However not all Asia Pacific Member Countries have been able to transform at the same pace. Upskilling refers to the expansion of the talent capabilities and employability so they can participate in a rapid Digital Transformation.

According to 2021 World Economic Forum (WEF) report, benefits of upskilling, which the analysis suggests could provide as much as 6.1 boost to GDP by 2030[1], will be facilitated when emerging Asian economies move into higher, value added sectors that require the most productive use of skills. Major economies such as China will benefit the most, with a potential gain of nearly $2 trillion by 2030, equivalent to 7.5% GDP. Meanwhile India could have substantial GDP gains as much as $570 billion additional GDP by 2030, which is equivalent to 6.8% of total GDP. Japan on the other hand, could add $1.13 billion to its total GDP by 2030 by closing the skills gap. The economy may be heavily focus on the services sectors, with business services employing over 11% of the workforce. This in turn suggests upskilling will involve transitioning already high-skilled talent as new job emerged.

How Upskilling will impact Asia Pacific Region

Industries that are transforming because of technology will see boosts when the talent pool to fill these more highly skilled jobs becomes available. Further, how much of a boost upskilling gives to an overall economy – across sectors – will be determined by new technology adoption, the current level of skills gaps and how the demand for skills is expected to evolve.

Despite Covid-19 Coronavirus Pandemic, strong demands continue for Emerging Digital Job Roles with critical Digital Skills and Knowledge, given these reasons

65% of APEC GDP Expected to be Digitalised and Spending to hit US$ 1.2 Trillion between 2020 to 2023 (Source IDC)

At an APEC level, during the closing of the Digital Skills Gap by 2030 which endorsed by APEC Human Resource Development Working Group lays out a common definition of digital skills, along with a set of aspiration targets, and members actions on a multi-stakeholder basis (Government, Employers, and Academia)

Technology Jobs populate the top 20 of the emerging jobs according to World Economic Forum (WEF) in its latest publication on Future of Jobs Review Report.

Emerging Technologies such as Internet of Things (IoT), Big Data Analytics, Machine Learning, Blockchain, Cloud Computing and Artificial Intelligence (AI) continue driving the Digital Transformation for sustainable and inclusive growth (Source OECD).

Across Industries in 12 Markets in APAC (Australia, China, India, Indonesia, Hong Kong, Malaysia, New Zealand, Singapore, South Korea, Taiwan, Thailand and Veitnam), 85% of respondents-who were surveyed in recruitment service-face challenges in building their workforce. Among the factors, High attrition among workers with specific skills, either due to skills mismatch or to fatigue and disconnection caused by the pandemic. (Source: Persolkelly's Workforce of the Future 2021 Report)

At the National Level, APAC Governments are investing heavily in developing their own home-grown AI Capabilities by financing research, development, and deployment efforts. Many, such as Australia, New Zealand and South Korea, do so through coordinated local and national strategies, while other such as Malaysia, Indonesia, and Thailand adopt a more collaborative approach with private-sector players. Other still, such as China and Singapore, do both. (Source: IIC)

Digital and technology skills demand remain a growth trajectory across APAC

Given the huge variety of industries in Asia Pacific, and the differing infrastructures from country to country, the pace of digital skilling has traditionally lagged North America and Europe, but it's fast catching up. In many APAC countries, technologies advances take place much faster than decision makers can define approaches to fully harness or leverage them.

Since 2015, Huawei has been reporting annual Global Connectivity Index[2] (GCI), which tracks the progress of 79 economies in deploying digital infrastructure and capabilities, looking into four core technologies called "enabler categories" (broadband, cloud, IoT and AI), measuring them by 40 GCI indicators listed in Figure 1.2. Some of the 40 indicators include ICT investments, ICT laws, e-commerce, E-Government services, cybersecurity, and smartphone penetration[2].

The report highlights 3 GCI Country Clusters – Starters, Adopters, and Frontrunners in order to differentiate between different levels of connectivity[2]. Results demonstrate that economies with higher GCI scores have greater Digital Readiness, thanks to the maturity levels and progress of infrastructure such as high-speed broadband and cloud capabilities, which indirectly minimise the impact of the pandemic.

GCI provides a comprehensive and objective assessment of a Country's connectivity from both a National and Business perspective, and assesses the current status, future trends, and challenges associated with Digital Transformation. It quantifies the value that connectivity generates for a country's transformation into a Digital Economy, and serves as a reference for regional and National Policy Makers, and Industry.
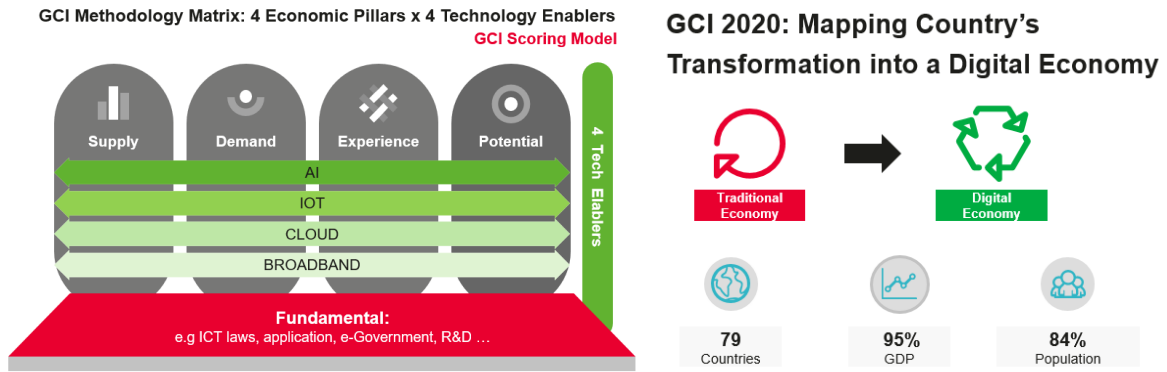
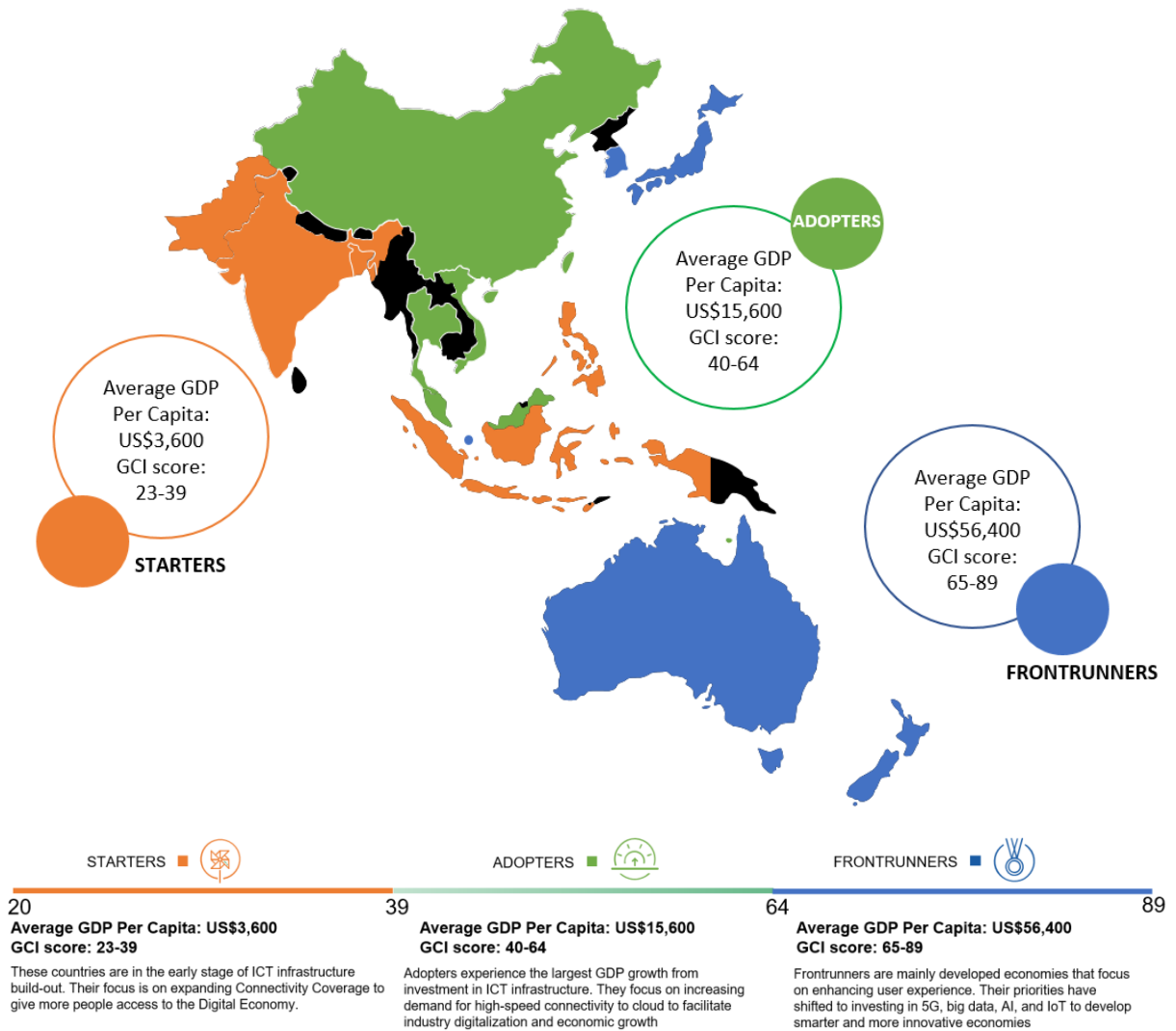Figure 1.1: GCI 2020 - 4 Tech Enablers with 4 Economic Pillars

Figure 1.2: Classification of the 3 GCI Country Clusters

5G will be widely available across Asia Pacific, including the 11 Focus Countries, by 2025

5G as a % of Total Connections in 2025 (excluding licensed cellular IoT)
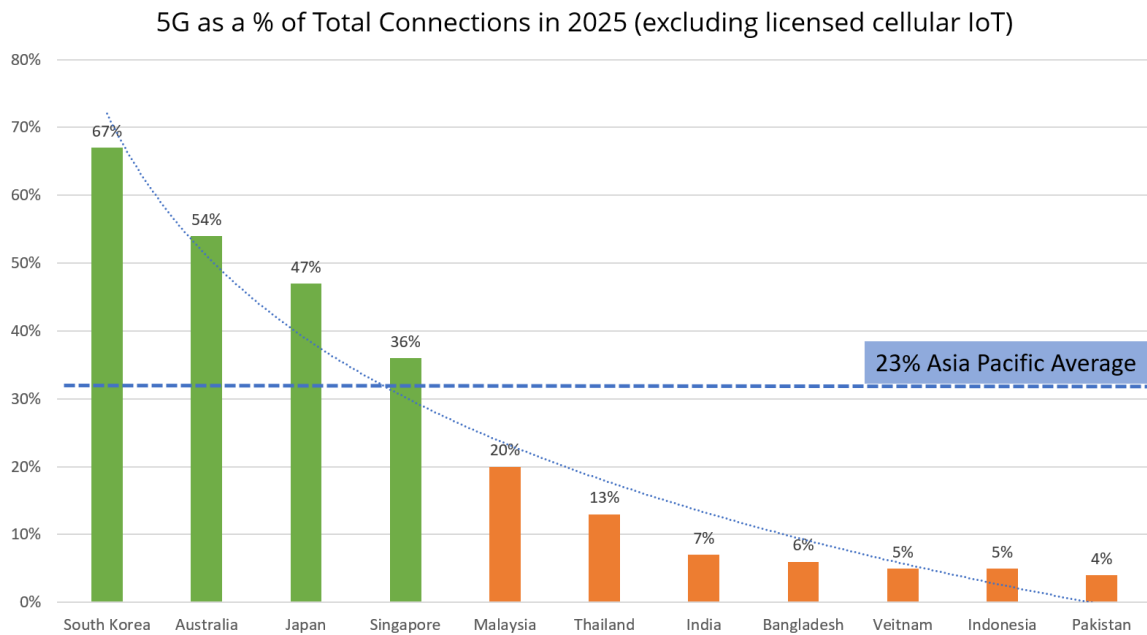
Figure 1.3: 5G with 11 Focus Countries in APAC / Sources: GSMA Intelligence[3]

Country's Connectivity will continue to become priority and foundation for Digital Services and Mobile Operators to increasingly enhancing their capacity to deliver intelligent connectivity, defined as the combination of high-speed low-latency networks, cutting edge AI and connecting with billions of devices through IoT to enable transformational new capabilities across different sectors of a digital society, including public services, industry, and etc. Asia Pacific region will continue to build more momentum in the 2020's as reflected by GSMA report with today 5G is available in more than 10 countries, including Australia, Japan, Singapore, South Korea, and Thailand.

In the medium term 2025, which access Technologies do you believe will be the most important in delivering your country's Industry 4.0 vision (% of respondents)?

The use of 5G Connectivity will be critical for Future Industry 4.0 Solutions
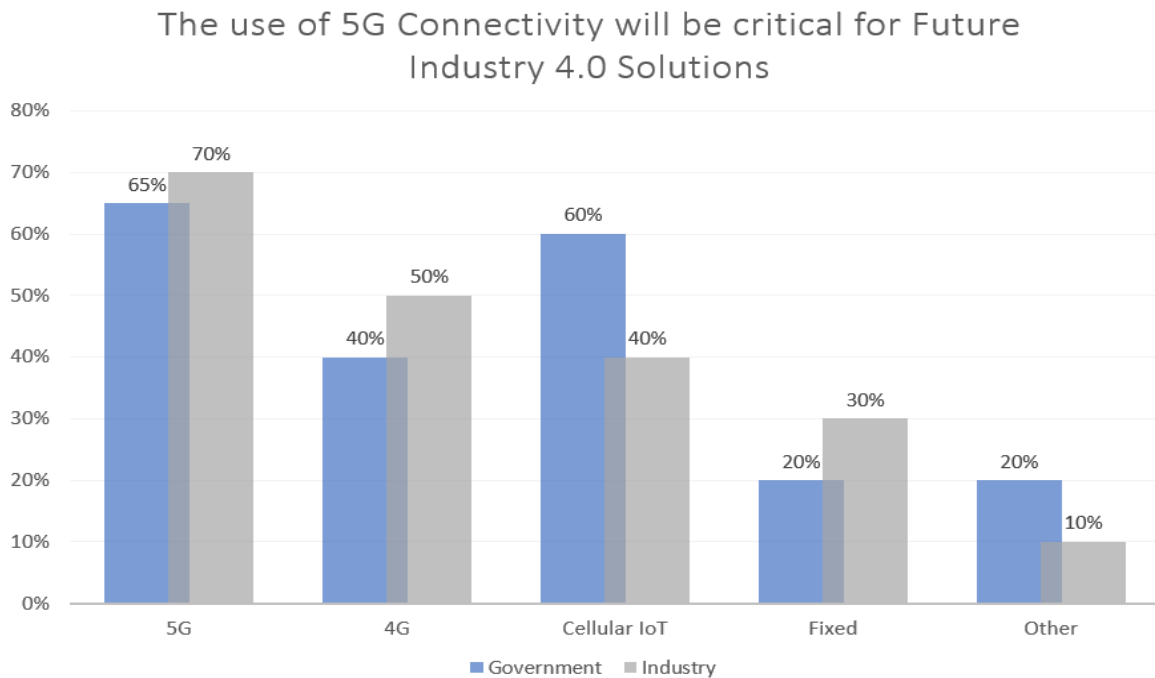
Figure 1.4: Government and Industry Response on 5G Connectivity /

Sources: GSMA Intelligence[3]

Besides providing a comprehensive and objective assessment of a Country's connectivity, GCI Report specifically pinpoint the values by establishing the correlation between GDP per capita and the GCI Score. Investments in ICT infrastructure correlate with strong GDP per capita, indicating that digital technologies accelerate the development of advanced factors for increasing economic competitiveness and recovery from the negative effects of the pandemic.

In addition, people and businesses in the Frontrunner economies have been able to transition faster to remote work, school, business, and services. Even before COVID-19, countries that were investing in digital infrastructure build out and capabilities enjoyed faster GDP growth during their transition to digital economies.

"Report Results indicated that Starter countries are narrowing the gap to the leading economies – thanks to improvements in broadband coverage connectivity and affordability"

One more point to note is that there are two indicators, which are related to digital talent. One is ICT workforce per capita and the other is software developers per capita. Obviously, this is important as digital talents are one of the key enablers for digital readiness. All these 40 enablers build on each other. For example, without ICT infrastructure, we will not be able to attract, train and retain digital talents. Without digital talents to develop applications, there will not be enough applications where the telecom infrastructure investment will be wasted.

Figure 1.5: Country Evaluation based on 40 Indicators in GCI
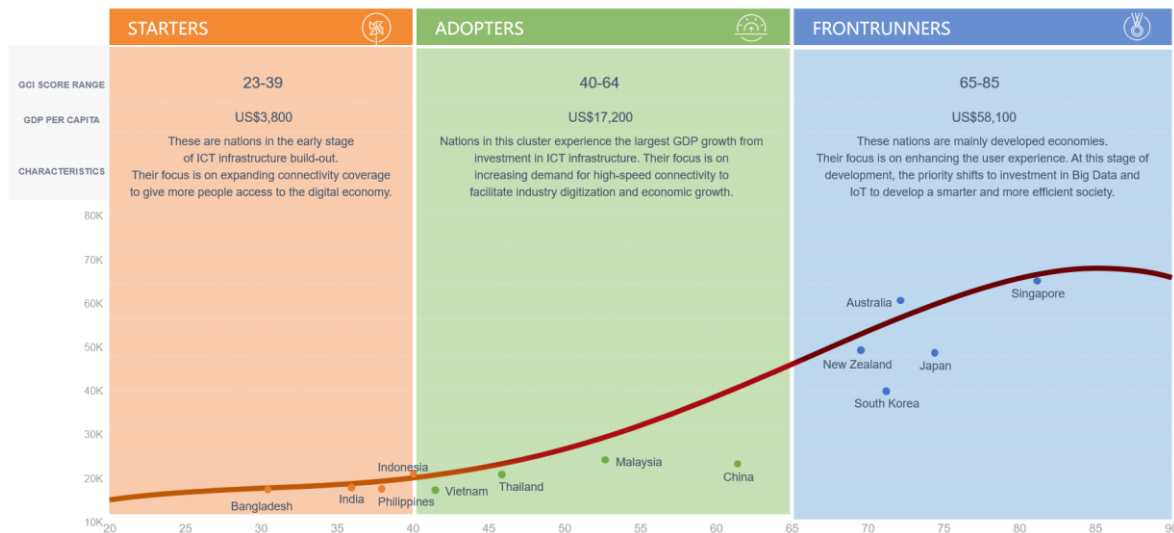
Figure 1.6: GCI Countries across Score Range, GDP Per Capita and Characteristics

GCI Cluster	Country	2020 GCI Ranking	2019 GCI Ranking	Status after the Covid-19 Pandemic
Frontrunners	Singapore	2	4	↑
Frontrunners	Japan	9	6	↓
Frontrunners	Australia	11	11	↔
Frontrunners	New Zealand	12	12	↔
Frontrunners	South Korea	13	13	↔
Adopters	China	22	26	↑
Adopters	Malaysia	34	30	↓
Adopters	Thailand	46	54	↑
Adopters	Vietnam	55	57	↑
Starters	Indonesia	58	62	↑
Starters	Philippines	59	59	↔
Starters	India	63	65	↑

Figure 1.7: GCI 2019 & 2020 Country Ranking and Status

There are several key findings from GCI 2020 report and other sources

STARTERS

Indonesia

- GCI Ranking (Global): 58.
- Rank 1 in STARTERS Cluster.
- Vision 2045.
- 1 of the 4 pillars of the Vision is human resource development and science and technology advancement.

ADOPTERS

Thailand

- GCI Ranking (Global): 46
- Rank #8 in Asia Pacific Region
- Thailand 4.0
- Industry collaboration on digital talent development

FRONTRUNNERS

Singapore

- GCI Ranking (Global) : 2
- GDP per Capita = US$60K
- Smart Nation Initiative
- Government role on digital talent development

Figure 1.8: Key Findings of Indonesia, Thailand and Singapore

There is a strong relationship between GCI and GDP. For example, Singapore has high ranking in GCI being number 2 in 2020. Singapore GDP per Capita is US$60K. This is not surprising as Singapore has announced and implemented Smart Nation Initiative since 2014 and digital talent development is included as part of the national plan.

Under the umbrella of Smart Nation Initiative, Singapore has announced and implemented the National AI Strategy where they think it is important for every Singaporean to upgrade and improve their digital skills so that they can keep up with the advances of AI and be ready to take on the exciting jobs that are created.

Thus a series of AI talent development initiatives are being implemented. The high GCI of Singapore demonstrates the crucial role of government not only on the overall national plan but also on digital talent development in specific.

With GCI global ranking of 46 (#8 in Asia Pacific), Thailand is experiencing the fruits of its ICT Policy Framework 2011–2020. As of 2019, 78% of the population was covered by 4G, with the mobile broadband connection rate reaching 132% of the population. Its smartphone penetration rate is 92%. The Thailand 4.0 plan is further driving digital transformation.

Thai industries understands the importance of digital talents to drive the Thailand 4.0. Many organizations are involved in digital talent development. Some of the examples include DEPA (Digital Economy Promotion Agency), NEA (New Economy Academy), NIA (National Innovation Agency) and 5G EIC (Ecosystem Innovation Center).

Having industry practitioners such as ICT vendors, industry training organizations, enterprise education departments, academia, and other stakeholders in the country to work together in digital talent development will certain improve digital economy of Thailand in the years to come?

Being the leader in GCI score in Starters cluster, Indonesia, has grown GCI score and got closer to Adopters. The Indonesia *Visi 2045* was announced in 2019, under which the government set a target to become the fifth largest economy in the world and per capita income reaching US$25,000. The vision specifically provides guidance for human resource development and science and technology advancement, development of a creative digital economy center, and infrastructure to improve physical and virtual connectivity.

After decades of structural transformation, Indonesia is the largest economy in Southeast Asia, with a GDP of over USD 1.1 trillion (current prices as of 2019). Economic growth has been accompanied by substantial progress in expanding access to skills for all. Poverty in Indonesia declined from a peak of 24.2% in 1999 to 9.2% in 2019. Human capital has been identified as one of five priorities of the Government of Indonesia's National Medium-Term Development Plan (RPJMN) for 2020–2024 and the country's long-term vision, *Visi 2045*, aims for Indonesia to join the world's fifth largest economies by 2045.

IMD World Digital Competitiveness Ranking 2020 Report [4]

"It is worth to note that this report has similar conclusion about digital talents. In its concluding remarks, it said "The Digital technologies remain at the core of strengthening the competitiveness of an economy. In particular, the role of knowledge generation and talent development in combination with effective regulation and infrastructure, continue to drive digital competitiveness."

The world is adapting to the new normal, in which society, governments and industries have adapted to a new way of living and operating. But the speed of adaptation is uneven. It is faster in some economies and slower in others. Asia Pacific is recovering more quickly with over 30% of organizations already progressing to the new normal and 26% returning to growth. This is then followed by North America. Latin America has the highest percentage of organizations in the economic slowdown stage, followed by EMEA - Europe, the Middle East, and Africa.

Every member countries in Asia Pacific agreed to certain extend that the region are experiencing growth with Digital Transformation investment. According IDC, "Digital Transformation investment are growing the economy with a prediction of over 65% of APAC GDP expected to be digitalized and spending to hit US$1.2 Trillion between 2020-2023".[5]

To be mature and ready in the digital economy, steady supply of digital talents to support the country digital transformation effort will be key for all countries in Asia Pacific. Again government, academia and industry shall play their crucial role in digital talent development.

Digital Talent Trends in APAC

While the GCI report highlights the importance of digital talents, it does not research specific details about digital talents in Asia Pacific. To complement the GCI information, this report has extracted some research information on digital talents in Asia Pacific and would like to share below:-

Unleashing Talent Geographically	Emerging Global Talent Hubs	Drawing Upon Latent Talent Potential	Persisting External Talent Openness	Emphasizing Holistic Practical Experience
Remote technologies redefining work location, opening up new sources of global talent	Traditional business hubs transforming into regional talent hubs	Large rural areas representing untapped sources of talent	Open mindset towards global talent ensuring positive outcome	Vocational training with academic education safeguarding employment opportunities

Figure 1.9: Digital Talent Trends in APAC

Unleashing Talent Geographically

The turmoil of the past year due to the pandemic not only caused huge worldwide economic impact, it also brought about changes in terms of how countries continue to manage their talent inflow and outflow. When comparing both IMD World Talent Ranking 2019[6] and 2020[7] reports, an interesting trend is observed where the general trend to develop domestic talent in 2019 shifted to attracting foreign professionals in 2020 for the Southern Asia and Pacific region.

This could likely be attributed to the emergence of work from home arrangement, where technology has now untethered talents previously bound to physical locations. Infrastructural investments to enhance network connectivity by these APAC countries have brought about greater flexibility for remote working international talents to contribute. It is no wonder that employers are now realizing the benefits of being able to tap onto worldwide talent without the hassle of immigration restrictions and providing relocation benefits. This also corresponds to one of the Huawei GCI 2020 insights, where countries investing in ICT helps industries digitalize and enables economies to increase their order of productivity.

Emerging Global Talent Hubs

The digital boom that we are witnessing now, coupled with a highly mobile workforce, have resulted in intense worldwide competition for the small pool of skilled talent. A recent research report on digital evolution by The Fletcher School at Tufts University[8] has shined the light on a group of digital entrepôts economies. Long having been gateways to their respective regions, these innovation hubs continue to play into their natural advantages, supplementing local skilled labour pools with foreign digital talents and providing various economic incentives for companies looking to setup regional headquarters.

This potent combination provides the catalyst for their ecosystems to continue corralling skilled talent and fund inflows, expanding upon their global business hubs status and becoming attractive talent hubs as well, thus ensuring a virtuous loop which strengthens their digital advancements. Unsurprisingly, well-known Asia Pacific heavyweights such as Singapore, Taiwan and Hong Kong have it made on the list. In particular, Singapore has been recognized for promoting and building up the required skills to propel its status as emerging Fintech hub for Asia.

Drawing Upon Latent Talent Potential

Populous economies in the region such as China, India, Indonesia and Vietnam, continue to attract investor interest despite their many institutional and infrastructural gaps. These countries share similar characteristics where large numbers of youths living in rural regions are growing up with poor accessibility to technology and education opportunities. These disadvantaged youths are eager to learn and hold promise for the future of their countries. Hence, these nations have been launching various initiatives with industry partners, providing more education opportunities to raise their workforce numbers and quality.

For example, the Vietnamese government 6 and Microsoft collaboration[9] to develop digital skills in Vietnamese youth, particularly youth living in disadvantaged areas, was lauded for developing a new ICT curriculum which provided computer access to more than 150,000 students and most importantly, the opportunity to learn digital skills.

Persisting External Talent Openness

People and ideas are the key ingredients to innovation, driving the proliferation of new products and services, and propelling economic growth for nations. Most competitive world powers also tend to promote an open mindset and welcome global talents into their folds. However, due to the pandemic, nations are facing backlash from local

populations with regards to open immigration practices, fearful of their own survival within such trying times.

As a result, some countries are starting to gravitate towards protectionist measures, seeking to revitalize their economies and placate the local populations' fear of job and income loss. Closing the door to foreign talents could become detrimental to the future growth of these countries when the world economies start to recover in the post-pandemic era.

Fortunately, even though some Asia Pacific nations are experiencing a pandemic resurge, most countries within the region are still displaying openness towards international talents, providing stability assurance to skilled foreign talent who in turn continue contributing to their economic progress. However, caution should be practiced as the global trend towards self-preservation could still take root within the local population mentality, charting different economic and talent outcomes for the APAC region

Emphasizing Holistic Practical Experience

People and ideas are the key ingredients to innovation, driving the proliferation of new products and services, and propelling economic growth for nations. Most competitive world powers also tend to promote an open mindset and welcome global talents into their folds. However, due to the pandemic, nations are facing backlash from local populations with regards to open immigration practices, fearful of their own survival within such trying times. As a result, some countries are starting to gravitate towards protectionist measures, seeking to revitalize their economies and placate the local populations' fear of job and income loss. Closing the door to foreign talents could become detrimental to the future growth of these countries when the world economies start to recover in the post-pandemic era

Singapore gives a glimpse into how such an approach would be like. Singapore's push for fresh graduates to gain hands-on experience under their belts led to the launch of the SGUnited Traineeships Programme. This scheme seeks to support recent graduates of Institute of Technical Education (ITE), Polytechnics, Universities and other private educational institutions in 2019 to 2021 to take up traineeship opportunities across various sectors. By setting up such initiatives, the Singapore government aims to provide young locals the opportunity in developing their skills professionally and equipping them with valuable industry experience. Most importantly, the participants would be in a better position to secure good jobs when the economy picks up post-pandemic. The results of the programme could be seen from the improvement of industry participants' outlook of skilled labor availability, which had propelled Singapore's ranking from 16 (2019) to 3 (2020) for this component in the IMD report [6] [7].
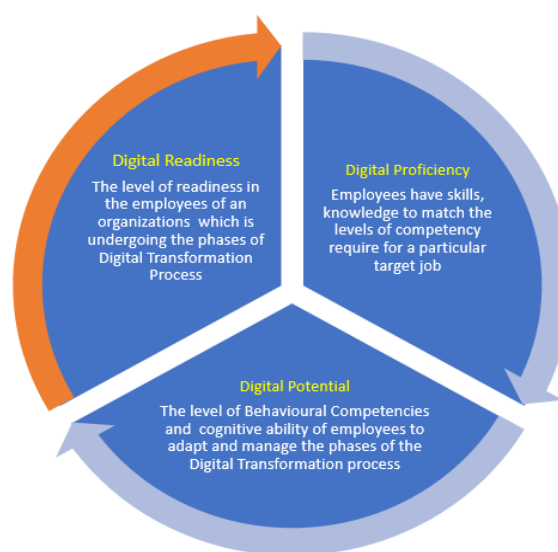
What is Digital Talent Readiness?

Having shared some insights about the GCI report, its relationship with GDP and digital talent trends in Asia Pacific, so what is Digital Talent Readiness?

Digital Talent Readiness refers to the level of digital skillset and knowledge proficiency, behavioural competencies, and cognitive ability of an employee to adapt and manage the phases with the Digital Transformation process. It validates whether the employees have what its require to support the tasks within the job roles.

The digitalization landscape in the region is diverse, with national and regional differences in readiness, capitalization, and regulatory capacities of digital transformation, among others

Within the context of Talent, Digital Readiness defined the employee's readiness level across any organization size (Large Corporates, Middle-Size Organizations and Small Medium Enterprise SME's), undergoing Digital Transformation process.

Digital Readiness
The level of readiness in the employees of an organizations which is undergoing the phases of Digital Transformation Process

Digital Proficiency
Employees have skills, knowledge to match the levels of competency require for a particular target job

Digital Potential
The level of Behavioural Competencies and cognitive ability of employees to adapt and manage the phases of the Digital Transformation process

In a nutshell, having "Digital Readiness", "Digital Proficiency" and "Digital Potential" support in accelerating transformation of business activities, processes, competencies, and models to fully leverage the growing dynamic changes and opportunities from digital technologies and their follow up impact across society in a strategic and prioritized way.

Meanwhile, Digitalization should be encouraged in that it can create new growth opportunities throughout innovation processes. For example, as the economy becomes digitalized, productivity can be improved and new industries developed. Throughout these processes the economy can grow, in parallel with the growing demands for Digital Talent across both broad based and high-level of Knowledge, Competency Skills and Abilities.

In a recent 2021 surveyed by Singapore DBS Group[10] that involved around 2600 corporate treasures, CEO's, CFO's and business owners across 13 markets across Asia Pacific region, Digital Transformation remains the Core Agenda for Large Corporates, Middle-Size Organizations and Small Medium Enterprise (SME's). Despite continued momentum in digitalisation efforts by businesses across Asia Pacific, majority of Corporates in the survey have a 'Digital Transformation Strategy' but many are in the early stages of developing and implementing digital strategies.

Data's from the survey showed that in 10 (70%) large corporates and Middle-Size Organizations segment in Asia Pacific have Digital Transformation Strategy in place, with Taiwan leading the way at 95%, followed by Singapore (91%), China (87%) and Hong Kong (86%). Meanwhile at the SME segment, countries such as Singapore lead with 72% having a digital transformation strategy in place, followed by Hong Kong (47%), China (44%), Taiwan (38%), India (25%) and Indonesia (20%). However, Asia Pacific Region SME's segment in general lags behind large Corporates and Middle-Size Organizations in terms of digital readiness with only 4 in 10 SME's (41%) having Digital Transformation Plan in place and 1 in 10 with a clearly defined Digital Strategy (12%).

In a nutshell, many SMEs in the region recognise the benefits of digital transformation and have a genuine interest in digitalising their businesses. They see going digital as essential for their businesses to survive and thrive in the new normal. At the same point, SME understand going digital as essential for their businesses to survive and thrive especially with the new normal (post pandemic). However the cost of adopting new technologies and the steep competition for digital talent have been impeding their progress.

Because of the massive numbers of SME in many countries and their huge potential to the digital economy (if they know how to leverage technologies), most countries in Asia Pacific are implementing specific policies or measures to incentivize SME and start-ups to leverage technologies to drive innovation to reduce cost, improve revenue and delight customers. The effort is diminished as a lot of SME is knowledgeable in their domains but not necessary in technologies.

Job Market and Hiring Trends

Asia Pacific is diverse, and each market within the region has its own unique challenges. Before we starts to deep dive into the digital roles, let us step back and begin the section by understand first the Market Outlook that set the hiring trends and insights across Asia Pacific Region. Yet there are key trends emerging from countries within the region that are likely to shape the future demand of future digital job roles that may require cross competency digital skills and knowledge in order support the phases of Digital Transformation Agenda.

As many of the Industries across member of the Asia Pacific countries started embrace Digital Transformation (Source: Singapore DBS Group Survey Report) to streamline their essential operation and to ensure their businesses to survive and thrive especially with the new normal (post pandemic)[9], we are witnessing a rise in the demand of emerging technologies and digital talents.

"Strong Foreign Direct Investment into the Asia Pacific, along with the demand for technology, communication and 5G Equipment, have created new demand and job opportunities across the high tech and industries"

Willis Towers Watson Article, Singapore Business Times

Whether for different kind of technologies, the demand for digital talents to fill in future job roles broadly and other specialist technologies continue to be very high across the region especially in the technologies domain of Cloud, 5G, AI, Big Data, IoT, from Start-Ups to Tech Titans. We begin by presenting a table format below to match Emerging Technologies Domain with Applications, and the Digital Job Roles trending in the Asia Pacific Market.

APAC CEOs say it's difficult to hire digital talent with the right skills

Source: PwC's 20th CEO Survey / Linkedin Digital Workforce Future / Asia Pacific
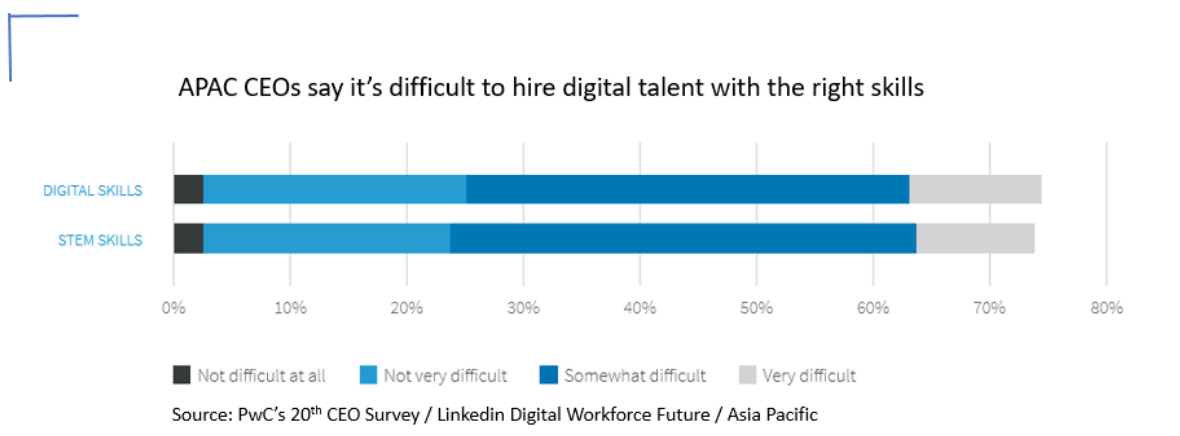
We begin by presenting a table format below to match Emerging Technologies Domain with Applications, and the Digital Job Roles trending in the Asia Pacific Market.

Emerging Technologies Domain	Applications	Job Roles Trending in the Market
Artificial Intelligence	AI has been used to develop and advance numerous fields and industries, including finance, healthcare, education, transportation, and more. AI can support three important business needs: automating business processes, gaining insight through data analysis, and engaging with customers and employees	AI Engineer, Software Engineer, Robotic Scientist, Research Scientist, Data Engineer, Full Stack Developer.
Big Data	Big data applications can help companies to make better business decisions by analyzing large volumes of data and discovering hidden patterns. These data sets might be from social media, data captured by sensors, website logs, customer feedbacks, etc. Organizations are spending huge amounts on big data applications to discover hidden patterns, unknown associations, market style, consumer preferences, and other valuable business information.	Data Scientist, Data Analyst, Machine Learning Engineer, Business Intelligence (BI) Developer.
Cloud	Cloud IaaS solution support organization reduce maintenance of on-premises data centers, save money on hardware costs, and gain real-time business insights. IaaS solutions give organization the flexibility to scale IT resources up and down with demand. It support quick provision new applications and increase the reliability of your underlying infrastructure. It bypass the cost and complexity of buying and managing physical servers and datacentre infrastructure. Each resource is offered as a separate service component based on the needs.	Cloud Solution Architect, Cloud System Administrator, Cloud Developer, Cloud Security Manager, Cloud Product Manager.
Internet of Things	IoT applications run on IoT devices and can be created to be specific to almost every industry and vertical, including healthcare, industrial automation, smart homes and buildings, automotive, and wearable technology. Increasingly, IoT applications are using AI and machine learning to add intelligence to devices. IoT applications can be used in many ways to help businesses simplify, improve, automate, and control processes while providing relevant information, activity performance, and even environmental conditions that need to be monitored and controlled remotely.	IoT Developer, IoT Embedded System Designer, IoT Infrastructure Architect, IoT Solution Engineer, IoT System Administrator.

5G	5G is not only about the technical capabilities and network enhancements, it also introduces a new interconnection ecosystem model. With unique edge computing and network slicing capabilities, 5G can help enterprises interconnect internal digital production facilities and connect them to external networks on demand. This will bring new capability requirements centered on 5G2B scenarios and applications, including 5G vertical industries expansion, 5G2B solution design, 5G dedicated network design, 5G industry service fulfilment and 5G service O&M (operations & maintenance).	5G Wireless Researcher, 5G Product and Services Manager, 5G Solutions Specialist, 5G Test and Automation Developer, 5G Systems Engineer, 5G Core Integration Engineer, 5G Transport Software Developer, 5G AIOps Engineer, 5G Dedicated Network Specialist, MEC Network Specialist

Table 1.10: Emerging Jobs Roles and Applications

Our next section take a look at the Digital Talent Hiring Trends on 5 Emerging Technologies Domain starting with Cloud Infrastructure as a Services (IaaS), Big Data & Artificial Intelligence, Internet of Things (IoT) and 5G. These 5 Emerging Technologies forms the basis foundation for Asia Pacific Governments and Organization levels to strengthen their strategies in the process of Digital Transformation.

Infrastructure as a Services (IAAS) revenue in

Asia Pacific Region

to grow at

11.2 %

2019-2024

owing to the growing demand for the cloud infrastructure services among enterprises.

Key Factors that contribute to the hiring in Cloud Infrastructure as Services (IaaS) saw increased government spending to modernize the existing IT Infrastructure and growing shift towards server virtualization are the major factors likely to boost the growth of the IaaS in the region.

According to recent 2021 Global Data Market Opportunity study[11], Today IaaS will be the fastest growing segment. China, Japan, India, Australia, South Korea will be the largest IaaS market within the APAC Region, today accounting for more than 80% of the overall market share by 2024.

Cloud computing has rated as the most sought-after tech skill along with artificial intelligence and big data by LinkedIn[12]. With ever-changing technology, the demand for cloud engineers is increasing rapidly.

Bank and Telco Lead Big Data Analytics spending in

Asia Pacific Region

to grow at

15.6 %

2019-2024

IDC research showed that spending on big data technology in banking and financial services is expected to grow at a compound annual growth rate of 15.6% from 2019 to 2024.

The big data engineering services market is expected to witness a growth at a CAGR of 16.3% over the forecast period (2021-2026) according to ResearchandMarkets.com[13]. The evolution of technological tools has enabled solutions to be delivered as a service. Owing to this, Software as a Service (SaaS), Platform as a Service (PaaS), and Data as a Service (DaaS) have emerged as potential growth opportunities for Big Data vendors according to Research and Markets study. Real-time processing of big data, using the cloud as an enabler, has become the norm

The use of big data analytics across the Asia-Pacific (APAC) region to solve a variety of business problems and other challenges has been growing and is expected to accelerate amid the pandemic. Banks have been one of the keenest adopters of big data analytics and will remain so as they look to capitalise on financial, transactional and customer data. IDC research showed that spending on big data technology in banking and financial services is expected to grow at a compound annual growth rate of 15.6% from 2019 to 2024[14]. The hiring of digital talents with diverse Big Data competency skills and knowledge background continue the growth momentum due to the diverse hiring industry sectors from not only the IT Sector, but other growing sectors such as Banking and Services, Manufacturing, Agricultural and etc.

On the other hand, Telco's are the next biggest spenders on big data analytics, usually to acquire insights related to customers, sales and marketing. Telco's and banks contributed nearly one-third of spending on big data analytics in the region, while the government and healthcare sectors will see the highest growth rates. The biggest big data analytics market in APAC is China, fuelled by spending by banks as well as local and state governments. In Southeast Asia, countries such as Vietnam and Malaysia are still in the nascent stage of adoption, but their spending will grow by over 15% due to increased investments by many startups and businesses (Source IDC).

In fact, The demand for data analytics roles is growing rapidly in Asia Pacific". Data science dominates LinkedIn's emerging jobs ranking according to LinkedIn's Emerging Jobs Report

Hiring Trends for **Artificial Intelligence** market in

Asia Pacific Region

projected with a CAGR of

59.4 %

By 2025

With AI and cloud computing at the forefront of innovation, AI architects, AI engineers and cloud solutions experts will be amongst the most sought-after tech professionals, especially when talent demand is accelerated by the government's policy in many of the countries in Asia Pacific.

It is almost impossible to talk about AI without connecting cloud computing and vice versa.

One of the main objectives for tech professionals in 2021 is to increase business agility using AI models for cloud computing deployments. With AI expected to impact IT operations, DevOps., software development, AI engineering is similarly expected to ensure the reliability and scalability of AI models

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Data scientists and analysts continue to be in demand. And with country such as Singapore's data analytics continue to be in high demand. This demand will only continue to grow. Non-analytics applications are evolving to incorporate data and analytics currently and in the future.

Advanced data analytics resonates with other tech topics including AI, machine learning, proactive security, privacy-enhancing computation. Advanced data analytics is also connected to data privacy with the massive explosion of data

Jobs that require AI skills have increased 4.5x since 2013. Asia Pacific, in particular, will exhibit the highest compound annual growth rate of 59.4% between 2018 and 2025 according to report published by Michel Page on Hiring Trends in APAC[15] Overall, Data Scientist, Machine Learning Engineer, Business Intelligent (BI) Analyst, Software Engineer forms the biggest bulk of hiring jobs in the domain of AI across Asia Pacific countries

Growth Opportunity

Asia Pacific Region 5G Market

45.5% CAGR

is forecast between

2020 and 2025,

to Reach 13.9 Billion in 2025
(Source:ResearchandMarket.com) 16

The 5G rollout, coupled with targeted initiatives continue to expand broadband and related infrastructure to rural and underserved areas across member countries of Asia Pacific, is creating a major industry challenge across the private and public sector in attracting, recruiting and retaining a skilled, productive and 5G telecom workforce. The shortage of properly trained workers is the most significant challenge the industry faces in the near and middle term

There is a need for existing engineers to expand and diversify their skillsets to include training in areas such as small cell antenna installation, 5G equipment specifications, 5G construction best practices, 5G infrastructure design, distributed antenna systems and fiber work. 5G will require many additional occupations beyond tower techs, including RF engineers, site managers, antennae installers and others

New concepts, such as private 5G networks, network slicing, and the B2B2X business model show promise of its potential to drive the growth of 5G solutions in APAC. Growth is being driven by China market in the consumer segment and the manufacturing sector, which is a top GDP contributor in most countries of the region, will boost 5G's growth as APAC is a key manufacturing hub for the world. By 2025, the manufacturing industry will contribute 84% of 5G enterprise revenue according to Market and Research study

Meanwhile in India, more companies are showing interest in 5G technologies with the Government of India allowing trials and testing. Companies are looking to integrate 5G technologies into existing network elements and stepping-up research and development to provide customer management solutions.

Jobs postings with '5G' in the title have doubled between Q4 2020 and Q1 2021.[17] Overall hiring trends will continue increase in the demand for expertise in 5G Domain in short to medium term as government roll out begins in many APAC countries.

IoT Market

TELCO Services, Multi-Cloud and Manufacturing Services are 3 areas of opportunity for Technology Providers as

Asia Pacific Region Market

prepares to Reach 436.8 Billion by 2026 –
(Source: Frost and Sullivan)[18, 19]

Much of this growth is expected to be driven by increased investments in 4G/LTE and 5G, reduced IoT sensor costs and government support.

Government spending on smart cities alone accounts for almost a third of the region's combined spending, followed by transportation and logistics, then manufacturing.

In the Asia Pacific region, Telco services, multi-cloud and manufacturing are three areas of opportunity for technology providers as the Asia Pacific Internet of Things (IoT) market prepares to hit US$436.8 billion by 2026 according to Frost and Sullivan Study[17].

The region's IoT market is rapidly being transformed by mega trends, including the integration of edge-computing networks into IoT systems and new narrow-band (NB) IoT deployments.

The contemporary Asia Pacific IoT job market is growing at a great pace with the increase in demand for skilled engineers and tech professionals who can serve the connectivity of billions of connected devices.

However, Gartner predicts that around 75 percent of the IoT projects may take twice as long as they should because of the shortage of IoT talent[18]. Much of this growth is expected to be driven by increased investments in 4G/LTE and 5G, reduced IoT sensor costs and government support.

Which Digital Skills does current Job Profile Require?

In this section, we will highlight the Digital Skills and Knowledge that are required by the Job Profiles under the emerging Technologies Domain. The Matrix Table format allow Organization and Government levels to support their strategies in workforce policy planning, design, and deployment especially in skills and knowledge gaps that require further cultivation and training.

Digital Job Roles	Key Digital Skills and Knowledge Required				
	1	2	3	4	5
Big Data and Artificial Intelligent (AI) Domain					
Data Scientist	Data Management	Data Governance	Data Modelling	Data Statistical Analysis	Data Visualization
Data Analyst	Data Visualization	Structured Query Language	Probability and Statistics	Data Cleaning	Data Management
Business Intelligence Developer	Data Reporting	Data Preparation	Data Mining	Statistical Analysis	Data Visualization
AI Engineer	Model Development with Machine Learning Algorithm	Deep Learning Neural Networks	Data Mining	Statistical Analysis	Probability and Statistics
Machine Learning Engineer	Data Structure and Algorithms	Data Sciences	ML algorithm selection, and cross validation	Data analysis and feature engineering	Statistical Analysis
Deep Learning Engineer	Programming Language in R and Python	Concepts of computer science and software engineering	Mathematical and Statistical Analysis	Front End/UI Technology & Deployment Services	Data preparation to model development on Cloud Computing Platform
5G Domain					
5G Wireless Researcher	Wireless Research and Standardization	Wireless Domain Analytical Skills	Advanced Wireless Solutions Design	5G Systems Signalling Procedures Development	Strong Wireless Fundamentals

5G Product and Services Manager	Market Research and Analysis	5G Product Innovation	5G Product and Services Development	5G Product Portfolio Management	5G Business Model Optimization
5G2B Solutions Specialist	Customer Needs Analysis	5G2B Product and Technology Understanding	5G2B Business Development	Sales Consultation	5G2B Solutions Design
5G Test and Automation Developer	Test Scope and Strategy Planning	Test Case Design and Implementation	Test Process Automation	Tools Design	Test Automation System Integration
5G2B Systems Engineer	New Technology Research and Evaluation	5G2B Network Architecture Planning	5G2B Network Solution Design	5G2B Network Systems Deployment and Integration	5G Systems Analysis and Validation
5G Core Integration Engineer	5G Core Network Product Deployment and Integration Planning	5G Core Network Product Installation and Configuration	Modular Testing and Acceptance Testing	5G Core Network Upgrade and Expansion	5G Core Network Integration Issue Troubleshooting
5G Transport Software Developer	Software Requirements Analysis	5G Transport Network Software Architecture Design	5G Transport Network Software Development	5G Network Software Verification and Integration	Vendor Technology Evaluation
5G AIOps Engineer	AI Technology Research and Development	AI/ML Algorithms Modelling	Network Policies Orchestration and Automation	AIOps Platform Administration	Systems Architecture Understanding
5G Dedicated Network Specialist	5G Industry Development and Requirements	5G Network Atomic Capabilities Design	5G2B Dedicated Network Design	5G2B Verticals Network Slicing Design	E2E Network Service Fulfilment

	Understanding				
MEC Network Specialist	MEC Trends and Industry Application Understanding	MEC Network Solution Design	MEC Platform Development	Application and Systems Integration	MEC Network Maintenance
Cloud Domain					
Cloud Engineer	Cloud Service Provider Platform and Tools	Operating System and Programming	Database Platform Operation	Network and Security Management	API and Web Services with Infrastructure Integration
Cloud Solution Architect	DevOps and Containerization	Cloud Adoption Plans, Application Design, Cloud Management and Operation	Business Analysis	Networking & Data Storage	Cloud Specific Patterns and Technologies
Cloud Developer	DevOps and Containerization	Operating System and Programming	Database Platform Operation	Network and Security Management	API and Web Services with Infrastructure Integration
IoT Domain					
IoT Developer	Machine Learning	Embedded System Engineering	Networking & Security	IoT Development Framework, Languages and Technologies	User Experiences and User Interfaces Design
IoT Embedded System Designer	Kernel and Real Time Operating Systems (RTOS)	Low level HW/SW programming at the register level	Software optimization skills at the SoC level	Wireless connectivity, specifically wifi and/or Bluetooth low energy (BLE)	API Automation & Testing

IoT Infrastructure Architect	Architect end-to-end application large-scale IoT solution, layered	Hardware and software technologies to support enterprise scale IoT solutions.	Kernel and Real Time Operating Systems (RTOS).	Sensors, data communication technologies	cloud IoT computing hosting (SaaS, PaaS, IaaS) networking design

Table 1.11: Key Digital Skills and Knowledge Required

Chapter Key Take-Aways

1. While digital infrastructure is the key enabler for countries to rebound more quickly in the new normal and enjoy faster GDP growth during their transition to digital economies, equally important is the digital talent readiness.

2. Asia Pacific is diverse, and each country has its own unique challenges and requirements in digital talent. However, the demand for digital talents to fill future job roles broadly and other specialist technologies continue to be very high across the region especially in the technologies domain of Cloud, 5G, AI, Big Data, IoT, from Start-Ups to Tech Titans.

3. While countries in Asia Pacific have digital economy strategies, the progress of digital talent development varies country by country. Governments are using a wide variety of approaches to address the digital talent gaps in their countries.

In the next chapter, collaboration practices among governments, academia and industry to build an open digital talent ecosystem to get the nations ready to grow in the digital economy will be discussed.

An Open Digital Talent Ecosystem: The APAC Landscape

Digital transformation has been one of the key trends of the decade, as seen by the emerging technology powerhouses in the Asia Pacific[20]. With post-pandemic recovery on top priority across the region, governments need to reprioritize. Investments in leading-edge technology are, without a doubt, an essential driver for industrial revitalisation. Successful digital transformations, though, is also about people.

The need for digital talent in the region is becoming glaring. An AWS research shows that the regional workforce applying digital skills will grow by 5x to around 820 million people by 2025[21]. This is no trivial matter for organizations, considering the current pandemic-related complexities and the significant drop in total employment in the region from the estimated 1.92 billion to 1.84 billion in 2020[22]

Such phenomena represent a concern that is collective and unique for the region. The entire region might be suffering from the overall shortage of tech workers, but developed countries or Frontrunners face different underlying concerns compared to emerging countries (Starters).

This section of the whitepaper will take a closer look at the overall landscape and challenges hindering select GCI-category countries in their efforts to develop and fulfil their growing regional desire for digital talents.

A Demand and Supply Imbalance

The Asia Pacific is highly fragmented when it comes to digital adoption. Frontrunners, such as Singapore, have led the region as a renowned hub for global technology firms. On the other spectrum end, Starters such as Indonesia are just commencing to scale up technology adoption as their local start-up ecosystem gains traction.

The digital talent demand of a country represents the overarching public-private need for skilled tech talents to support its digital future pursuit.

A weighted aggregated score of multiple factors will be used to measure this factor:

1. total investments in the ICT sector in proportion to other expenditure
2. the national importance of ICT to national vision[23]
3. investment in and development of homegrown talents[24]
4. digital competitiveness[25]
5. number of tech start-ups in operation

Next, digital talent supply is seen as the current availability of the in-country digital talent pool, which is equipped with the required skills and competencies to be commercially productive.

This report will use an average of standardised and weighted determinants, which includes:

1. population digital skills[26]
2. science and technology skills[27]
3. availability of scientists and engineers in the population[28]
4. availability of skills and competencies in the local talent pool[24]
5. Tech talent as % of the total workforce

Please refer to the appendix within for more detailed information on the methodology adopted for this exercise.

In the graph below, we have mapped 14 selected GCI countries according to their respective categories (Starters, Adopters, Frontrunners) and two criteria: digital talent demand and digital talent supply. This graph aims to portray a clearer picture of country-specific gaps in terms of talent needs and availability.
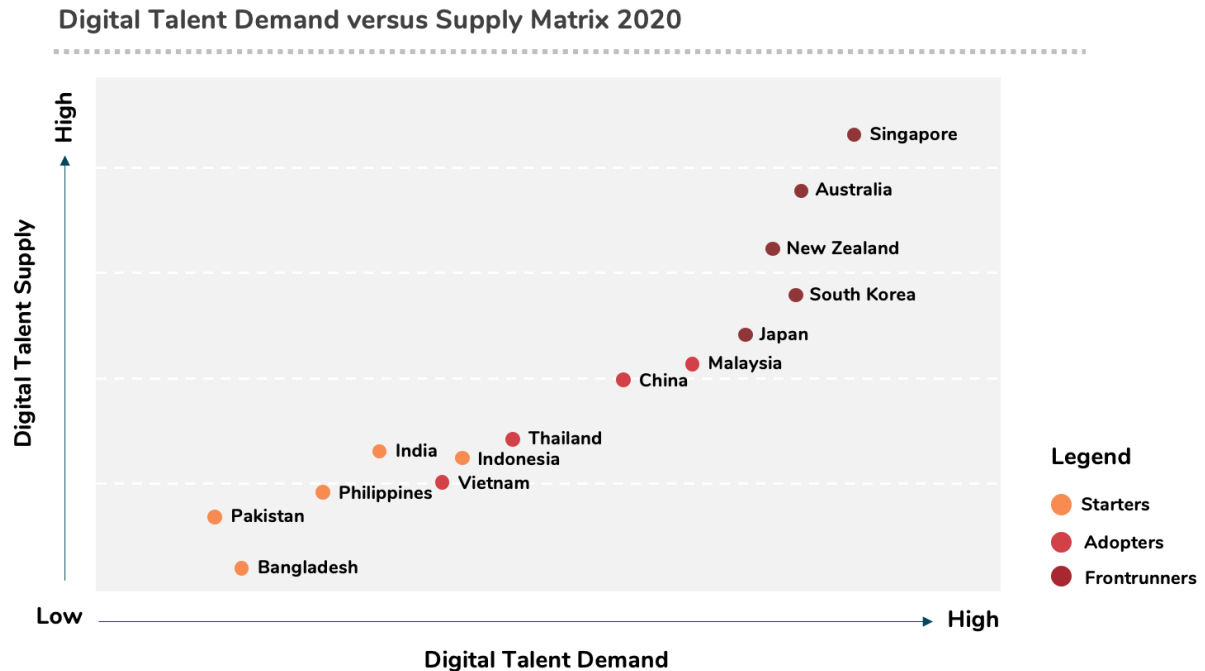

Figure 2.1: Digital Talent Demand vs. Supply Matrix according to GCI Categories

When we aligned their high GCI scores with that of last year's report, we found that Frontrunner countries had greater digital talent demand due to their mature digital competitiveness and high priority set on the ICT sector, an economic driver.

In contrast, the total ICT spending reflects investments into developing homegrown talent to a certain degree, but does not provide a full picture. We have identified that certain digitalization policies that drive these spending, do not have a specific pillar focused on developing tech talents per se in the country.

Surprisingly, the number of tech start-ups does relatively better in this area. APAC countries, excluding China, with a large number of tech start-ups, do well in attracting digital talents as they possesses attractive culture and flexibility of work.

For the supply side, Frontrunners have outperformed other GCI-category countries due to overall their better population attributes in terms of possessing sufficient digital skills.

This is supported by the proportions of tech talent in the total labour pool. The higher the number of tech talents as a percentage of the population indicates a bigger availability of talent that can be channelled back into supporting the local economy.

In addition, the higher availability of hard skills and competencies in the existing talent pool also supports the notion of Frontrunners performing better in supplying digital talent due to their heightened ability to pick up and apply digital skills.

Country Insights

Singapore

FRONTRUNNERS	GCI Score
🇸🇬 Singapore	81
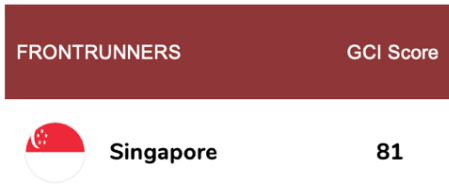
Singapore leads APAC in terms of digital talent demand due to consistent investments in digital capabilities and initiatives. The government positions itself strategically as a global tech and commerce hub with low taxes and advanced technology infrastructure.

With the likes of Grab and SEA Group setting up headquarters in the country, tech hiring has been on the rise. However, local talent has never been sufficient in the past to meet the growing tech scene needs. And as the government tightens its hiring policies for skilled foreign workers, Singapore will have a hard time filling approximately 60,000 of these vacancies in the next 2 to 3 years.[29]

In order to meet this high demand, Singapore has made it a top priority to improve on tech talent supply. The government has invested heavily into creating robust tech curriculums for both its public and private institutions. Initiatives such as the SkillsFuture program enhances the digital talent supply by providing learning platform credits for Singapore citizens aged above 25 to develop new tech skills.[i]

Malaysia

Malaysia has shown great potential in being a technology leader in the Southeast Asia region. The unveiling of the MyDigital[31] blueprint has highlighted building a competent digital talent pool as one of its strategic pillars to boost the

ADOPTERS	GCI Score
🇲🇾 Malaysia	53

digital economy. The growing start-up scene in Malaysia has also fuelled the rise in demand. As SMEs make up the majority of enterprises in Malaysia, the shift towards digitalizing workloads will further drive the requirements of local tech talents.[32]

The government has been quick to recognize the increasing need for a holistic talent pipeline. From student learning enhancement programs to upskilling, reskilling and digital employment portals, the Malaysian Digital Economy Corporation (MDEC) has solid plans in place to resolve the digital talent gap in Malaysia.

Indonesia

STARTERS	GCI Score
Indonesia	39

Indonesia has slowly been moving up the regional tech powerhouses chart as the demand for digital talent has skyrocketed in recent years: overtaking Vietnam (an Adopter country). The local digital economy is multiplying and will require over 17 million tech talents by 2030.[33] This can be attributed mainly to the growth of local tech start-ups such as Gojek and Bukalapak, as well as the government's vision to transform Indonesia into a digital-first country.

Digital talent clearly stands out as one of the key pillars of Indonesia's digital roadmap. The government recently announced digital talent scholarships and digital entrepreneurship programs, which aims to accelerate the development of highly skilled digital talent. Alongside other initiatives such as developing a start-up centric curriculum and massive online upskilling programs, the urgency for digital talent supply has never been higher here.[34] As a result, brain drain in the country is expected to dramatically reduce as the local tech ecosystem continues to grow.

Challenges in Building Digital Talent Capital

The Lack of Work Readiness in Graduates

One key reason as to why employers find it challenging to recruit young digital talent is the lack of work readiness.

Studies of work-readiness in the Asia Pacific region finds that the perception of fresh graduates (especially in Malaysia, Indonesia and Australia) lacking the qualifications, skills and personal competencies, is worryingly high.[35]

According to Malaysia's Ministry of Education (MOE), every year, over 20% of all fresh graduates cannot find a job within six months due to the reasons above.[36] A number of tech-hiring managers surveyed by the Malaysian Global Innovation & Creativity Center (MAGIC) also say that almost 9 out of 10 fresh graduates lack relevant skills for workplace readiness.[37]

Industry recruiters find that the majority of the region's tech degree students spend most of their education coding in lecture halls based on their textbooks, and only learn how to build actual projects and applications in their final year. This procedural system often deprives graduates of opportunities such as internships and work-related placements, which is necessary to gain real-working experiences.

The lack of institutional support to secure work-related exposure in technology firms exacerbates the gap in the need to foster the soft skills that are critical. Many graduates, thus, lack the basic work readiness when entering their first job – they become easily overwhelmed in fast-paced digital companies.

This leads to scenarios where graduates eventually leave the tech industry for other careers. In Singapore, for example, 22% of graduates identified lack of jobs as the biggest factor for abandoning their preferred sectors, including the tech scene.[38]

Some industry experts argue that adopting online learning and micro-credentials prove useful for tech enthusiasts, be it high-school graduate or mid-career converters to acquire industry certifications without paying for a three to four-year degree. These low-cost programs are often consists of short curriculums that focus on providing niche tech skills-based learning experiences. In some instances, non-tech students can combine and stack individual certifications to earn full credentials that vouch for their technical skills.

This paper also found that the penetration of such initiatives is varied amongst GCI-category countries in APAC. Several governments of Frontrunner countries such as Singapore, New Zealand Australia have partnered with private enterprises such as Microsoft, IBM and other digital-first companies to launch and approve several micro-credential programs such as #GetReadySG[39], Australia's Work Readiness Micro-credential[40] and NMIT's micro-credential program[41] to accelerate digital talent development. In fact, these program can be found in even Starters such as Indonesia and

India (NASSCOM) with the launch of: Indonesian Student Micro-Credential Program (KMMI) 2021, FutureSkills PRIME Beta Platform[42]

The common trend here is that technology enterprises with global presence in Asia Pacific play an important part in providing valuable industry certifications

Industry certifications in emerging ICT domains introduced by governments need to be linked to industry participants and their current demands in order to able to integrate teaching of the latest skills and recognition for program graduates.

Countries that lack industry certification must thus take the initiative to engage and incentivise the private sector to launch micro credential programs that create win-win situations for the entire digital talent pipeline.

With that said, although certified courses and programs provide better identification of skills rather than purely testing theoretical knowledge, students who receive certifications still lack the exposure to work experiences. Governments with online learning certification programs should integrate and work on enhancing the development of non-technical skills, which are critical in modern-day tech roles, through modern-day internships and contractual placements.

Case Study: New Zealand

FRONTRUNNERS	GCI Score
New Zealand	72

New Zealand (NZ) has a relatively talent-hungry IT industry, with over 2,000 new jobs created every year.[43] However, technology companies have been struggling to hire locally and have relied on the unsustainable method of overseas talent recruitment for years.

Industry research has shown the majority of roles recruited are for senior or experienced candidates, with a small number of entry-level positions available. Much of the skills shortage consist of senior management capabilities, while there is an oversupply for under-skilled graduates.

The local digital talent lacks practical, real-life work experiences necessary to build work readiness. Internships in NZ have been hard to secure, with most technology companies keeping local entry-level vacancies at a minimum.

Summer of Tech, an independent internship provider, placed 352 students in internship positions in 2019. They have an average of 3,000 registered students for their preparation boot camps, but only 1 in 6 secured placement positions successfully every year.

High internship satisfaction rates and eventual hiring of these interns emphasizes the fact that fresh graduates in NZ are not short of technical skills, but largely lack the exposure needed to build work readiness.

In the end, tech talents and companies face the chicken-and-egg issue. How are students supposed to gain commercial experience, if companies are only willing to hire work-ready students?

Underdeveloped Technology Curriculum

A majority of a country's digital talent pipeline comes from the local education system. Governments in the Asia Pacific have long been devising solutions to equip students with enhanced digital skills. However, the tech-related syllabus of many Starters, Adopters and a handful of Frontrunner countries (such as Japan) are becoming irrelevant.

Academic systems across the Asia Pacific often play catch-up when implementing in-demand skill sets into curriculums. The education sector is clearly lagging in this department, as the designing of technology courses and learning experiences are responsive rather than anticipatory.

Together with outdated national education blueprints and irrelevant learning materials, the talents produced by these institutions face poor industry prospects. As a result, most graduates are frequently hit with the hard reality of having a mismatch in tech skills required by the market.

Many school curriculums do not incorporate the technical sophistication that many of these companies require.[44] There is also a lack of project-based learning, whereby students learn by solving real-life challenges using technology.

As the private sector are more technological updated and makes up most of the tech talent demand, governments must establish public-private partnerships (PPP) to better sync academic pipelines with industry needs. This will allow the education sectors to nurture local talent pools that have the appropriate digital skills.

Frontrunners such as Singapore have found success in this area. By way of the TechSkills Accelerator (TeSA) initiative, IMDA fostered a collaborative effort with Thoughtworks to rollout several well-received programs to bolster ICT professional development.[45] However, in Adopters like Malaysia, such implementations have been lacking due to delays in negotiation, absence of guidelines and procedures, political issues, misalignment of objectives and evaluation criteria. For Starters such as Indonesia, the focus has been to speed up PPP-related process but there remains a bottleneck in progress of implementation due to inconsistent and incoherent actions by government agencies.[46]

This report identifies several common factors that can attribute to successful PPPs: coherent policies, clear leadership roles, sustained progress measurement and improvement plans, sufficient agency capacity, sound funding plans and political independence. Governments will need to pay more attention to co-planning and co-designing policies with industry players, establish action plans and completion timelines, setting out clear goals and KPIs for various stakeholders, lay down transparent funding

guidelines. In fact, expert institutions and personnel must be present to understand and deal with complex contract negotiation with the private sector.[47]

Through robust public-private partnerships in place, government can consistently roll out and implement education policies that enables academia flexibility and the reshaping of educational curriculum. This prevents future tech talents from exiting the industry, as they graduate with the up-to-date digital skills to meet current and future requirements.

Case Study: Malaysia

ADOPTERS	GCI Score
Malaysia	53

The shortage of technology talent in Malaysia is partially attributed to universities failing to equip students with the latest skills. Given how quickly technologies change, most Malaysian students that graduate in three-year courses come equipped with knowledge that is already outdated.

Industry experts argue that government agencies such as the Malaysian Qualifications Agency (MQA) and the Ministry of Education should take a more facilitative stance rather than a regulatory one. For example, a less prescriptive approach should be adopted in elements involving programme nomenclature, syllabus and structure to allow institutions the flexibility to respond to industry needs quickly.

The time taken for universities to generate new program content and obtain necessary approval from regulatory bodies is hindering the speed at which tech courses need to adapt. For instance, an average vetting process for course changes takes almost four years to complete and fully implement.[ii]

Local institutions often focus too much on offering niche courses and subjects based on their perspectives of what is on-trend. Due to this, graduates with degrees in specific fields such as cybersecurity or mobile app development often find it hard to get relevant internships.

The government should therefore establish a curriculum that focuses on building strong, foundational problem-solving skills. An excellent way to start is to establish a national skills framework to highlight in-demand skills that different roles in the digital economy need (and want) in the future (i.e. Singapore's Skills Framework).

Some private universities are even starting to allow lecturers and teachers to expose students to the latest technologies using additional materials that they find relevant. This allows better exposure to current industry developments while enabling more private-public partnerships to give students a more hands-on experience.

Poor Accessibility to Technology Education

Having a robust curriculum to develop and nurture a digital workforce is only part of the solution that countries desire. Technology Education require connected reliable basic network infrastructure to allow students to be connected.

Due to the pandemic, online education or MOOC has been well received in the Asia Pacific but mostly by Frontrunners. Meanwhile, Starters and Adopters face the sudden requirement of supplying the robust connectivity infrastructure to enable nationwide holistic remote learning experiences.

The accessibility to tech education remains divided, especially among Starters and Adopters. The larger wealth gaps there have amplified concerns of online learning, which includes lack of gadgets and internet, and an inconducive home environment, among others.

Another factor in this divide is the immense concentration of institutions that offer updated technology syllabus to be mostly around developed cities. This amplifies the disparity in access to quality education, especially due to geographical limitations in archipelagos such as Indonesia and the Philippines.

The gap between private and public schools as far as access to digital learning tools is a concern for Adopter and Starter countries. Quality equipment available to support tech education is easier found in well-funded private institutions, ones that have the support of a strengthened talent development direction from a national level. Such a case is more likely to happen in Frontrunner countries.

The lack of development and scarcity of well-trained and well-paid teachers compounds the stratification between public and private education sectors.[49] In the end, students lose out in the classrooms, further widening the inequity and future possession of digital skills.

Case Study: Philippines

STARTERS	GCI Score
Philippines	38

School closures have been relatively severe in the Philippines, as the archipelago is the only Starter country to prolong the resumption of in-person classes since the start of the pandemic.[50]

This resulted in the loss of learning opportunities for many students, as remote learning was of less quality when it came to technology subjects. Furthermore, the Philippines's National Economic Development Authority (NEDA) highlighted the widening learning gap between rich and poor students, as virtual classes required access to reliable power, connectivity, and technological devices.[51]

As only 20% of the region has internet access, some 1.1 million students have failed to enrol on basic math and other classes.[52] This may seemingly not have an immediate impact on the supply of digital talents. Still, in the long term, a large number of students will fall behind in the foundational and computational skills needed to succeed in a future tech career.

The Philippines clearly does not spend as much on education as their regional neighbours as spending per student is among the lowest globally.[53] Public schools lack not only computers but also books and other basic learning necessities. The focus, moving forward, should be on building an inclusive learning system that is vital to prevent further dropouts due to the widening digital education divide.

Global Mobility Restrictions

With the COVID-19 pandemic halting almost all international movements in and out of Asia Pacific, tech talents no longer have the mobility to fill up regional vacancies.

Countries like Singapore, Japan and New Zealand rely on foreign tech talents to plug the gap in the local ecosystem.

As countries close their borders, organizations face issues with relocating talents in their quest to build a digital workforce. This means that companies in the countries above must take the local hiring route or potentially risk stunting business growth.[54]

Various lockdowns have grounded much of the in-demand tech talents and have fuelled the rise of cross-border online work across the region. According to EY, the region has, in turn, responded positively to full-time remote work, as the majority of talents wants flexibility in where and when they work.[55]

This, in itself, is not an issue. However, when hybrid and remote work arrangements continue for long periods, employee fatigue and disconnection becomes apparent. This causes high attrition rates and further suppresses the ability to retain tech talents in a truly digital age.

Companies will need to reconsider their IT spending as the move towards remote work naturally brings an increased need to invest in collaborative technology. This not only presents a challenge in terms of setting up a new structure of existing processes. It also introduces a new set of sociocultural obstacles, which have now become more daunting to manage due to remote work.[56]

Case Study: Japan

FRONTRUNNERS	GCI Score
🔴 Japan	75

In Japan, a relatively small population is behind the 3rd largest global economy. With a rapidly ageing workforce and a historical culture that enforced tight reins on immigration, Japan is doubling down its efforts to promote internal skill-building while embracing foreign talents.[57]

Even before the pandemic, attracting foreign talent to Japan was an arduous task. Language and culture were significant barriers for highly skilled immigrants to relocate. Now, with borders on lockdown, foreigners looking to work remotely with Japanese companies are thinking twice.

Japan has been lagging in the growing regional trend of expanding online work beyond international boundaries. The International Labour Organization expects the country's global competitiveness to take a hit – unless they double down on efforts to improve the development of skilled local digital talents.[58]

According to Oxford, the country has a substantially low share of work orders accepted through job brokers around the world. Traditional business culture, rigid protocols, group communication styles, security concerns, and the lack of digitization have stripped Japan of the opportunity to champion remote work.[59] The current mobility restrictions have thus increased pressure on the need to make use of the abundance of workers that has long focused on hardware excellence.

With Japan expecting to lose one-third of its total labour force by 2065 due to demographics, the government recognised the need to embrace globalisation and have been more open to inflows of foreign talent. The required residency period for highly skilled immigrants to earn permanent residency status has now dropped from 5 years to a year, and speaking Japanese is no longer mandatory.[60]

Key initiatives such as the Comprehensive Innovation Strategy and Future Investment Strategy 2018 may do well in attracting more foreign talents as Japan looks to open up its borders.[61] However, inherent cultural and governmental obstacles might still stand in the way of retaining the best digital talents in the future.

A New Generation of Employees

The tech workforce in many of today's companies comprises the younger generations. PwC's 14th Annual Global CEO Survey found attracting and retaining younger workers to be one of the biggest talent challenges, especially in the tech field.

Millennials and Gen Z's, who are considered digital natives, have different characteristics and expectations. With high levels of tech exposure at a young age, they have vastly different expectations: instant access to everything. This is also reflected in their career preferences and discomfort with rigid corporate structures and working in information silos.[62]

The new generation of tech talents desires to keep learning and advance quickly up the corporate ladder. This tendency fuels their job-hopping mindset — they switch jobs relatively quickly if their current expectations are not met. This nomadic trait has led them to be the most likely generation to switch careers.[63] Coupled with a need for more flexible and innovative ways of work, the current generation of tech talents further increase the difficulty of talent retention.

Younger tech talents are also attracted to employer brands that they look up to as consumers. As the competition for talent is tougher than ever before, companies that want to snatch top talents need to leverage heavily on this aspect in their talent management strategy, all while investing in diversified recruiting channels and redesigning graduate programs.

Emerging tech roles have been known to assess both the technical skills and soft skills of graduates. Our observations find that the latter may be lacking in this newer generation of tech talents. It is thus becoming more crucial that companies implement scenario or job role based technical competency assessments in interviews, ongoing career development and innovate traditional hiring processes to gain better transparency on their digital talent career path.

The need for young women in technology has also never been greater. With higher participation in higher education and use of tech, Frontrunners have started to realize the need to be more open to provide equal opportunity for women to be part of the solution. For Adopters and Starters, however, the right foundations to a balanced workforce must come from providing equal access to education and removing industry barriers to skills training as well as employment.

Case Study: Singapore

FRONTRUNNERS	GCI Score
Singapore	81
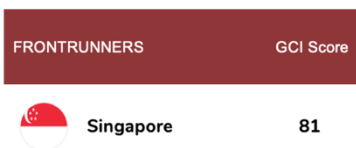
Millennials, being digital natives in nature, make ideal candidates for filling the thousands of tech jobs that are driving Singapore's Smart Nation vision — regardless of roles in data analytics or software development.

This, in itself, is a double-edged sword. Singapore faces stiff competition in securing the young generation of digital talents, both from regional neighbours and tech hubs such as the Silicon Valley and Shenzhen.[64] A survey from Randstad found that 40% of the local tech workforce are looking to switch current roles to pursue career growth.

Several notable Singapore companies have been successful in attracting top talent by revamping workplaces practices to suit modern-day needs. These, however, are not long term solutions. Instead, agile workplaces that embrace individuality must be employed to engage the digital workforce of today.

Retaining these tech talents is not an easy task either. Younger employees are always on the lookout for learning and professional development opportunities. Companies that fail to cater to this passion will find it nearly impossible to prevent these highly motivated talents from walking out the door.

A successful quest to secure tech talent will require employers to be more open to newer, human-centric ways of work and be able to respond decisively to recent changes. Initiatives such as organisation ambassadorships and international crash-course programs are definitely new initiatives that can move the needle in terms of keeping talents engaged.

According to BCG and Singapore's Infocomm Media Development Authority (IMDA), the number of women working in tech in Singapore stands at an impressive 41%. However, the city-state has one of the lowest shares of female tech majors in South East Asia.[65] In order to really build a gender-neutral tech workforce, broader systemic problems needs to be addressed.

Government Policies, Initiatives and Investments for Digital Talent Development

Most governments across the Asia Pacific agree - the vitality of digital talent is driving their country's aspiration for a digitalized economy. Thus, these governments undertook various fiscal and non-fiscal measures to narrow the gap in their digital talent supply.

The pillars below demonstrate how they interplay to boost the overall Digital Talent demand & supply, thereby providing stimulus to the country's digital economy.

Infrastructure
Digital and physical infrastructure that evolves along with needs to allow innovation and talent building

Policies, funding and guidelines
Government active support in creating a sound digital environment is vital for digital economy's success

Programs and education
Relevant programs and education to develop demanded digital skills can advance any economy

Enterprise partnerships
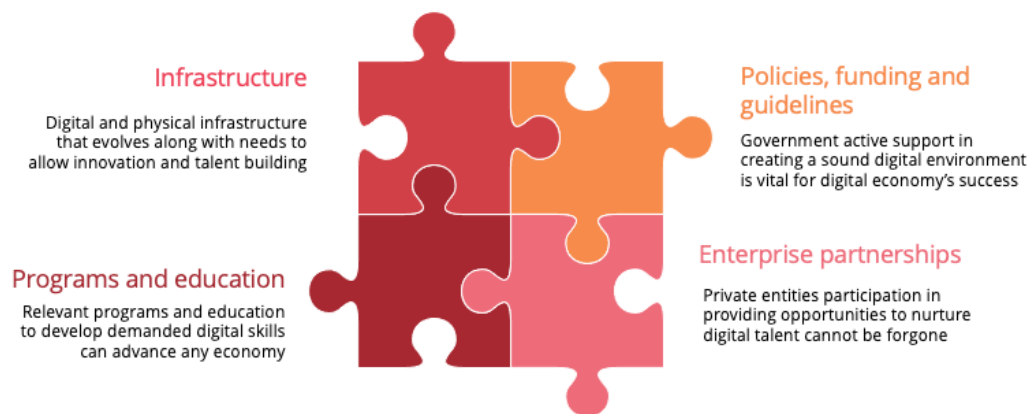Private entities participation in providing opportunities to nurture digital talent cannot be forgone

Figure 2.2: Pillars required to narrow down Digital Talent Demand and Supply

However, due to resources and varying parliamentary priorities, such measures differ from one country to another.

This research, therefore, aims to explore and evaluate contrasts in government policies, initiatives, and investments for digital talent development between three categories of GCI countries – Frontrunner, Adopter, and Starter.

Digital Talent Development Maturity

As Frontrunner countries are mainly developed economies that focus on enhancing user experience, one might assume that with the maturity in digital infrastructure, there are comprehensive strategies in place for developing digital talent. While there lies some truth to this, not all Frontrunner governments aced this front.

We calculated the Digital Talent Development Maturity Score ("DTD Maturity Score") using five contributing factors of equal importance:

1. Digital talent related policies and initiatives availability
2. Agencies and ministries collaboration to drive policies and initiatives
3. Value of digital talent development investment as a percentage of government expenditure
4. Development and active involvement in public-private partnerships for digital talent development
5. Current and future digital talent employment as a percentage of workforce

We scored each country on a scale of 1 to 10, with 1 being the lowest and 10 the highest. For instance, if a government planned an ambitious policy, but the execution was unfeasible for its context, and it suffered a poor track record in achieving its earlier initiatives, the country would score 1 or 2 in its digital talent development maturity.

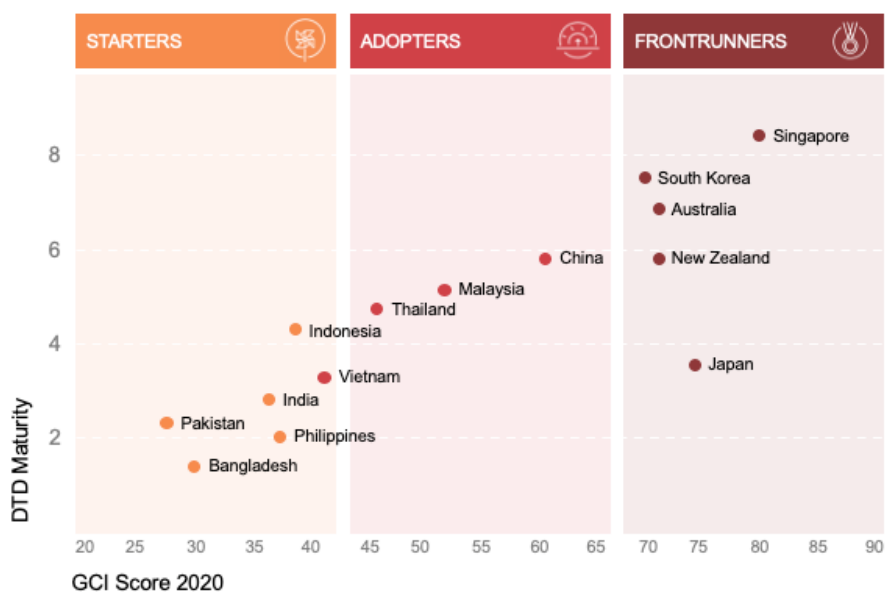*DTD Maturity Score calculations and country highlights can be found in the Appendix D.*

Figure 2.3: DTD Maturity vs. GCI Score 2020

The general trend in the Asia Pacific Digital Talent Development Maturity is that Frontrunners do score higher than Adopters and Starters. However, this trend has outliers in each GCI category.

Frontrunners Prioritize Digital Talent Development, with Exceptions

Frontrunner countries are developed economies with robust resources compared to their counterparts. This includes digital infrastructure and physical infrastructure - facilities, transportation, and more.

DTD Maturity Score

FRONTRUNNERS	
Singapore	8.4
South Korea	7.8
Australia	7.0
New Zealand	5.8
Japan	3.6

The average DTD Maturity Score between the five APAC countries in the GCI Frontrunner category is 6.6. Three out of five scored above average and led the digital talent development maturity for the entire APAC region.

The leaders of these countries — Singapore, South Korea and Australia — have developed a conducive digital economy by making sizeable investments and budgeting for the future. This was a vital move to sustain digital economic growth.

Between the leaders, they share three key commonalities in prioritizing digital talent development:

1. Relevancy of digital education syllabus
  a. Each of these countries invests in ensuring that the syllabus offered is relevant to the workforce demand.
  b. For instance, in South Korea, the country goes beyond basic digital skills and offers specialized courses in Artificial Intelligence (AI) [66]
    i. In fact, the government plans to invest over US$ 3 billion to support AI education and implementation across industries such as the semiconductor industry. [67]

2. Digital talent employability
  a. Workforce ministries and enterprise-centric government agencies collaborate to present job opportunities.
  b. During the pandemic, 590 companies in Singapore participated in providing placements through fiscal and non-fiscal support from the government [68].
    i. Today, 63 percent of the Singapore workforce apply digital skills in their jobs, while about 22 percent apply advanced digital skills – the highest among APAC countries [69].

3. Extensive digital talent policies
  a. Digital talent policies in these countries cover citizen and permanent residence all career stages – from fresh graduates to mid-career switchers.
  b. The policies include fiscal subsidies for digital talent education, often covering 90% of the cost – again witnessed in Singapore through SkillsFuture SG [70]

However, amongst the Frontrunners, there are outliers. Despite successes in digital infrastructure, two out of five Asia Pacific GCI Frontrunner countries fell below average in their DTD maturity. These countries are New Zealand and Japan.

Though New Zealand has a substantial supply of digital talent, it is largely under-skilled for the jobs created. Due to this, companies had to import digital talent from abroad, creating a surplus of unemployed digital talent [71]. Consequently, New Zealand had to exit the digital industry for its livelihood.

Similarly, in Japan, digital education was irrelevant to current global demand. The country's digital education emphasises hardware solutions, but software skills in IoT, Cloud and AI were deemed not relevant and forgotten [72]. This created a mismatch and slowed the evolvement of digital talent for the country

Thus, it is imperative to note that digital infrastructure maturity is unparallel to digital talent development maturity. Therefore, to future-proof digital infrastructure maturity, digital talent development maturity has to correlate.

Adopters Lack Digital Talent Policies and Funding

The average DTD Maturity Score in Adopters is 4.85, which is considered fair. In fact, China is on par with New Zealand, and together with Malaysia, both countries outperformed Japan, a Frontrunner country.

Despite the varying scores, Adopter countries understand the value of digital talent in digital economy building. Hence, active initiative and investment are currently in-progress to cultivate the future of workforce.

However, these efforts are narrowed and insufficient to realize the ultimate growth of digital talent. For instance, the digital talent policies in adopters country are narrowed to the younger generation / fresh graduates but forego the marginalised community such as mid-career converters, women re-joining workforce and more. In terms of investments, these countries spends on average of 1-3% of government expenditure in digital talent.

DTD Maturity Score

ADOPTERS	
🇨🇳 China	5.8
🇲🇾 Malaysia	5.0
🇹🇭 Thailand	4.8
🇻🇳 Vietnam	3.6

Within the category, Thailand is an interesting case study. It was one of the first countries in the Southeast Asian region to embrace digital infrastructure. Back in 2018, the Kingdom launched a 20-year strategy to achieve its Thailand 4.0 aspirations.

However, digital talent development was less pronounced in the 20-year strategy compared to infrastructure building. The Kingdom's Digital Economy Promotion Agency developed a few initiatives from digital education to employment. Also, along with international enterprises (Huawei included), the Kingdom established some programs to upskill its nation with digital knowledge.

Despite the early head start, talent gaps remain wide due to a lack of funding. This report estimates that the Kingdom is likely to spend US$ 10-13 million on digital talent development in 2021[73], a small figure compared to other initiatives and its neighbouring countries' investments.

Moving on to Vietnam, the country is often deemed as the software developer hub in Southeast Asia.; it has an organic growth in digital talent. However, these positive sentiments have less to do with the government and more to do with cultural norms.

For instance, computer science is a favoured subject, but due to the low proficiency in English, it prevented Vietnam from being recognized for its digital talent like India.

Vietnam's 'The National Digital Transformation Programme'[74] goals has minimal emphasis on digital talent success. The program focuses on businesses, cooperatives, and business households that want to adopt digital transformation to improve their production, business efficiency, and competitiveness. Example of the goals are:

- 80 percent of online public services at level 4 to be online with access on mobile devices;

- 50 percent of banking operations by customers to be fully online;

- 70 percent of work and service records at credit institutions to be processed and stored digitally.

Thus, with a lack of government initiatives and investment to combat this shortfall, the Vietnam's DTD Maturity Score is lower than its counterparts.

In essence, Adopter countries show that a government's initiatives and investment in digital development can differentiate the pace at which a country achieves its digitalization initiatives.

Starters Rely on Private Enterprises to Drive Digital Talent

Starter countries are in the early stages of their digital infrastructure build-out. Some face geographical limitations, and others are hindered by economic wealth. Thus, the average DTD Maturity Score for the Starters category is 2.6.

Starter countries share 2 commonalities. First is the prioritization of infrastructure building and second is the reliance on foreign global enterprises to cultivate digital talent. As government policies and digital-related spend are concentrated in infrastructure, there are a gap in digital talent. This gap is often filled by foreign global enterprises, which require digital talent to meet their business objectives. Thus, it creates a harmonize scenario for Starter governments that leads to high reliance on such enterprises.

DTD Maturity Score

STARTERS	
Indonesia	4.2
India	2.8
Pakistan	2.2
Philippines	2.0
Bangladesh	1.8

Indonesia is an outlier. The country scores 60% higher than the category's average score. Amongst all digital talent development initiatives, Digital Talent Scholarship is one of the prominent ones in the country. The scholarship, established in 2018, has been cultivating digital talent and aims to create 9 million highly skilled digital talents by 2023 [75].

Indonesia also provides a dynamic and vibrant ecosystem for digital-native businesses (DNBs). The country's DNBs receive close to 30% of total start-up funding in Southeast Asia. Moreover, the government holds a close partnership with these enterprises to build digital talent there. For instance, Indonesia's collaboration with Tokopedia provides a certified internship programme for software engineering, marketing, and business development [76]

Governments from other Starter countries are less proactive in digital talent development. Some rely on commitments from private enterprises to narrow the digital talent gap in their country and sit out almost completely in activate participation in digital talent development.

An example is Bangladesh. The government famously launched the 'Digital Bangladesh' initiative a few years back in bid draw investment for digital infrastructure and to an extent digital talent. The government introduced policies and incentives such as 50% income tax relief for foreign talent importation, 100% profit repatriation and more [77]. However, that initiative was left dormant since 2019 without any replacement or active efforts. Government became solely dependent on international enterprises to invest in digital talent building.

Corresponding to the initiative, tech giants have taken the initiative to nurture digital talent since 2014, with Microsoft Corp. and Huawei among them. Microsoft Corp. helped over 60,000 Bangladeshi [78] gain digital skills through online learning courses from GitHub, LinkedIn and Microsoft, while Huawei intends to invest in scholarships, technology competitions, and digital skills training. However, the impact remain minimal in digitally transforming the Bangladesh. As a result, sole reliance on public-private partnerships alone is insufficient.

Thus, government intervention and active participation in digital talent development is a necessary piece to the whole puzzle of any country's digital aspiration.

Contrasts in the Three GCI Categories

Up to this point, the report has established that every GCI category recorded varying average scores in DTD maturity. Frontrunners, with advanced digital infrastructures, scored the highest on average, while Starters scored the least; outliers are present in all categories.

Despite varying scores between countries in each GCI category, there are general characteristics that can represent each category. They are as follows:

1. Frontrunner
   a. Government digital-talent-related policies are driven and collaborated through a few ministries within its government agencies
   b. Initiatives created are of wide coverage – ages, stage of career, skillsets
   c. Emphasis on a government's active involvement in public-private partnerships; leverages metrics to measure and review its efficacy
      i. In Singapore, before a grant is approved, government agencies will interview and set KPIs for each enterprise. To receive grant claim, enterprise will be required to submit performance review, in accordance to the initial KPI, at the end of the committed program [79]

2. Adopters
   a. Government relies on a handful of government agencies to drive policies and programs – limited ministerial involvement and collaboration
   b. Fiscal investment in digital talent development is low compared to the total government expenditure and is limited by geography
      i. In Malaysia, Digital Nasional Berhad (DNB), Malaysian Investment Development Authority (MIDA) and Multimedia Development Corporation (MDEC) have similar digital goals. However, three of these agencies seem to be operating in silos with limited joint-initiatives.
      ii. Malaysia spends less than 1% of its government expenditure on digital talent building. [80] [81]

3. Starters
   a. Government relies on international private enterprises to develop digital talent in its country, and government involvement is limited.
   b. Insufficient digital talent fiscal investment per capita.
   c. Narrow policies and initiatives – often neglecting varied career phases, ages, skillsets and geography.
      i. The case of Bangladesh, as mentioned above, show a valid example of high reliance on foreign enterprises to build digital talent in its country, which is unsustainable. This can neglect marginalized group of citizen if they do not benefit the foreign enterprises' agendas.

Digital Talent Development – Singapore vs. Malaysia vs. India

	FRONTRUNNERS	ADOPTERS	STARTERS
	🇸🇬 Singapore	🇲🇾 Malaysia	🇮🇳 India
DTD Maturity	8.4	5.0	2.8
Number of digital talent related policies & initiatives	40+	15-20	< 10
Level of public private partnership establishment	High	Low	Mid
Digitally skilled worker as % of country's workforce	8%	6%	12%
Gov. spend on DTD as % of total gov. expenditure	8%	1%	< 1%

*percentage figures are rounded up to the nearest whole number

Figure 2.4: DTD Maturity vs. 3 selected Countries

Amongst all countries, Singapore leads in DTD maturity.

As an island state, the country has shown serious commitment to building digital talent, and as a result, Workforce Singapore supported close to 100,000 Singapore citizens finding employment in 2020 alone [82]. This includes citizens in all career stages, from fresh graduates to mid-career converters.

Aside from Workforce Singapore, multiple other government agencies played a role in cultivating digital skills. One of such is Infocomm Media Development Authority (IMDA). The statutory board established Singapore Digital Scholarship for scholars, Professional Conversion Programme for mid-career converters [83], and TechSkills Acceleration [84] – a PPP for all professionals.

Not limited to education, Singapore is investing in digitalizing its local business and attracting global enterprises to expand the operations in its country. Such initiatives ensure that digital talent cultivated by the country will find future-proof career paths that suit every person's level and needs.

Although digital talent development has a long way to go in its country, Singapore has started to benefit from its commitments. For instance, Singapore households are the wealthiest per capita across the Asia Pacific, recording at US$ 136,780, according to a global wealth report by Allianz [85]. This figure increased two-fold in the past decade in concurrence with the country's digital infrastructure and talent strategy.

In contrast to Singapore, Adopter country Malaysia and Starter country India recorded US$ 11,541 and US$ 1,282 household wealth per capita [85], respectively. Though geographical, infrastructural and governance played roles in these numbers, the lack of robust digital talent policies and initiatives denies their people a better future.

Thus, digital talent development is no longer imperative solely for a country's digital infrastructure evolvement, but it is equally important in economy and nation-building.

Building a Sustainable Digital Talent Pipeline

Over the next decade, emerging technologies such as 5G, Cloud Computing, Big Data, AI, IoT, and Blockchain are poised to dramatically reshape economies. This ongoing process will lead to significant changes in how people work, with existing job roles either becoming obsolete or requiring new skills. In this context, governments need to lead the way and work closely with industries (demand) and academia (supply) in terms of planning for the development of their local talent population.

As pointed out in the earlier chapters, demand for talent will continue to outstrip supply. The competition for scarce top digital talent will become increasingly intense. While the leading APAC economies have already started their talent pipeline building initiatives, there is generally still a lack of cohesiveness in policies and strategies. In addition, traditional talent development approaches, such as talent review and training, are slow, tedious, and expensive in nature. As such, new learning and development approaches are happening at both the national and industry levels to reshape digital talent along with corresponding goals and plans.

In the sections below, an introduction for a new digital talent management framework will be put forth and discussed, before moving on to recommendations for sustaining the APAC digital talent development movement.

In the digital era, talent capabilities have changed significantly. More emphasis is placed on talent skillsets including analysis, creation, practice, and intelligence-based skills. Talent must also be able to adapt to internal and external collaborations that lead to self-built teams and a matrix way of working. Faced with the challenges of knowledge explosion and a diverse range of capability requirements, a systematic digital talent development framework will provide useful guidance for national policies formulation, as well as industry organizations' talent workforce management.
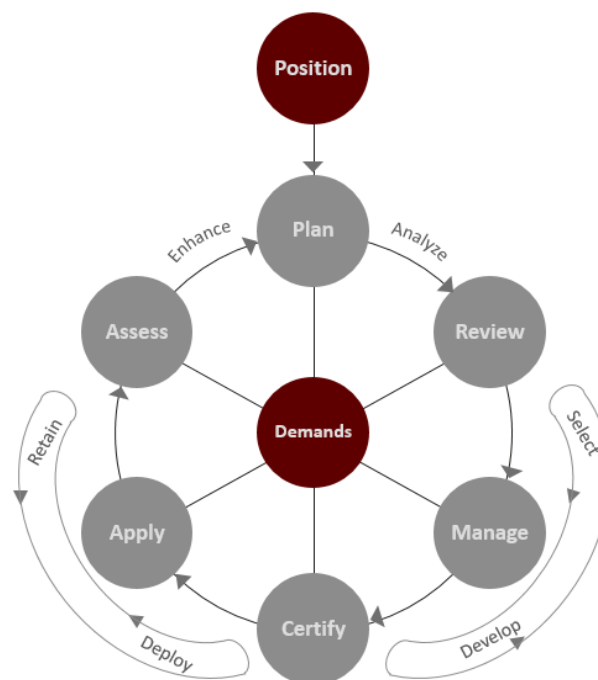
By referring to The Open Group Architecture Framework (TOGAF), this report provides a unique, six-dimensional talent development framework as shown above. This framework begins with the organizational talent positioning strategy and focuses on talent demands. It defines six

dimensions (talent planning, review, management, certification, application, and assessment) and provides some empirical suggestions

The Talent Development Portfolio - Solutions for Digital Tomorrow

Talent Planning, Review and Management

As talent management, development, and enablement practices are continuously enhanced, and new ways of working becomes more prevalent in companies, talent management methods also need to continually evolve to combine the best of both internal and external talent resources. Hence, talent planning and review require a good grasp of the demand and supply forecast of digital talent within the economy, which are two important aspects in talent development, playing a fundamental, guiding, and global role in building the digital talent team.

Hence, talent planning and review require a good grasp of the demand and supply forecast of digital talent within the economy, which are two important aspects in talent development, playing a fundamental, guiding, and global role in building the digital talent team. Talent forecast first involves gathering data from various sources such as labor employment statistics, surveys, new infrastructure investment, enterprise recruitment, and graduates with related major in each area. Such data are typically huge and varied, which would require performing analysis using a big data platform and running the data against a model trained on previous employment data.
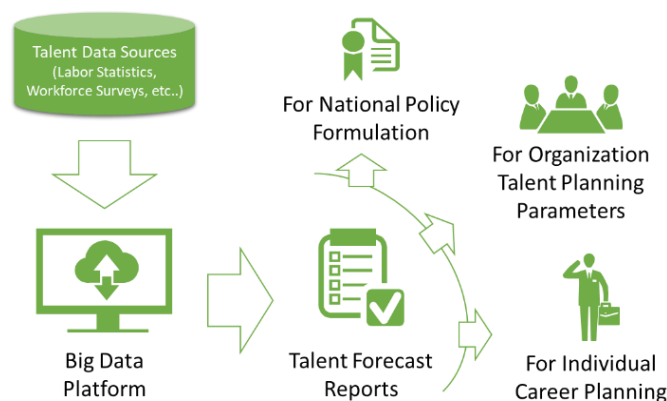
This forecast report should be made accessible to the public, which would provide useful information for different stakeholders: for governments to strategically plan national talent policies, for organizations to scientifically formulate and accurately implement their own talent policies for high-quality talent recruitment and re-skilling, and also for individuals such as fresh graduates considering their future career prospects or mid-professionals deciding on their area of specialization.

Certification Programs: Mechanism for Enhancing Employability

Talent Development, Certification, Deployment, and Assessment

In the digital era, the business environment is complex, volatile, vague, and full of uncertainties. Therefore, the entire ecosystem balance between government, industry organizations and academia institutions will continually and dynamically change. Hence, the issue at hand is not only about the right talent with the right capabilities, but also the talent potential to learn new capabilities, i.e. whether they can adapt to an ever-changing environment, continuously grow, and take on new roles. This would require a comprehensive training and talent certification system to impart trainees with the necessary new skills and also ascertain their grasp of the core knowledge areas.

Industries have a huge demand for digital talent, especially at the early stage of digital transformation. Therefore, multiple technical means are required to meet these requirements.

A holistic digital talent assessment system ensures the quality of talent development. Generally, the following three aspects are considered:

1. Developing a career and job survey system and regularly conduct surveys for various enterprises in the digital domain.
2. Collaboration between government-industry organizations-academia to develop professional competence standards for digital talent, and guiding the development of academic and continuing education courses, and training materials and solutions.
3. Establishing a certification system for each typical job, including certification courses, examinations, and authorized organizations
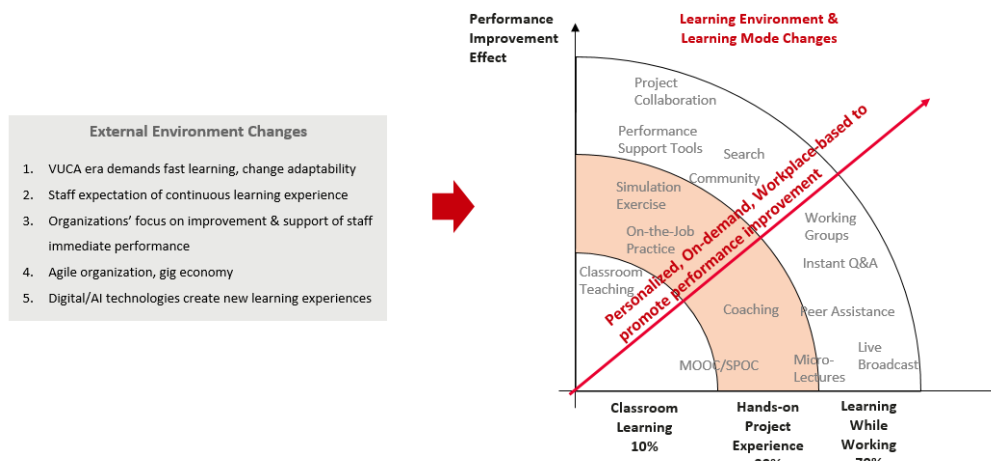

Figure 3.1: Learning Environment & Learning Mode Changes

Using Huawei as example, as a leading technology vendor, Huawei has accumulated domain expertise in the latest digital technologies. The diagram below illustrates Huawei's expertise in

5G technologies, gained through participation and collaboration in 5G projects in multiple industries. As a result, Huawei has developed deep understanding of the capability requirements for jobs in the industry, translating into partnerships with national governments to define national talent capability standards, develop education courses, textbooks, solutions, and examination questions based on the 5G capability certification, and launch certification systems for different level and groups of people by cooperating closely with Government Agencies, Industries, and Academy Sector.
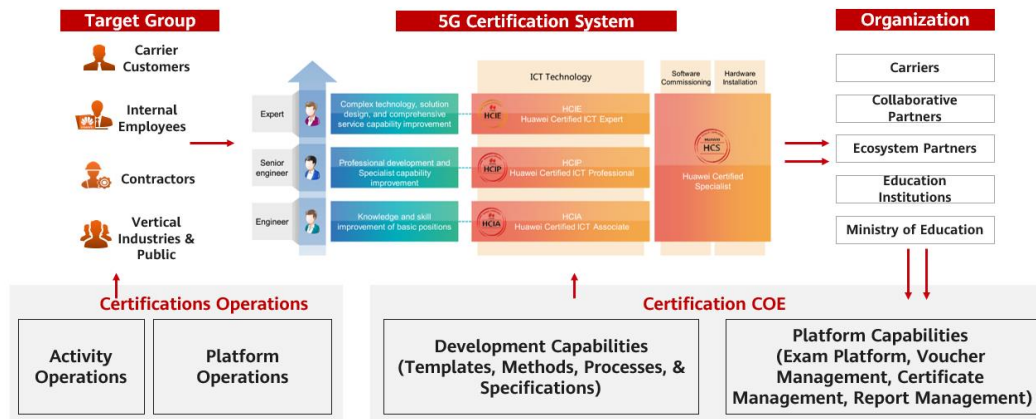

Figure 3.2: 5G Certification System Capability System

Deploying and Adopting New Technologies for Training Efficiency Improvement

The traditional toolkit for human resource development — combining performance reviews with lecturing and trainer-led learning methods — has multiple weaknesses

1. No systematic training targeting specific jobs
2. Lack of extensive, comprehensive training
3. Lack of knowledge application in scenarios
4. Trainer-centered lecturing
5. Insufficient case studies
6. Assessment based on trainees' feedback on mastery of the content

This model is slow, tedious, and inflexible. The fast, wide transformation in the digital era requires a change in the learning and development model, for example, from the qualification accountability system to the learner responsibility system, creating a learner-driven culture, and deploying a large-scale (digital) learning system to achieve

In the future mode of learning, more emphasis will be put on talent evaluation and development in interactive scenarios and using digital methods to strengthen self-assessment. Knowledge maps are introduced in online learning to help trainees better understand training content and motivate them to learn. Training, practice and review methods have been widely used in scenario-based training design. The output framework is also evolving

self-organized instant learning (see diagram below).

based on customer value and talent development efficiency
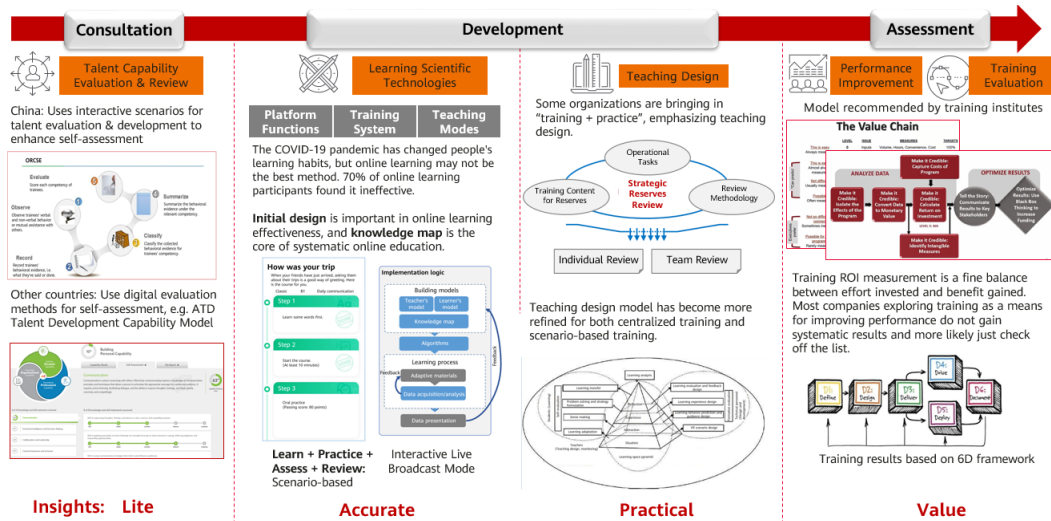

Figure 3.3: Future Learning and Development Approach

The above future's learning and development (Figure 3.3) will become light, accurate, practical, and value-based. New technologies improve the efficiency of training planning, development, and delivery, and bring obvious benefits, for example:

1. Trainees can control the time and location of their learning
2. Trainees can access knowledge and expert systems when needed.
3. VR, AR, and simulation technologies help present a workplace-like learning environment.
4. Trainees can choose the types of media (print, audio, video, etc.) used in their training plans.
5. Course sign-ups, examinations and training records can be processed electronically, reducing paperwork and time.
6. Trainees' performance during training periods can be monitored

In the next section of this report, key insights of Digital Talent Development Cases across some of the member countries in Asia Pacific Region will be discussed.

Cases and Practices in Digital Talent Capability Building

Industry participation in digital talent development is crucial. Below is an example of a digital talent ecosystem illustrating how an ICT solution provider such as Huawei in working with various Government agencies, Industry and Academia in Asia Pacific to develop the digital talent capability. It illustrates the importance of collaboration and systematic planning of talent demand and supply.
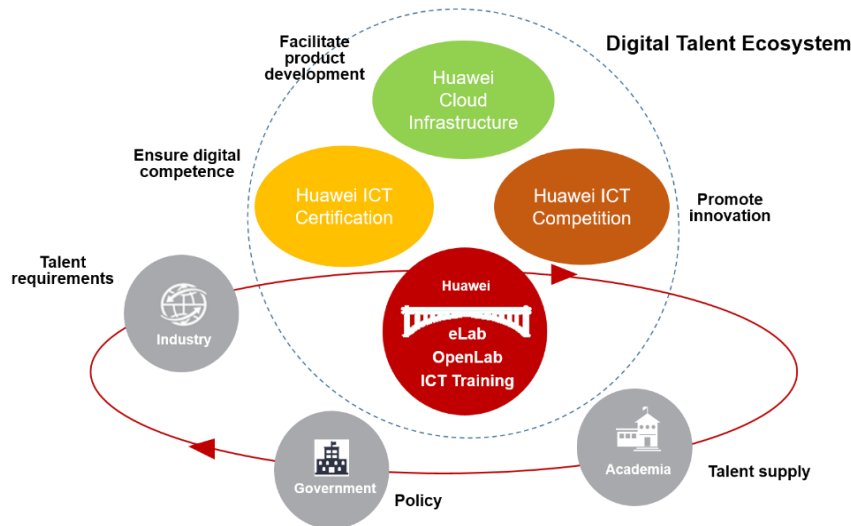

Figure 3.4: Four Key Elements of Digital Talent Ecosystem

There are 4 key elements in the digital talent ecosystem worth to highlight.

1. Huawei, as an example here, collaborates with other key stakeholders such as Government, Universities, Industry, Telecom Operators and Enterprises to identify the digital skills required and develop the curriculum addressing the skills gaps of the countries. The training can be delivered by Huawei's Authorized Learning Partners (HALP) or Huawei.

   The practical element is important. There is a significant investment in the eLab and OpenLab with which students can practice their digital skills.

2. To support SME to drive rapid development, cloud infrastructure is offered to SME and Start-ups to develop applications, software, product and services using the latest tools and at the same time enhance their digital skills.

3. To promote rapid innovation, ICT Competition is organized regularly as a platform for innovators to develop, submit and compete with innovative services, products and solutions. This is a great platform to share experience in innovation.

4. Different levels and types of ICT Certifications are developed and available to ICT practitioners to ensure they are equipped with the right competence to perform their roles and increase employability.

Below are 6 examples of digital talent development programs in some APAC countries where Government, Industry and Academia collaborate to develop digital talent to narrow the demand and supply gap.

Singapore IMDA Digital Talent Development Initiative[86]
Accelerating Singapore's Digital Economy through Growing and Upskilling the Talent Pipeline

Singapore, ranked number 2 in GCI score in 2020, continues to show strengths in recovering from COVID-19. The key contributors definitely include their focus on talent, business capabilities and ICT infrastructure.

The Infocomm Media Development Authority (IMDA) leads Singapore's digital transformation with infocomm media (ICM). To do this, IMDA will grow a dynamic digital economy and a cohesive digital society, driven by an exceptional ICM ecosystem — by developing talent, strengthening business capabilities, and enhancing Singapore's ICM infrastructure.

Technology Professionals Continue to be in High Demand

In Singapore, digital and technology remain an area of opportunity for good jobs, and employment continued to grow in FY2020 by almost 4% from FY2019 despite the economic downturn.

From 2016 to 2020, the number of tech jobs in the economy grew by almost 20%. The continuous supply of digital talents through various talent development programs shall ease the demand and supply gap.

2022 ASIA PACIFIC DIGITAL TALENT INSIGHTS
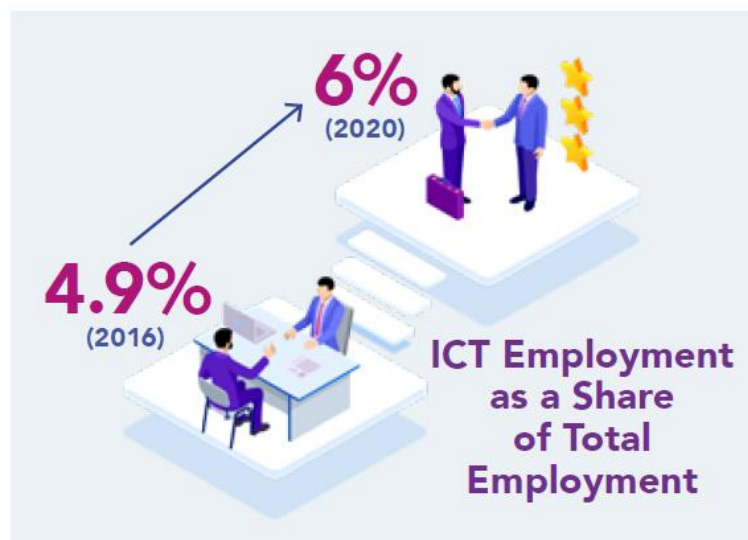
Holistic Approach in Talent Development

Speaking about Singapore talent development programs, it is very comprehensive and well-thought covering different types of workers across different industry sectors and citizen of all ages.

Below are some of the programs led by IMDA, which worth to be discussed.

1. SMEs Go Digital Programme is a major effort to support SMEs to build strong digital capabilities. About 40,000 SMEs benefitted from the programme in FY2020 alone, a threefold increase from FY2019.

2. Silver Infocomm Initiative (SII) enpowers seniors aged 50 and above to actively engage in the digital age through classes and workshops on IT awareness and literacy.

3. The TechSkills Accelerator (TeSA) is a tripartite initiative by the government, industry and the National Trades Union Congress (NTUC), to build and develop a skilled Information and Communications Technology (ICT) workforce for the Singapore economy, and to enhance employability outcomes for individuals. IMDA takes an integrated approach to ICT skills acquisition and practitioner training - in core ICT skills and in sector-specific ICT skills - and enhance employability outcomes through place and train programmes, and career advisory services.

4. STEM curriculum is being fine tuned to nuture future technology professionals through strong collaboration with the Ministry of Education (MOE).

5. 5G reskill programs are developed to support the 5G rollout. Singapore is forging ahead to realise its vision for a world-class, secure and resilient 5G infrastructure, a critical enabler for the growth of the digital economy. IMDA partners with the telecom operators to hire and reskill 1,000 professionals in support of Singapore's 5G rollout.

Case contributed by IMDA

Malaysia CENTEXS International ICT Certification Program[87]

Advanced Digital Training Lab and 5G Testbed to Nurture Use Cases

To spearhead the digital transformation to advance Sarawak's economy and reduce reliance on natural resources, Sarawak Digital Economy Corporation (SDEC) was set up to drive the Sarawak Digital Economy Strategy from 2018 to 2022. The strategy is supported by seven enablers consisting of digital infrastructure, digital skills and talent development, research and development, digital innovation and entrepreneurship, digital and data, cyber security and digital government.

The Centre of Technical Excellence (CENTEXS) was established in October 2014 to train and upskill the young generation to meet the technical requirements of the State industries focusing on the trade of oil and gas, Electrical & Port, Construction and Textile & Hospitality.

ICT Talent Development for the State Digital Economy
Since December 2017, CENTEXS and Huawei work together to promote digital training and establish a digital lab, as part of the efforts to equip the youth of Sarawak with ICT knowledge and experience. With this partnership, CENTEXS is the first Huawei's Authorized Learning Partner with end to end ICT infrastructure development capability in South East Asia, not only for local but also for ASEAN.

With the support of Huawei, CENTEXS offers Huawei certifications and specialist programs covering wireless, microwave, fiber, data center, telecom energy hardware installation and set up a digital lab for high school graduates. In addition, Huawei also offers the iLearning cloud platform to improve the way students are taught.

The 8,000 square feet digital training lab is equipped with indoor and outdoor practical sites designed for digital infrastructure specialist programmes covering wireless, microwave, fibre, data centre and telecom energy hardware installation.

The Sarawak CENTEXS-SDEC 5G test bed and Huawei Advanced Training Programme (Certified ICT Associate), CENTEXS Open Lab, Augmented Virtual Reality (AVR) Training Lab 2020 were launched on the 14 Aug 2020.

Showcasing Smart Farming enabled by 5G

Case contributed by CENTEXS

Thailand EEC Digital Talent Development Program[88]
**Partnership between Government and Huawei**

As one of the founding members of ASEAN, Thailand has always hoped to enhance its status and influence in the region. In 2016, Thailand announced the Thailand 4.0 initiative with the objective of transforming the country with innovative and value-based industries. More than anything else, this big initiative requires talent.

EEC (Eastern Economic Corridor) is located in the eastern coastal area of Thailand and is the core area for implementing the "Thailand 4.0 Strategy." In March 2021, Eastern Economic Corridor Office (EECO) and Huawei signed a Memorandum of Understanding (MOU) on Digital Talent Development and Collaboration. The event also marked the opening of Huawei ASEAN Academy (Thailand) EEC Branch.

Working with EECO, the ASEAN Academy in EEC will start to provide training programs focusing on SME in November, 2021. The goal is to support the Thai industry to train 3,000 SME in 2021 and a total of 30,000 ICT talent between 2021 and 2024.

EEC & Huawei Digital Talent Development Program (DTD) Objectives in the coming 3 years:

3 Years Frame: EEC & Huawei Digital Talent Development Program
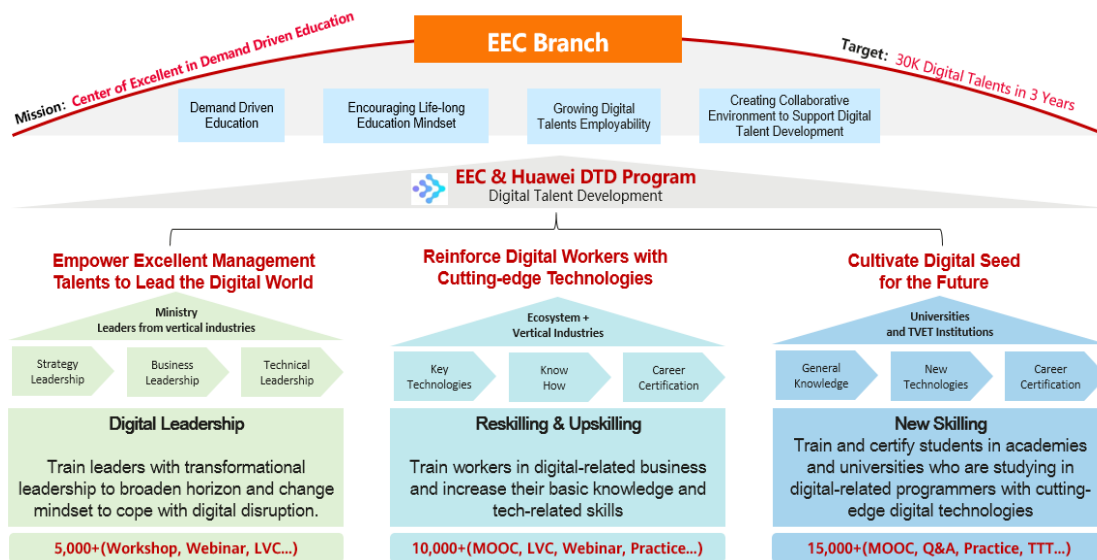
Besides EEC collaboration, Huawei has signed digital talent development agreements with many other government departments, universities, and enterprises in Thailand, and is fully committed in the development of digital talent ecosystem to support Thailand 4.0. The Huawei ASEAN Academy will provide trainees with cutting-edge ICT technologies and industry best practices, covering key technologies such as 5G, Cloud, IoT, Big Data, AI, cyber security, and digital leadership.

Case contributed by EECO

Indonesia Telkom ITDRI Program[89]
Collaborating to Build Digital Capability for Indonesia

Indonesia aims to be among the top 5 largest economy in the world. Innovation capability, technology and digital talent will play the vital roles in this journey.

To support this effort, ITDRI (Indonesia Telecommunication and Digital Research Institute) was established by Telkom Indonesia under the direction of the Ministry of State Owned Enterprises (MSOE) to help SOEs accelerate digital capability development in terms of digital talent readiness and innovation. ITDRI hopes to play a key role as a hub for all integrated elements in the digital ecosystem to drive research, innovation, and the development of global-ready digital talents.

ITDRI believes that an integrated process is necessary to accelerate the process toward Indonesia's technology leadership. While talent development is absolutely essential, equally important is continuous innovation based on in-depth research. With this in mind, ITDRI has developed an ecosystem that consists of three pillars, namely, Research Institute, Digital Academy and Telecommunication & Digital Capability Center.

ITDRI Operating Model
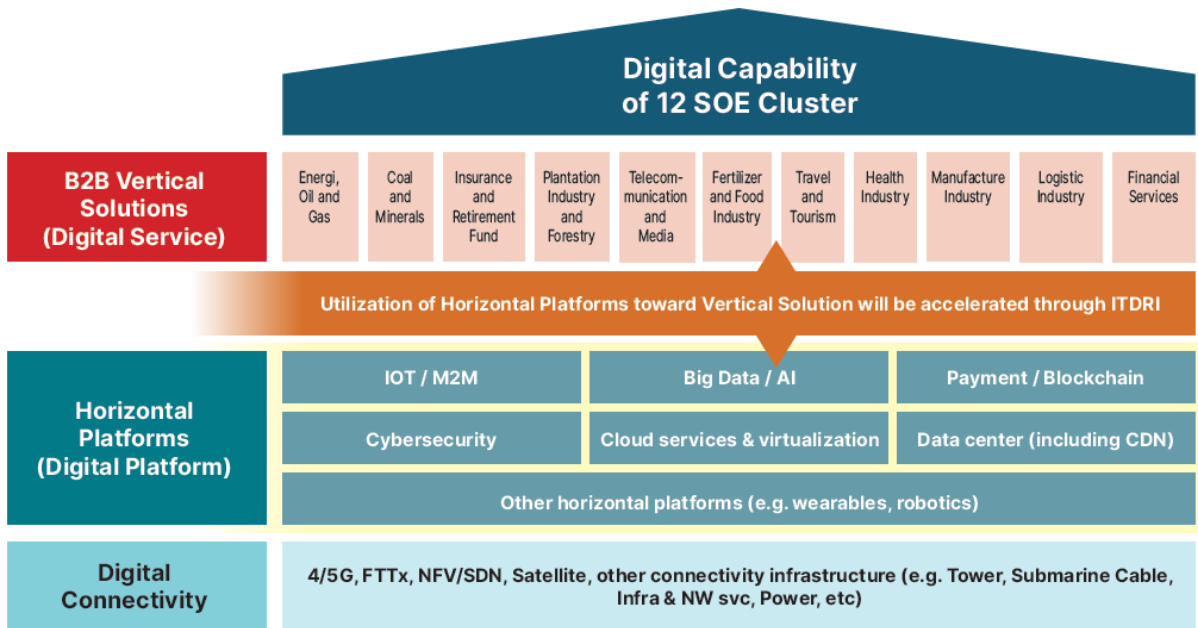
ITDRI targets three outputs:

- Applicable research results

- Ready digital talents

- Proven innovations
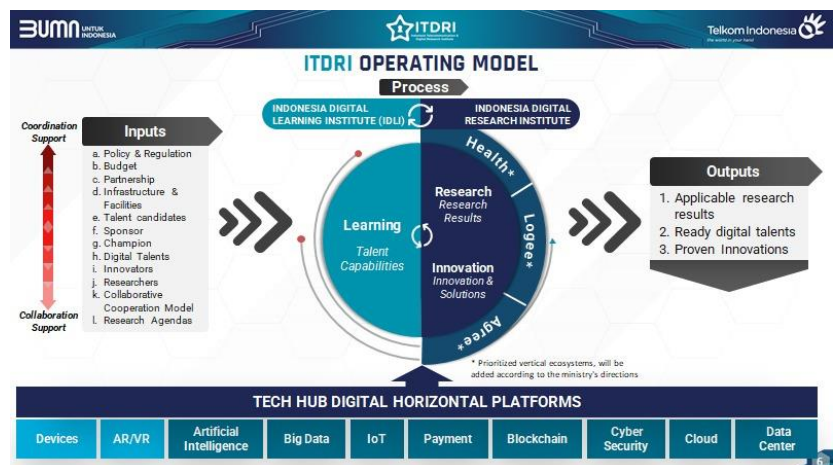
Collaboration is key to the success of ITDRI's research and innovation. ITDRI wants to collaborate with key stakeholders, which consist of government institutions, businesses comprising 12 SOE clusters, academics, communities, and technology providers. These partners will play the vital roles of research & innovation partners, enablers, and sponsors.

The goal is to support the 12 SOE Clusters to develop their digital capability which includes digital talent, research, and innovation so the 12 SOE cluster can be more focus on specific vertical solution in more effective and timely manner.

Digital Capability of 12 SOE Cluster

B2B Vertical Solutions (Digital Service)	Energi, Oil and Gas	Coal and Minerals	Insurance and Retirement Fund	Plantation Industry and Forestry	Telecommunication and Media	Fertilizer and Food Industry	Travel and Tourism	Health Industry	Manufacture Industry	Logistic Industry	Financial Services

Utilization of Horizontal Platforms toward Vertical Solution will be accelerated through ITDRI

Horizontal Platforms (Digital Platform)	IOT / M2M	Big Data / AI	Payment / Blockchain
	Cybersecurity	Cloud services & virtualization	Data center (including CDN)
	Other horizontal platforms (e.g. wearables, robotics)		

| Digital Connectivity	4/5G, FTTx, NFV/SDN, Satellite, other connectivity infrastructure (e.g. Tower, Submarine Cable, Infra & NW svc, Power, etc)

Telkom ITDRI model illustrates the importance of collaboration among all key stakeholders in the digital ecosystem to build sustainable digital capability and digital talents to realize the vision of Indonesia.

Case contributed by

Chairman of ITDRI Jemy V. Confido

Sri Lanka NAITA Technical and Vocational Education and Training Program[90]
Advanced Facilities for In-house and Outdoor Practices

The National Apprentice and Industrial Training Authority (NAITA) was established in 1990 to provide industrial training for apprentices who completed the in-house training under TVET sector. Since then, NAITA has been working with more than 18,000 industries to provide industrial training for youth to acquire employable skills through well formulated skills programs with highest professional Standards to meet the skilled manpower requirement in the industry.
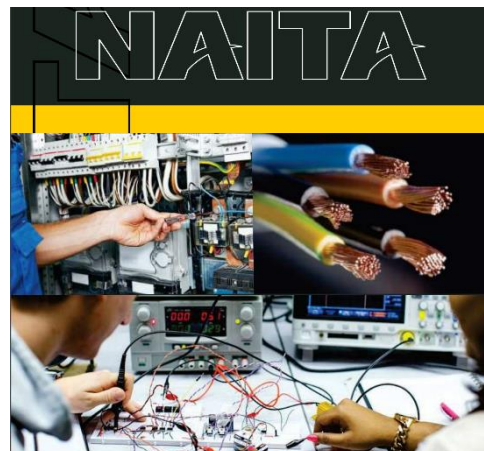
NAITA and Huawei Collaboration

NAITA and Huawei join hands to train Telecommunication Technicians to suit today's world.

The first advanced training course for telecommunication technicians, jointly organized by NAITA and Huawei, took place on April 16 2021 at the Training Centre, Orugodawatte.

Huawei has taken further steps to establish a state of the art laboratory with extensive facilities for in-house and outdoor practical training to facilitate this advanced telecommunication technician course which started off with 30 new technicians in the field.

Partnering with Huawei, NAITA targets to training 300 youth annually with On-site Engineer practical skills.

Huawei officials presented technical demonstrations to Minister of Education and State Minister of Skills Development, Vocational Education, Research and students.

To support the industry requirements, Huawei will continue to expand its ICT talent development program to further strengthen the ICT knowledge and skills of digital talents in Sri Lanka.

Case contributed by NAITA

China Digital Talent Development [91] [92] [93]
Investing in Digital Infrastructure and Digital Talent Pipeline to Create Digital Opportunities

Successful digital talent building is more often than not, dependent on the systematic planning and execution of a comprehensive talent strategy. This involves not only organizations' own talent strategy, but also talent development direction at the national level. Yet, there is still a lack of clarity for all involved stakeholders in terms of crafting the right talent development path.
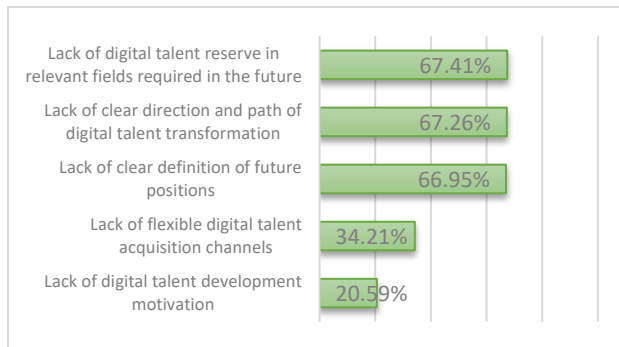
Industry Perspective: Talent Challenges

In a recent industry talent survey conducted by Huawei, the lack of talent reserves to drive future ambitions has been flagged as the top challenge facing industries. This is followed closely by another two challenges highlighting the uncertainty in building the right talent: clarity in the direction and path of transformation, and the definition of future positions.
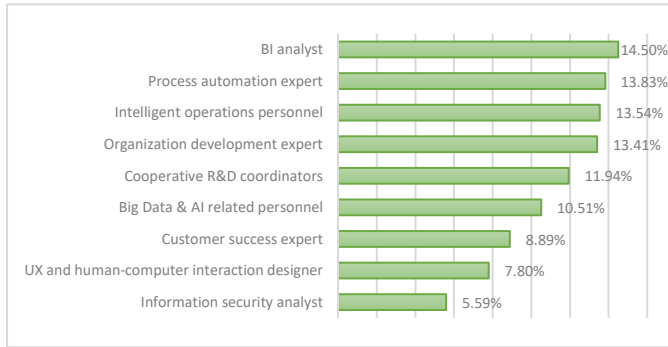
This lays bare the fact that many organizations have difficulties in translating their traditional hiring practices to match the demands of the digital age. As a result, it is imperative for governments to step in at the national level and set the overall direction to boost their local digital talent pool.
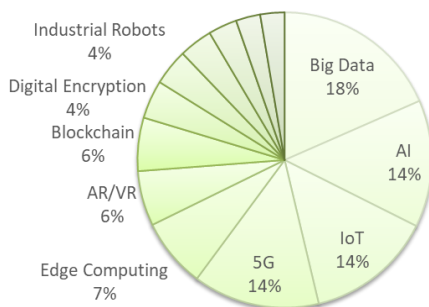
Industry Perspective: Critical Digital Skills and Jobs in Demand

This then brings the focus to another important question: What type of skills do industries need to continue thriving in the digital age? This can be glimpsed from the same survey result. It is no coincidence that the TOP 5 desired digital technical skills are all important technologies which revolve around "data".

Big data topping the list for all industries confirms the trend of data becoming the new gold across the pan-industry. To truly utilize data, companies need to accumulate data, process it into information, and extract insight from the information. This would enable businesses to improve their overall operational capabilities. Obtaining data is the first step and Internet of Things (IoT) provides a huge source of rich data. Combined with 5G and Edge Computing, these data can be collected and transferred to a centralized Cloud Computing infrastructure to store massive data. The huge computing power also drives the continuous analysis on a Big Data platform and processes the data into information. Artificial Intelligence algorithms can then transform this information into intelligence, and use machine intelligence to realize the automation and intelligence of enterprises.

Job Role	Percentage
BI analyst	14.50%
Process automation expert	13.83%
Intelligent operations personnel	13.54%
Organization development expert	13.41%
Cooperative R&D coordinators	11.94%
Big Data & AI related personnel	10.51%
Customer success expert	8.89%
UX and human-computer interaction designer	7.80%
Information security analyst	5.59%

In terms of the job roles, a similar pattern is observed, where the top roles in demand have work functions related to understanding and application of data/information into use cases, such as analyzing business data (BI analyst), analyzing process information and automating known business scenarios (Process automation expert), and even intelligence-enabled operations (Intelligent operations personnel).

Of note, even though Big Data & AI related personnel is most commonly associated with data, this was a less chosen option. This could be due to the fact that China has been a forerunner in these technology domains, hence the demand for talent could have moved from roles such as AI algorithm researcher and big data platform maintenance engineer, to more service function and use case-oriented roles appearing at the top of the list.

Government Perspective: China's Digital Technology Investment and Talent Cultivation Strategy

It is no coincidence then that these technology domains have been highlighted in China's 14th Five Year Plan (2021-2025) as the country strives to transform from a cost-driven competitor into an innovation-driven powerhouse. China's Ministry of Industry and Information Technology has announced plans to guide and support local enterprises to make breakthroughs in the research and innovation of these core technologies. This includes a 7% annual growth in R&D investment, which would propel China to the top in terms of worldwide R&D investment.

In terms of digital talent development, China has set the following initiatives as part of the Five Year Plan:

- Developing more world-class strategic talents and leading figures in science, technology and innovation teams.

- Fostering reserves of young scientists and engineers with international competitiveness, developing and discovering talents through major scientific and technological tasks and major innovation bases, and supporting the establishment of post-doctoral innovation posts.

- Strengthening the training of innovative, skilled, and application-oriented personnel.

- Implementing a more open talent policy, providing excellent research and innovation environment, improving support systems to attract foreign talent.

China's Initiatives and Rapid Expansion

The World Economic Forum has noted that high levels of government spending and foreign investment have enabled China to roughly double the size of its economy every eight years since the introduction of economic reforms in 1979.

With the renewed focus on key technology domains, the Chinese government has set the stage in terms of defining its technology blueprint which offers clear direction and stability for industries to expend efforts in innovation and R&D. At the same time, China's investment in the digital infrastructure and digital talent pipeline promote positive externalities and encourage organizations to jump onto the digital bandwagon, which will generate more digital development opportunities for existing and fresh employees. This will in turn provide the impetus for the local digital talent pool to flourish.

Recommendation for sustaining the APAC Digital Talent Development

The Digital Transformation comes with a lot of challenges to many countries in Asia Pacific region. It brings innovation to all sectors not just for the ICT sector alone but cutting across different vertical sectors such as Banking and Finance, Oil and Gas, Public Sector and others. The new disruptive and emerging new ICT technologies, together with the slow adaption rate, lead to widening of the digital skill gap between three different groups: digital leaders, digital professionals and digital users. It is necessary that each group have the right skill sets and proficiency levels in order to deal with the fast-changing trends in the digital transformation process.

The main takeaway is that member countries of the Asia Pacific region can benefit from emerging opportunities in the Digital Transformation but will need to upgrade its value proposition in ICT based on a clear offering of good quality and agile digital talents at competitive costs. However, the growing rate of turnover and the lack of highly specialized resources, correlated with an increase in salaries can negatively impact the competitiveness of Asia Pacific countries especially from Starters, and Adopters category. Frontrunners will have a better foundation with necessary policies, tools, human capital to maneuver and control these impacts. While upskilling and reskilling using vocational training as the main tool, 'Starters' and 'Adopters' countries will need to target more complex technologies and premium specializations in the value chain to break the current pattern.

Thus, in order to come up with the recommendations listed below, we have based our analysis on the dual approach used for the study, the Data Insights from Huawei Global Connectivity Index (GCI), the Digital Skills Matrix platform results, and Asia Pacific Digital Talent Hiring landscape, along with the 15-points checklists, recommendations. The following recommendations are classified according to two main categories.

The first one is Direct Recommendations (Immediate Actions), meaning reform areas that can be identified directly or which can be considered as being on the front burner. The second category includes 'Areas for Discussion, where reforms require further policy dialogue, data mining, discussions and consultations with relevant stakeholders in order to build strong public and private policies.
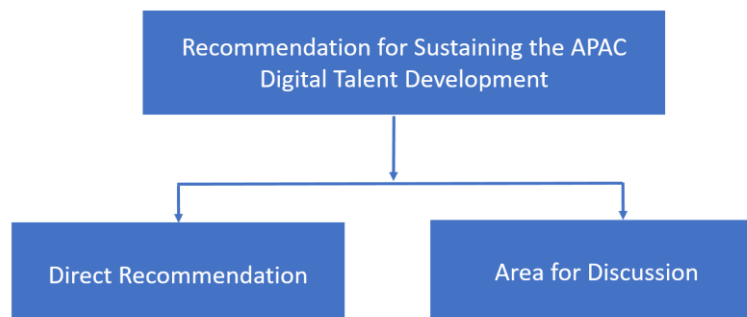
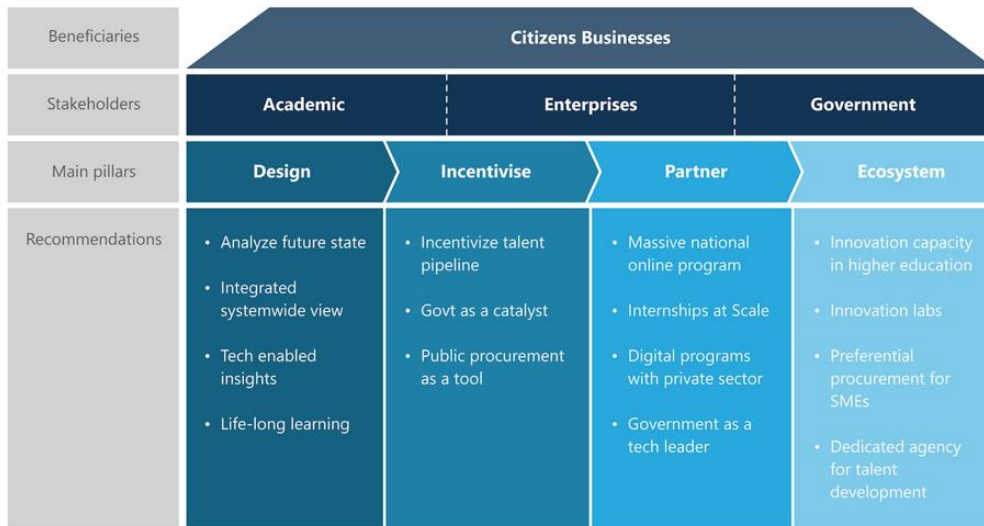# Four pillars and a 15-point checklist to transform workforce development

Figure 3.5: Four Pillars and 15-Point Checklist Workforce Transformation

Right now, we live in the era of unprecedented technological change and disruption. Creating and sustaining jobs will be the number one priority for governments in the coming decade. This will be crucial to ensure economic growth and transition economies into the digital era.

Any digital talent development framework needs to address the five challenges and build an inclusive society that can reap the benefits of this "new future world of work.

Our recommendations are around four distinct pillars, viz., Design, Incentivize, Collaborate and Ecosystem (DICE), and lead us to a 14-point checklist that governments can use to work towards embracing a best-in-class program

Design

1. Analyse the workforce, determine their future needs and the gap between the needs of today and tomorrow and develop a National Skills Framework together with Industry to highlight the skills in demand for now and future.

2. Create an integrated systemwide view of all agencies involved in workforce development and establish concrete goals. Involve Private Sectors in the coordination and development of Digital Talent Policies and Initiatives that target group of unemployment, youth, and graduates.

3. Joint-Design cooperation with Universities in the design and development Emerging ICT curriculum programs as part of the integration into degree/diploma programs.

4. Provide a foundation digital upskilling system for citizen career-planning (navigating the career options) and lifelong learning.

Incentivize

5. Incentivize employers for building the talent pipeline and job creation (as compared to just job creation currently).

6. The government takes the lead to incentivize citizens, enterprises and educational institutions. It also acts as a catalyst to kickstart every initiative.

   i. Incentives for citizens to garner digital skills (e.g., Frontrunners, such as Singapore provide, no-strings-attached grants to citizens to pursue skill development).

   ii. Incentives in the form of reimbursements, tax reliefs, and grants for employers to invest and support in digital programs (e.g., South Korea established a US$2 billion grant to support AI education and innovation in the semiconductor industry).

   iii. Incentives for training and hiring the marginalised workforce (special grants and support for companies hiring women, mid-career employees in transition, etc.).

7. A public procurement policy to support companies who invest in the national talent development programs (companies get credits during tender evaluation for investments made in supporting national talent development initiatives).

Partner

8	Develop a National massive online (MOOC) national program in partnership with universities and technology giants to address large skill gaps in specific areas with ambitious targets (e.g., NASSCOM – a not-for-profit organisation in India has partnered with the government and IT industry to offer free/subsidised programs, viz., "National Skills Prime", encompassing ten emerging technologies, including certifications).
9	Partner with enterprises to scale emerging ICT Technologies internships programs that help build a digital talent pipeline — both for the company and the nation level:

> i. Incentivize companies to offer internship programs to fresh graduates as well as experienced senior candidates
>
> ii. Develop industry-specific internship programs in partnership with universities (e.g., NTU in Singapore offers an internship in International Trading targeted at the commodities industry to develop industry-ready talent

10	Establish digitally relevant & emerging ICT certified programs in partnership with leading technology giants and universities to develop talent for the specific needs of the industry (e.g., INTI International University & Colleges in Malaysia partnered with IBM to introduce the IBM Innovation Center for Education (ICE) program, which offers a series of undergraduate programs to develop employable students). Setup teachers cultivation training programs for emerging ICT programs in the areas of AI, Big Data, Cloud, 5G, and IoT.
11	Fund innovation capacity in higher education (e.g., The European Union, through its European Institute of Innovation & Technology, set aside funds to drive 23 pilot projects that look to improve entrepreneurial and innovation capacity across institutes over a period of 2 years)

Ecosystem Development

12	Establish the government as a leading adopter of technology, attract the best talent pool and set the pace for the rest of the country. (e.g., South Korea set a budget of US$ 1.9 billion to advance the country's interest in Artificial Intelligence by funding projects in defense, healthcare, and public safety, and the creation of 5000 AI specialists).
13	Build innovation labs, which are accessible to citizen and SMEs, to make it a sandbox environment for experimentation and commercialization. Create environment to promote innovation such as Innovation Competition.
14	Support SMEs by having a preferential procurement policy (e.g., the Australian federal government has stipulations that ensure between 10 to 35 percent of procurement from SMEs). Encourage SME's to send their digital talents for upskilling with emerging ICT Technologies to improve their digital skills competences.
15	Set up a dedicated agency/department with clear mandate and budgets focused on helping small and medium enterprises prepare a future-ready workforce, including assistance to recruit talent, upgrade skills and redesign jobs.

The Way Forward

		FRONTRUNNERS	ADOPTERS	STARTERS
Design	1. Analyze future state	☑	☑	●
Design	2. Integrated systemwide view	●	●	●
Design	3. Tech-enabled insights	●	●	●
Design	4. Life-long learning	●	●	●
Incentivize	5. Incentivize talent pipeline	●	●	●
Incentivize	6. Government as a catalyst	☑	●	●
Incentivize	7. Public procurement as a tool	☑	☑	●
Partner	8. Nation-wide online program	☑	☑	☑
Partner	9. Internships at Scale	●	●	●
Partner	10. Digital programs with private sector	☑	●	●
Partner	11. Government as a tech leader	☑	●	●
Ecosystem	12. Innovation capacity in higher education	●	●	●
Ecosystem	13. Innovation labs	●	●	●
Ecosystem	14. Preferential procurement for SMEs	●	●	●
Ecosystem	15. Dedicated agency for talent development	☑	●	●

Legend
- ● Immediate action
- ● Area for discussion
- ☑ Achieved / In-progress

Figure 3.6: 15 Points Checklists Across levels of Adoption

We analyzed the three categories of countries to evaluate their current adoption of the 15 best practices. We classified their progress across three distinct phases, viz.,

- **Achieved / In-progress:** They have completed the initiative or atleast made some progress in working on this initiative.

- **Immediate action:** This represents activities that they should prioritize for immediate action to get some quick wins.

- **Areas for discussion:** These are initiatives that can be addressed over the mid-to-long term.

This approach provides a framework for countries who are at varying stages of development to define their priorities based on their current levels of progress.

1	Frontrunners	All Frontrunners have established very sound infrastructure and systems. They average a score of 7 on the checklist. Some of them, like Singapore and Australia, have done well in developing powerful agencies to support the needs of the citizens and the businesses
		However, these countries face tough competition from the Starters and Adopters who compete aggressively in global markets with lower cost structures. The challenge for these countries is to advance and become innovation economies. They need to aspire to tick off every single point on this checklist
		The priority is to focus on building sustainable ecosystems through strong partnerships between national and international stakeholders

| 2 | Adopters | The Adopters have made good progress in developing the basic policies but usually lack a proper holistic implementation and collaboration across the various stakeholders. They average about 3 points. There are 8 areas for immediate action for near to mid-term success |
| | | First, focusing on the government as a leading adopter of technology is an avenue to catalyse the local industry. Second, developing a holistic nationwide view of the digital ecosystem should be a priority in the mid-term, as it can support the journey towards becoming a Frontrunner. |

3	Starters	Starters have just about begun their journey. They have had a high reliance on the private sector to drive digital talent development with limited government involvement. Many of these countries are sufficient in size to be able to collaborate with the private sector and address many of the points on this checklist
		The first and immediate priority would be to anlayze the current and future state. Many starter countries have managed to set up massive online national programs to drive digital education. This can be supplemented with initiatives such as internship programs and developming digital programs in partnerships with the private sector.
		Setting up a dedicated government agency with clear mandate and budget for talent development is also a must focus immediate priority.

The biggest attraction of Asia Pacific as a region is its size as a market, the diversity of its talent pool and its importance as a sourcing destination for technology. While nation states will compete, and this augurs well for the overall development of the region, the long-term growth will come through solid collaborations between nations and the key stakeholders of Government Policy Makers, Industry leaders and Academic sectors.

Appendix A: Acronyms

Acronym	Term
5G2B	5G to Business
AI	Artificial Intelligence
AIOps	Artificial Intelligence for IT Operations
API	Application Programming Interface
AR	Augmented Realty
B2B	Business-to-Business
B2C	Business-to-Consumer
BI	Business Intelligence
CAGR	Compound Annual Growth Rate
CAPEX	Capital Expenditure
DaaS	Data as a Service
DevOps	Development & Operations
DNB	Digital Nasional Berhad
DNBs	Digital Native Businesses
DTD	Digital Talent Development
E2E	End to End
GCI	Global Connectivity Index
GDP	Gross Domestic Product
GSMA	GSM Association
IaaS	Infrastructure-as-a-Service
ICT	Information and Communication Technology
IoT	Internet of Things
IT	Information Technology
MDEC	Malaysian Digital Economy Corporation
MEC	Multi-access Edge Computing
MIDA	Malaysian Investment Development Authority
ML	Machine Learning
O&M	Operations & Maintenance
OPEX	Operational Expenditure
PaaS	Platform as a Service
PPP	Public-private partnerships
SaaS	Software as a Service
SME	Small and Medium-size Enterprise
SoC	System on Chip
SOE	State Owned Enterprise
TVET	Technical and Vocational Education and Training
VR	Virtual Reality

Appendix B: References

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   https://www3.weforum.org/docs/WEF_Upskilling_for_Shared_Prosperity_2021.pdf

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3. Advancing digital societies in Asia Pacific: a whole-of-government approach
   https://www.gsma.com/asia-pacific/wp-content/uploads/2020/11/201031-DigiSoc.pdf

4. IMD World Digital Competitiveness Ranking 2020

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Appendix C: List of Figures

Appendix D: DTD Maturity Score Calculations

We calculated the Digital Talent Development Maturity Score ("DTD Maturity Score") using five contributing factors of equal importance:

1. Digital talent related policies and initiatives availability
2. Agencies and ministries collaboration to drive policies and initiatives
3. Value of digital talent development investment as a percentage of government expenditure
4. Development and active involvement in public-private partnerships for digital talent development
5. Current and future digital talent employment as a percentage of workforce

Formula:

(Factor 1 + Factor 2 + ………… + Factor 5) / 5 = DTD Maturity Score

Example India:

DTD Maturity Score = (2 + 1 + 1 + 3 + 7) / 5

DTD Maturity Score = 14/5

DTD Maturity Score = 2.8

Highlights of each country's DTD Maturity Score

Singapore

- >40 policies, initiatives and PPP, driven by various agencies under Ministry of Education, Ministry of Communications and Information, Ministry of Trade and Industry and more
- Invests 8% of government expenditure in digital talent related initiatives – involves grants, subsidies and cash payouts for citizens of various age groups, career phases and community

South Korea

- Invests >US$ 3 billion to support AI education in its country – directly aimed at support private enteprrises in industry such as semiconductor to upskill and be future ready

Australia

- $585 million Delivering Skills for Today and Tomorrow package, delivered by The Digital Skills Organisation is funded by the Australian Government Department of Education, Skills and Employment - low level of PPP to drive this nation-wide effort
- Digital talent investment represents less than 2% of government expenditure

New Zealand

- Decent amount of programs, e.g GovTech Talent Graduate Programme
- Surplus of digital talent with mismatched skills. Result of low level of PPP – inability to deliver relevant experience and job
- Less than 10 percent of large organisations and Government agency training was spent on digital technology upskilling
- Limited news released on Ministries of Education collaboration with Ministry of Business, Innovation & Employment

Japan

- Japan's digital education is hardware or non-software engineering focus because of culture. They have bold plan to more than triple the bench of digital talent, focusing disproportionately on software developers, data engineers, data scientists, machine learning engineers, product managers, agile coaches, designers, and other types of new jobs
- However, limited actions have been seen in realizing the above. They have not shifted the education nor have flagship PPP been announced for this plan

Japan's digital scorecard in 2020.

Objectives	Metric	Japan 2020	Best in Class
Digital and global competitiveness	Total factor productivity (5 year average % growth)	–0.11%	+2.81%—China
	Digital competitiveness - IMD[1]	#27	#1/2—US, Singapore
Digital talent	Universities with software-related programs	29	117—US
	Digital talent as % of workforce[2]	1%	3%—US

Source: McKinsey

China

- China takes a top down approach in digital talent development. PPP in the country seems to be limited to only homegrown private enterprises and limited collaboration with foreign ones. For instance, Alibaba runs the Global Digital Talent Program
- Furthermore, limited investment were made to help build digital talent in marginalized area of the country. Most of it is concentrated in first and second tier cities. This report estimate that china spends 2-3% of its annual government expenditure on digital talent development.

Malaysia

- Malaysia ministires and government agencies rarely collaborate, despite driving similar initiatives. For instance, MDEC, MIDA and MyDigital all run different programs and initiatives that rarely overlaps.
- A fairly new initiative named MWIT (Malaysia Work in Tech) aims to invest RM100 million (US$24.14 million) to develop digital talents, which is much lesser than neighboring countries, which are spending above US$200 million.

Thailand

- Thailand digital policy are heavily focus in infrastructure building rather than talent.
- In 2021, the Government was reported to likely spend US$10-13 million in digital talent building, which is very much lower than neighboring countries.

Vietnam

- Vietnam recently introduced a new digitalization strategy, as mentioned above. None of the goals in the strategy took into consideration of digital talent building.
- Language barrier is a key reason preventing the country from becoming a top notch digital talent hub, yet no serious initiative is available to mitigate this issue.
  - o Thus, with no initiative, limited investments are made in digital talent building by the government.
- However, due to cultural preference for software engineering, Vietnam digital talent cultivation is promising

Indonesia

- Ever since the appointment of Gojek's founder as the minister of education, culture, research, and technology, the country has relied on that ministry to drive all digital initiative, talent included. Thus, limited collaboration between other ministry and agencies under them were reported.
- There were a lot of mention of government focus in digital talent building in 2019, but such announcement and news faltered in 2020 and 2021.
- However, the country established ppp with Tokopedia to introduce a large scale digital talent program to upskill its citizen. In addition, Alibaba Cloud commits to invest US$1 billion to support digital talent pool.
  - o The government focus on tax deductions for enterprise who support digital talent building but actual fiscal investment is rarely mentioned

India

- NASSCOM – a not-for-profit organisation in India has partnered with the government and IT industry to offer free/subsidised programs, viz., "National Skills Prime", encompassing ten emerging technologies, including certifications
- Credit to global enterprises and NGOs, digital talent supply in India is high and will remain high if the landscape remain unchanged

Pakistan

- National Level Training Program (DigiSkills.pk) launched by Ministry of Information Technology & Telecommunication through Ignite National Technology Fund has been providing free of cost training in freelancing and other marketable skills to youth. The program comprises of 10 courses including Freelancing, Digital Marketing, Search Engine Optimization, Graphic Design, Digital Literacy, e-Commerce Management, Creative Writing, QuickBooks, AutoCAD and WordPress.
  - i. Unknown collaboration between other agencies and ministries
- Punjab Skills Development Fund to join the Reskilling Revolution and partner with the World Economic Forum on a Closing the Skills Gap Country Accelerator in Pakistan, named **Parwaaz.**

i. Parwaaz is a multi-stakeholder alliance representing both the **public** and **private** sector. It focuses on three areas: lifelong learning and upskilling, future-readiness and youth employability, and innovative skills funding models.

Philippines

- In Oct 2021, the country launched a Digital Job Programme led by Department of Information and Communications Technology (DICT) and the Cooperative Development Authority (CDA)
    o The iniative creates jobs but it is unsustainable because the citizen does not have access to programs that can train them for needed digital skills
- There are also limited mention of ppp to develop digital talent in the country.
    o In Aug 2021, a Phillipines tech company invests PHP80 million in grants to its academic partners to fund programmes focusing on emerging technologies, sustainability, and inclusion and diversity. There were no mention of government collaboration in this initiative.

Bangladesh

- The government famously launched the 'Digital Bangladesh' initiative a few years back in bid draw investment for digital infrastructure and to an extent digital talent. The government introduced policies and incentives such as 50% income tax relief for foreign talent importation, 100% profit repatriation and more.
    o However, that initiative was left dormant since 2019 without any replacement or active efforts. Government became solely dependent on international enterprises to invest in digital talent building.

Appendix E: Limitation of this Report

While the study was comprehensive in its coverage, we will like to advise the readers of some possible limitations in its overall approach. The objective was to provide an overarching framework that provides insights into benchmarks and best practices. It is used to initiate discussions and further specific data needs to be analysed before actions are initiated to achieve specific goals.

1. **Secondary research:** The study relied on publicly published data and strategies adopted by the various government agencies. It is possible that there are some initiatives that may not have been adequately covered in the government websites or publications. This could have led us to form an opinion that may not be update with the latest initiatives underway. We did have access to a limited number of industry experts, but this in no way was comprehensive across the geographies covered in this study.

2. **Assumptions:** We did have to make certain assumptions particularly relating to the effectiveness of the various programs underway. These assumptions have been based on a best-effort basis. While we are confident of the broad trends and measurements, there could be a small margin of error given the limitations on the availability of data particularly in developing nations.

Sources of data: We have relied largely on government data and statistics which are not consistently measures across countries. They are also collected at different points in time and for different purpose. This could have some impact on the overall analysis

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