

GALLUP®



AWS Asia Pacific Digital Skills Study

THE ECONOMIC BENEFITS OF A TECH-SAVVY WORKFORCE

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Executive Summary

Digital transformation is happening at a rapid pace across the Asia Pacific (APAC) region — from the way we work to the way we live. We are seeing information technology drive significant transformation at the individual, organizational, and macroeconomic levels.

To study these dynamics in a global context Gallup collaborated with Amazon Web Services (AWS) to conduct one of the largest international surveys on digital skills to date.¹ Gallup surveyed more than 30,000 workers with access to the internet in 19 countries — comprising 67% of the total value that jobs requiring advanced digital skills add to the global economy — and surveyed more than 9,000 employers.

Among the 19 countries included are Australia, India, Indonesia, Japan, Malaysia, New Zealand, Singapore, South Korea, and Thailand. The data show nearly three-quarters of workers in these countries do not use a computer in their jobs, suggesting there is a significant imperative — and opportunity — to bridge the skills gap between the region's workforce and its business needs.

The results consistently show that workers who obtain digital skills provide immense economic value to businesses and workers worldwide and APAC, increasing gross domestic product (GDP), revenue, innovation, wages, job security, and job satisfaction for businesses that integrate these technologies and the workers who acquire the needed skill sets. While both workers and organizations cite strong interest in digital skills training, companies around the region are struggling to fill vacant jobs that require these skills.

Gallup's analysis also found a number of practical obstacles to hiring digital workers, including a notable disconnect between how much employers say they value nontraditional education certifications, such as industry certifications, and their actions when evaluating candidates' resumes. Specifically, the study found a self-imposed skills gap in entry-level technology job requirements, where employers are slightly more likely to prefer or require a bachelor's degree than they are to prefer or require digital skills certifications, despite the fact that managers give greater hiring preference to candidates with digital certifications than they do to candidates with a non-computer-science bachelor's degree.

¹ The largest comparable survey Gallup found is the Program for the International Assessment of Adult Competencies, an international collaboration between government agencies led by the Organization for Economic Cooperation and Development (OECD). That survey, among other things, tests problem-solving in a technologically rich environment and collects data on the use of computers and computer skills at work. The sample size is approximately 5,000 per country across 40 countries, administered in various years.

Top Five Takeaways

1 **Advanced digital workers earn 65% more than non-digital workers, adding nearly \$1 trillion to Asia Pacific's annual GDP.**

Workers who use digital skills at work add significant value to their national and regional economies, while also earning greater individual incomes for themselves. The 8% of APAC workers who use advanced digital skills on the job — such as software developers and cloud architects — add an estimated \$934 billion to the region's GDP on their own. When their economic contributions are combined with those of APAC workers who use more basic or intermediate digital skills at work — such as email, word processing or drag-and-drop website design — the net economic benefit of digital skills in the region totals almost \$4.7 trillion per year.

These macroeconomic benefits are a direct result of the higher incomes digital workers earn. While most workers in the Asia Pacific region do not use any digital skills at work, those who do secure noticeable salary advantages. The average APAC worker who uses advanced digital skills in their job earns 65% more than a worker that has similar levels of education and experience, but does not use digital skills. Even utilizing basic digital skills at work — such as email or word processing software — earns workers an additional 39% over their non-digital peers.

In addition to the ways this kind of income boost can transform the lives of individual digital workers, those gains also scale to significant value for national and regional economies.

2 **Workers who use advanced digital skills feel more satisfied and secure in their jobs.**

APAC workers who acquire advanced digital skills realize benefits beyond higher salaries. More than three-quarters (79%) of workers who use advanced digital skills express high job satisfaction, compared to less than half (46%) of workers who only use basic digital skills.

Additionally, workers with advanced digital skills express higher confidence in their job security than those with basic digital skills (77% to 45%).

3 **Employers that rely heavily on advanced digital skills, digital technology, and cloud technology report higher levels of revenue, growth, and innovation.**

APAC organizations that employ workers with advanced digital skills report annual revenues that are 150% higher than those that employ workers with only basic digital skills. About three-quarters (76%) of highly digital organizations have introduced an innovative product or service within the past two years, a rate more than 30 percentage points higher than basic digital organizations (45%).

Findings further show two-thirds (66%) of organizations that employ advanced digital workers have steady annual revenue growth (meaning at least 10%) over the past year, making them 23 points more likely to experience steady growth than basic digital organizations (43%).

These benefits may also be partially rooted in organizations' adoption of cloud technology. Eight in 10 APAC employers that run most of their business on the cloud report innovating in the past two years, and 69% report annual revenue growth of 10% or more. Organizations that do not leverage the cloud are half as likely to report innovating (36%), and 28 percentage points less likely to experience steady revenue growth (41%).

4 Seven in 10 employers in Asia Pacific countries face digital hiring challenges, in part due to strict bachelor's degree requirements.

Over three-quarters (76%) of APAC employers have job openings that require digital skills, and most of these organizations (72%) report difficulties in filling these positions. Twenty-five percent of employers say it is “a significant challenge” to hire workers with the digital skills they need.

One reason is the stringent employer requirements that digital workers have a bachelor's degree. Only 27% of digital workers in the region say they have a bachelor's degree, yet 38% of APAC employers say a degree is required for IT staff — even for entry-level tech positions. Organizations that enforce degree requirements are nearly twice as likely to say hiring digital workers is a significant challenge (32%), compared with organizations that only prefer — but do not require — a bachelor's degree (17%).

In response to these hiring challenges, many APAC organizations are adjusting their hiring requirements: 76% of employers in the region say that digital certifications or training courses are acceptable substitutes for a bachelor's degree. This is an important development, as digital workers in the Asia Pacific region are about twice as likely to hold a digital certification (50%) as they are to hold a bachelor's degree (27%). Therefore, companies that acknowledge industry-certified applicants may be just as qualified as those with university degrees nearly double the pool of digital workers who are eligible to apply for their roles.



5 Two-thirds of organizations in the region say they are likely to adopt at least one emerging technology.

While most organizations already find hiring for today's digital skills to be a challenge, they also must begin preparing for the hiring challenges of the future. When asked how likely it is that each of 10 emerging technologies — including 5G, the metaverse, blockchain, and artificial intelligence — will become a standard part of their business in the future, 67% of APAC employers say it is highly likely that at least one emerging technology will become part of their operations. More than half of employers (56%) believe multiple technologies will become standard, and 17% say all 10 will be a part of their organization's business in the future.

Detailed Findings

The pace of digital transformation happening across the Asia Pacific region is exciting to witness. However, rapid technological changes are contributing to a widening digital skills gap that must be addressed to unlock the region's full economic potential, especially in the face of challenging economic times.

According to the International Data Corporation, the public cloud services market in the Asia Pacific region (excluding Japan) will grow at a compound annual growth rate (CAGR) of 26.4%, from \$51.2 billion in 2021 to \$165.2 billion in 2026.² As more organizations move their technology to the cloud, the adoption of cloud computing, machine learning, data analytics, and cybersecurity across every industry will fuel a vast number of new jobs. The opportunity to become a leader in the digital economy depends on having a robust workforce of skilled professionals to support current and future innovation.

However, governments and industries across APAC are grappling with a shortage of digitally skilled talent, and they are struggling to keep up as a result. Now is the time to upskill and reskill workers with a sense of urgency. Training for the most in-demand cloud skills must become commonplace so people can grow their careers, organizations can expand, and countries can thrive.

To assess the effects and benefits of digitization on the workers, employers, and overall economy of the Asia Pacific (APAC) region, Gallup surveyed more than

16,000

working adults and

7,500

employers across

9

countries.

from August 2-24, 2022.³

Workers and employers were asked about whether their job or business involved the use of a computer or tablet. Those who reported their job or business relied on computers or tablets to some degree were segmented into three categories based on the highest level of digital skills used:

- basic digital skills: e.g., email, word processors and other office productivity software, social media
- intermediate digital skills: e.g., drag-and-drop website design, troubleshooting applications, data analysis
- advanced digital skills: e.g., cloud architecture or maintenance, software or application development, artificial intelligence, and machine learning

² Source: IDC Press Release, [Asia/Pacific* Public Cloud Services to Reach US\\$165.2 Billion in 2026](#), according to IDC Forecast, September 2022, #prAP49725422

³ The nine countries surveyed include Australia, India, Indonesia, Japan, Malaysia, New Zealand, Singapore, South Korea, and Thailand. Throughout this report, "Asia Pacific" refers to all respondents across these nine countries.

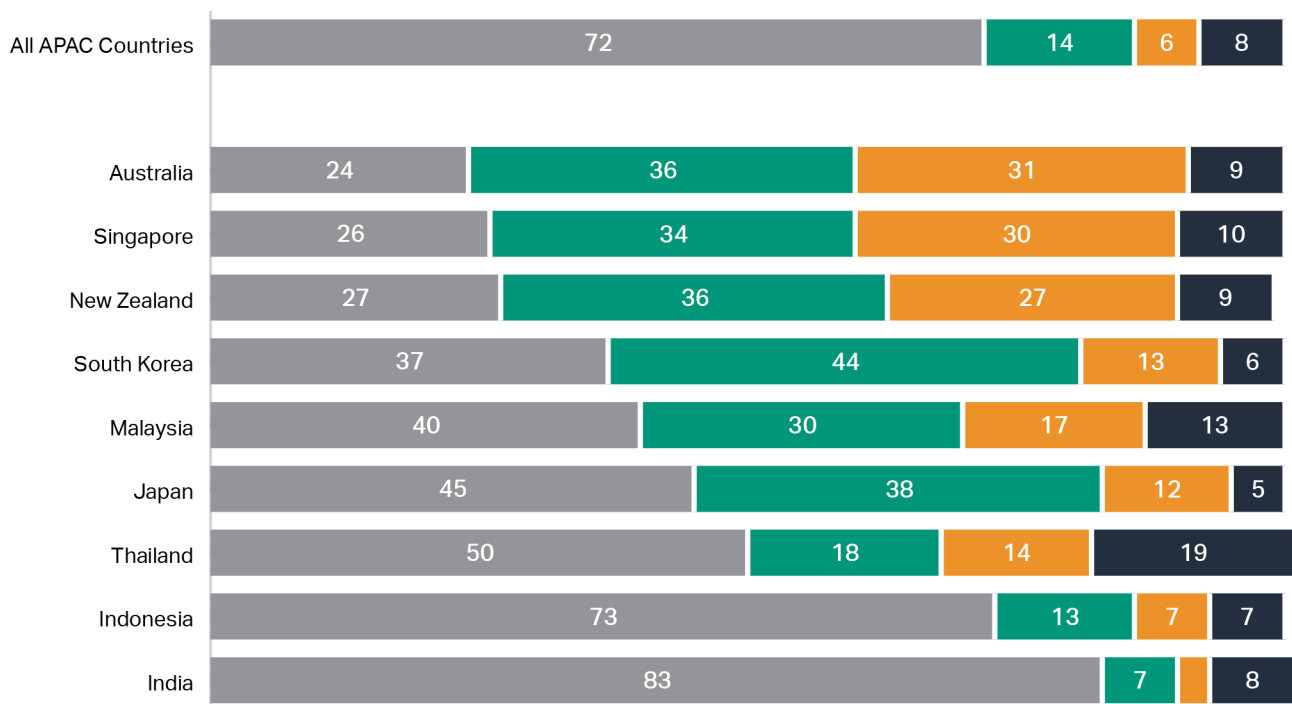
Using respondents' self-reported skill assessments, as well as supplemental Gallup World Poll data, Gallup estimates that **nearly three-quarters (72%) of workers in the Asia Pacific region do not use a computer at work**. The proportion of non-digital workers varies across the region, from as few as one-quarter of workers in Australia (24%), Singapore (26%), and New Zealand (27%), to as many as 83% of workers in India.

Of the 28% of APAC workers who use some level of digital skills at work, half use basic digital skills. Six percent of workers employ intermediate digital skills, and the remaining 8% use advanced digital skills.

CHART 1

Level of Digital Skill Use Among APAC Workers

■ % None ■ % Basic digital skills ■ % Intermediate digital skills ■ % Advanced digital skills



Note: Due to rounding, segments may sum to 100%, +/-1; numerals shown when ≥5%.

In addition to reporting the level of digital skills they currently use at work, workers also provided feedback about how satisfied and secure they feel in their current job, whether they are interested in pursuing additional digital training, what incentives or barriers they face to doing so, and how they anticipate digital skills will factor into their future employment. Similarly, employers were asked about the benefits they derived from their workers' digital skill sets, barriers to hiring and training digital workers, and their organization's projected reliance on current and emerging technologies.

The data show, across APAC, workers and employers who leverage digital skills in their workplaces report stronger outcomes in a number of key business and employment metrics. Advanced digital workers' salaries are 65% higher than workers who do not use computers at work; meanwhile, organizations that employ these advanced digital workers report more than double the annual revenue of basic digital organizations (\$1.1 million to about \$441,000), in addition to growing and innovating at faster rates.

Middle-income economies⁴ — where the discrepancies between jobs that require limited digital skills at all and those that require advanced digital skills are likely more pronounced than in high-income economies — often report the most significant benefits as a result of obtaining advanced digital skills or hiring workers who have them. For example, the largest gap in job satisfaction between basic and advanced digital workers is in the middle-income economy of Indonesia, where advanced digital workers are twice as likely to be highly satisfied with their job as basic digital workers. Meanwhile, basic digital workers in the high-income economies of Australia and Japan are nearly as satisfied with their jobs as advanced digital workers in those countries — though advanced digital workers do hold a slim advantage in both instances.

Still, while workers in middle-income economies report greater benefits from digital skills than those in high-income countries, workers and organizations throughout the region report at least some degree of improvement. As a result, countries with a greater focus on increasing the level of digitization in their economies would likely drive widespread improvements in citizens' salaries and job satisfaction, as well as the financial health of its businesses.

Digital Workers Create Trillions in Economic Benefits for APAC Economies

In addition to improving the lives of its citizens through higher incomes and fulfillment in their work, there is another major incentive for APAC nations to improve the digital skills of their workforces: Increased earnings for individual workers have a tremendous impact on local economies and national gross domestic product (GDP).

To determine the magnitude of these effects on national GDP, Gallup first calculated the additional income basic, intermediate and advanced digital workers earn over workers who do not use any digital skills in the same country. Then, Gallup scaled those individual gains across the total number of workers in each country that use each level of digital skills, plus the estimated revenue they generate for their employers.

For example, using self-reported digital-skills-use data from the [AWS Global Digital Skills study](#) and supplemental employment data from Gallup's World Poll, Gallup estimates there are 1,922,649 workers in Malaysia who use advanced digital skills at work. Those workers report annual incomes that are \$21,773 higher, on average, than the incomes of non-digital Malaysian workers. As a result, Malaysian workers who acquire and use advanced digital skills in their jobs earn — and thus contribute to Malaysian GDP — roughly \$41.9 billion more each year than workers with no digital skills. As Malaysian workers' incomes account for 40% of overall GDP, it is estimated these workers generate a total of \$105.7 billion when considering not only the \$41.9 billion in wages they earn for themselves, but also the \$63.8 billion in capital they generate for the organizations they work for.

Across all APAC countries surveyed, digital workers add an estimated **\$4.7 trillion to the GDP of the region**. Due to their higher prevalence in the workforce, more than half of those gains are from individuals who only use basic digital skills, such as email, word processing, and social media at work.

1,922,649
workers in Malaysia use advanced skills at work.

These workers earn
\$21,773
more in income on average using advanced skills.

\$41.9 billion
more in earnings and GDP contributions from workers who use advanced digital skills.

⁴ In this report, middle-income economies (India, Indonesia, Malaysia, Thailand) and high-income economies (Australia, Japan, New Zealand, Singapore, South Korea, Taiwan) are defined by [World Bank income classifications](#).

CHART 2

Digital Workers' Additional Contributions to APAC GDP in 2022 USD

By level of digital skills used

■ Basic digital skills ■ Intermediate digital skills ■ Advanced digital skills



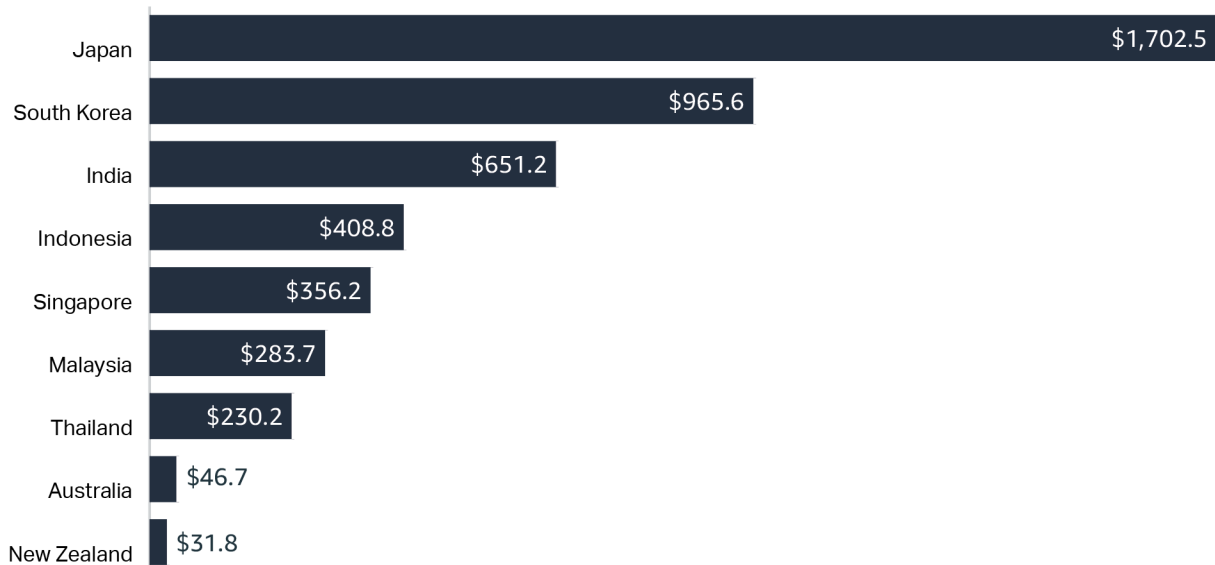
While advanced digital workers do contribute the most to GDP on a per-capita basis, there are certainly economic benefits to increasing the digital base of a country's workforce at any level, including training non-digital workers to use basic digital technology.

In part because the advantages of digital workers' income varies across APAC countries (compounded by differences in countries' employment rates and prevalence of digital skills), so too does the distribution of GDP gains. More than half (57%) of the additional GDP generated by digital APAC workers is concentrated in Japan and South Korea.

CHART 3

Digital Workers' Additional Contributions to APAC GDP, by Country

In billions of 2022 USD



APAC Workers With Digital Skills Earn Up to 65% More Than Non-Digital Workers

One of the most common reasons APAC workers express interest in broadening their digital skill set is the prospect of a higher salary. Nearly half (46%) of digital workers who want additional digital skills training say an increased salary is what motivates them.

Those motivations are well-founded; across the region, workers who leverage advanced digital skills do enjoy higher salaries. On average, digitally skilled APAC workers earn salaries that are 58% higher than those of their non-digital peers. This salary premium is as high as 65% for workers who use advanced digital skills, though workers who only use basic digital platforms, such as email and productivity software, still earn 39% more than workers who do not use any digital skills.

CHART 4

Income Premium for Individual Workers Over Non-Digital Workers

% Premium, by level of digital skills



These salary increases control for workers’ education and years of experience; that is to say, if two workers have identical educational backgrounds and the same number of years of work experience, but one uses advanced digital skills at their job while the other does not, the advanced digital worker would expect to earn 65% more than the non-digital worker.

While digital workers throughout the region earn more, on average, than non-digital workers, the income premium varies widely by country. Workers in Singapore and Indonesia who use any level of digital skills earn nearly double the salaries of workers who use no digital skills at work in those countries (97% and 93% higher, respectively).

By comparison, the income gap between digital and non-digital workers is noticeably lower in Australia (5%) and New Zealand (16%). This may be partially a result of the industries that these countries’ non-digital workers are employed in. May 2022 data from the Australian Bureau of Statistics estimates that workers in the country’s mining industry earn roughly AUD \$2,700 per week. That is the highest average salary of any industry in the country, 21% higher than the average salary of workers in the information media and telecommunications industry (AUD \$2,236), and 30% higher than that of workers in the professional, scientific, and technical services industry (AUD \$2,082).⁵

⁵ <https://www.abs.gov.au/statistics/labour/earnings-and-working-conditions/average-weekly-earnings-australia/may-2022>

Organizations With Digitally Skilled Workforces Grow, and Innovate More Regularly Than Non-Digital Peers

Just as workers hope to earn more by increasing their digital proficiency, the predominant reasons APAC employers provide digital training to their employees are centered on improving the organization's bottom line. More than half of employers provide training to improve operational efficiency (59%) and employee productivity (52%).

In a number of measures, the organizations that employ workers with advanced digital skills enjoy the greatest boosts to their revenue and other key business outcomes. Organizations in the APAC region that employ advanced digital workers — such as software developers or cloud architects — report 2021 annual revenues 150% higher than organizations that employ only basic digital workers, and 286% higher than those that employ intermediate digital workers.

CHART 5

2021 APAC Employer Median Revenue

In 2022 USD

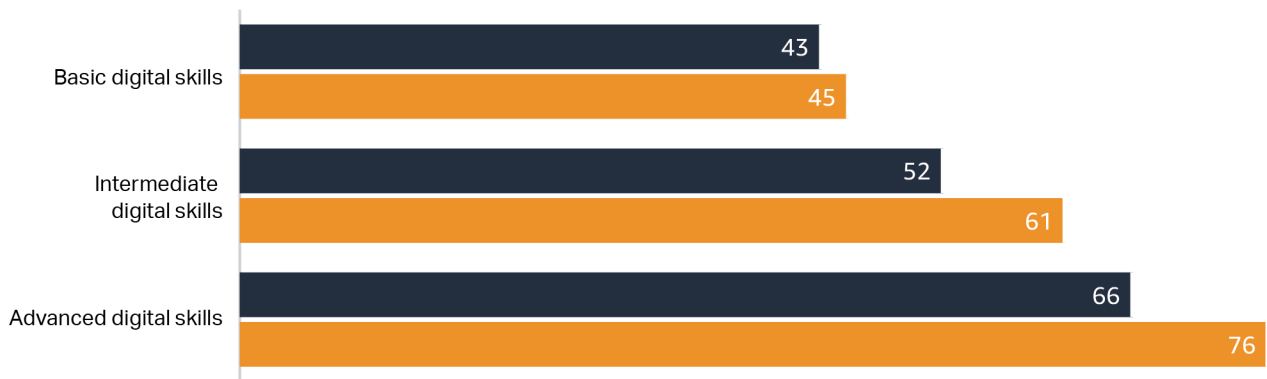


Increased digitization of APAC employers — whether through hiring or upskilling — also has demonstrable impacts on two additional key performance indicators: innovation and revenue growth. More than three quarters (76%) of organizations that employ advanced digital workers brought a new or improved product to market over the past two years, a rate 15 points higher than intermediate digital organizations (61%) and 31 points higher than basic digital organizations (45%).

CHART 6

Growth and Innovation by Level of Digital Skills Employed

■ % Steady revenue growth (10%+) ■ % Innovated

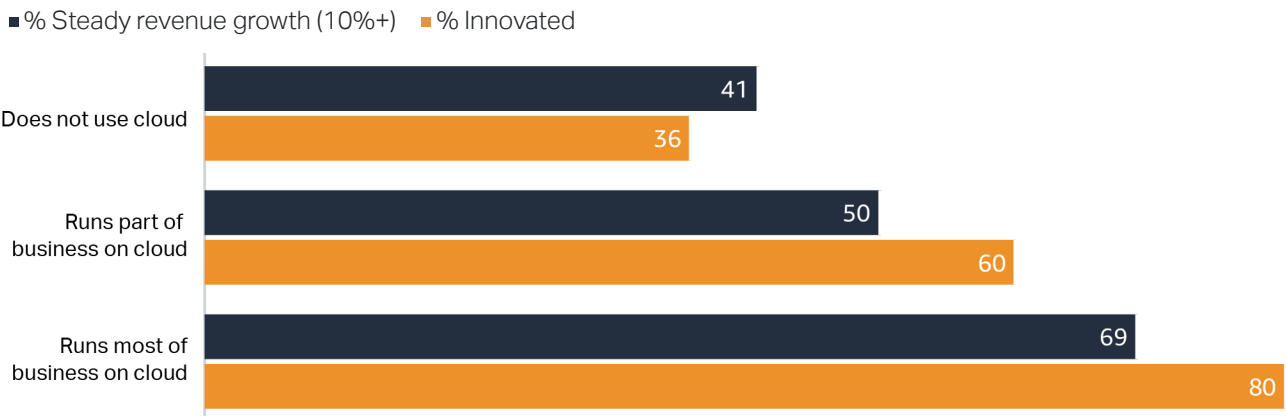


In addition to — and likely, in part, as a result of — increased innovation, two-thirds (66%) of advanced digital organizations reported steady revenue growth (defined as annual growth of 10% or more) over the past year; by comparison, 43% of basic digital organizations and 52% of intermediate digital organizations experienced steady annual revenue growth.

The benefits of increased digitization appear to go hand-in-hand with adoption of cloud technologies, which refers to “on-demand delivery of IT resources over the internet,” including data storage and software or other applications.⁶ Thirty-nine percent of APAC employers run most of their business from the cloud; in doing so, these organizations significantly increase their likelihood of growing and innovating over organizations that do not use the cloud.

CHART 7

Growth and Innovation by Cloud Adoption



While organizations that run the majority of their business from the cloud reap the greatest benefits, organizations that shift even part of their operations to the cloud see meaningful improvements in their rates of growth and innovation over organizations that do not use the cloud.

6 <https://aws.amazon.com/what-is-cloud-computing/>

Digitally Skilled Workers Across APAC Report Higher Job Satisfaction and Improved Job Security

In addition to commanding higher salaries, APAC employees who develop greater digital proficiency — particularly those who acquire the most advanced level of skills — also report improvements in other aspects of their workplace experiences.

Across the region, 79% of workers with advanced digital skills are highly satisfied with their jobs, a rate 33 percentage points higher than basic digital workers' satisfaction (46%), and 29 points higher than that of intermediate digital workers (50%).

CHART 8

Life Evaluation by Skill Level

"Please imagine a ladder with steps numbers from 0 at the bottom to 10 at the top. The top of the ladder represents the best possible employment situation for you, and the bottom of the ladder represents the worst possible employment situation for you.

On which step of the ladder would you say you personally feel your employment situation is at this time?"

% Rating job satisfaction as an 8 or higher



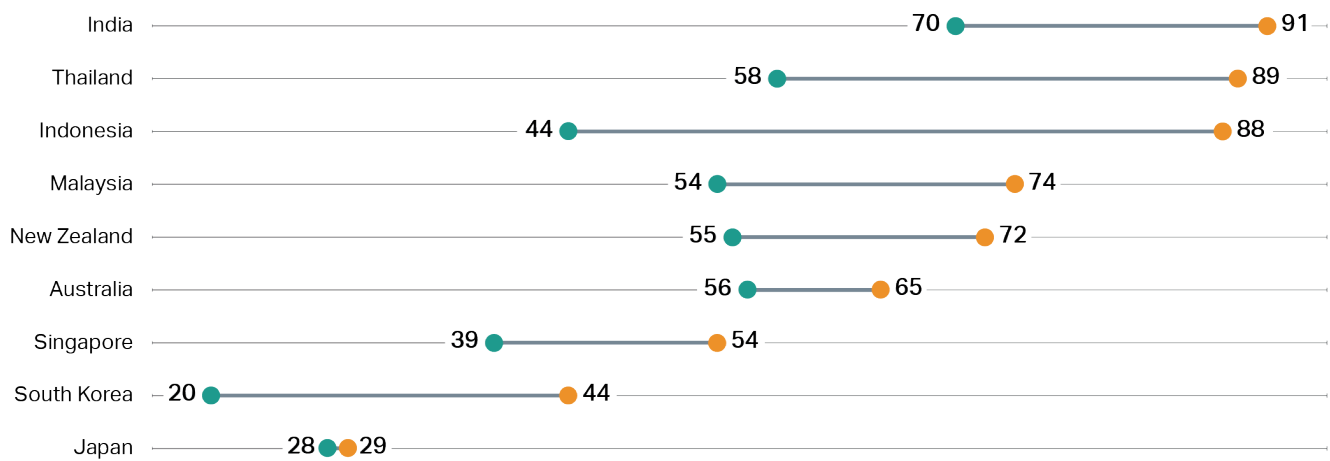
While digital workers across the region generally experience gains in job satisfaction, there are differences per country. Generally, workers in middle-income economies, such as India, Indonesia, and Thailand, report both the highest overall levels of satisfaction, as well as the largest satisfaction advantage for advanced digital workers over basic digital workers.

CHART 9

Job Satisfaction Among Basic and Advanced Digital Workers

% Rating job satisfaction as an 8 or higher

● Basic digital workers ● Advanced digital workers



Meanwhile, workers in high-income economies — such as Australia and Japan — see smaller increases in job satisfaction after workers acquire more advanced digital skills.

While Gallup research finds measures like job satisfaction and employee engagement are highly important and beneficial to both individual workers and their employers, one metric that has become increasingly relevant — particularly within the technology sector — is job security. Despite the economic uncertainty around the globe, the most advanced digital workers in the APAC region report the highest levels of confidence in their job security. For workers who are concerned about losing their current job or being able to secure new employment, this may provide yet another incentive to improve their digital skill set.

Among workers who use advanced digital skills, 77% say their job security is an eight or higher on a scale of zero to 10. By comparison, roughly half of basic (45%) and intermediate (51%) digital workers are as confident in their job security.

CHART 10

“On a scale of 0 to 10, where 0 means not secure at all and 10 means completely secure, how secure is your current job?”

% Rating job security as an 8 or higher



About Three-Quarters of APAC Organizations Have Digital Job Openings; 72% Say Hiring for These Roles Is a Challenge

Most advanced digital workers appear to be less concerned with job security than their peers with basic or intermediate digital skills, likely because they know how in-demand their skills are. Over three-quarters (76%) of APAC employers report they are seeking to fill job openings that require digital skills.

This widespread need for digital talent may be creating a greater demand than the supply of workers available. Almost half of digital employers say they either do not receive enough qualified applicants for these openings or they lose qualified applicants to more competitive offers from other companies (46% and 45%, respectively).

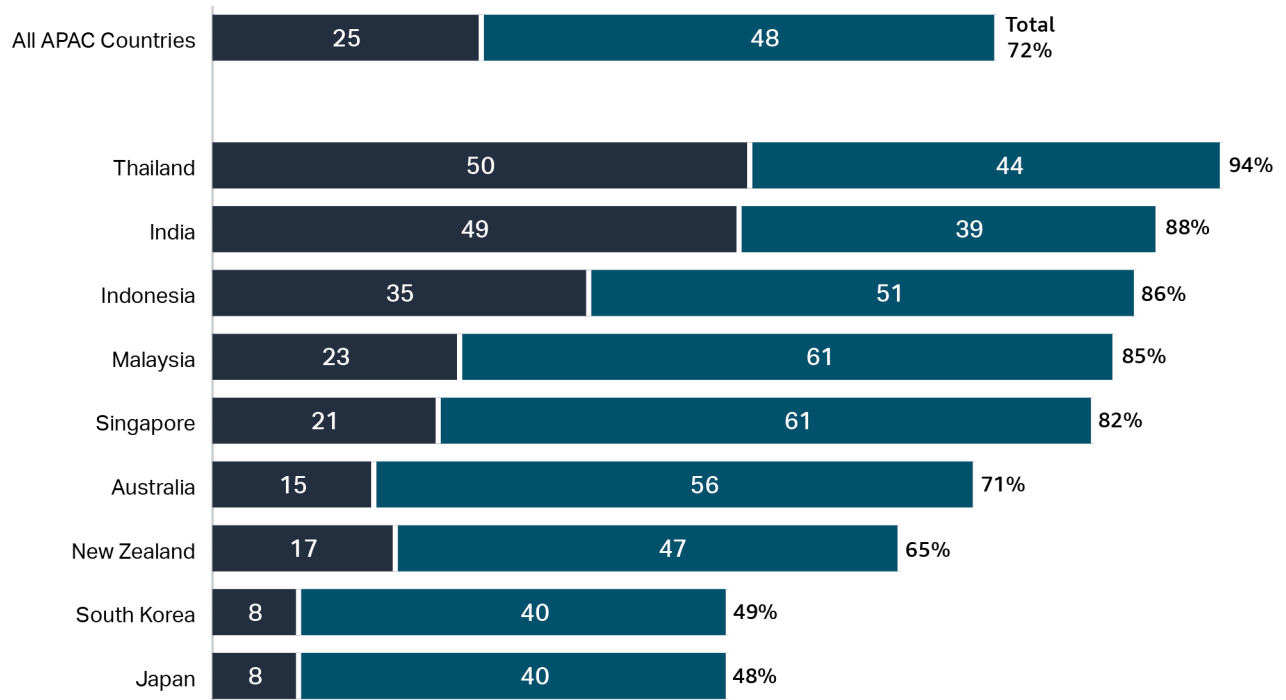
While this competition may be beneficial for workers, it is a major hurdle for hiring managers. More than seven in 10 (72%) employers say it is challenging to hire workers with the right digital skills, with one-quarter (25%) saying it is “a significant challenge.”

Even the middle-income APAC countries — where advanced digital workers report the largest advantages as a result of their digital skills — experience these acute shortages in digital talent. For example, in Thailand, digital hiring is a near-universal obstacle. Ninety-four percent of Thai organizations find hiring digital talent challenging, with half of these organizations categorizing the challenge as “significant.” More than 80% of organizations in India, Indonesia, and Malaysia report similar challenges.

CHART 11

“Please indicate if, and to what extent, hiring employees with the digital skills your organization needs is a challenge.”

■ % A significant challenge ■ % Somewhat of a challenge



Due to rounding, segments may sum to the totals shown, +/-1.

Formal Degree Requirements Exacerbate Digital Hiring Challenges

To a certain extent, these hiring challenges may be related to a lack of local workers who possess the digital skills companies need — particularly in India and Indonesia, where 83% and 73% of workers, respectively, use no digital skills at all.

Additionally, organizations may be hindering their own ability to hire for these roles by having stringent degree requirements. Across APAC, 38% of organizations require a bachelor’s degree to be hired into an entry-level IT job, and a further 38% say they prefer — but do not require — entry-level IT staff to have a bachelor’s degree. Companies that require a bachelor’s degree are about twice as likely to say hiring digital workers is “a significant challenge” (32%), compared with companies that only prefer entry-level IT workers have a bachelor’s degree (17%).

CHART 12

Difficulty in Hiring Digital Workers by Degree Requirements for IT Staff

■ % A significant challenge ■ % Somewhat of a challenge



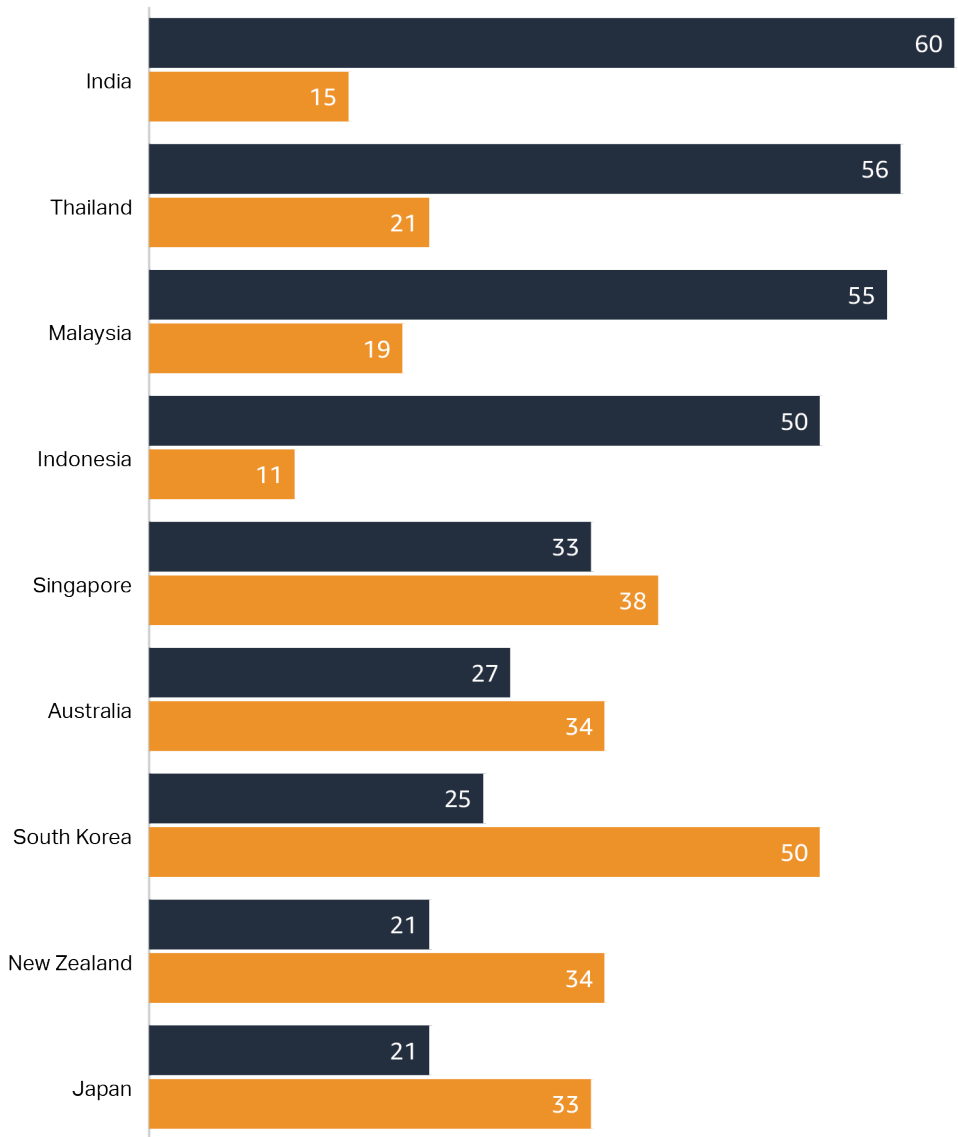
Due to rounding, segments may sum to the totals shown, +/-1.

This relationship also bears out at the country level. The four APAC countries whose employers report the greatest difficulty in hiring digital workers — Thailand, India, Indonesia, and Malaysia — are also the most likely to say they require IT employees to have a bachelor’s degree. These countries’ hiring difficulties may stem from a shortage of workers who meet their requirements, as these countries also have the lowest proportion of digital workers who have obtained a degree.

CHART 13

Bachelor's Degree Requirements and Attainment

■ % Employers that require a bachelor's degree ■ % Digital workers who have a bachelor's degree



Conversely, Australia, New Zealand, South Korea, and Japan report lower levels of hiring difficulty, as well as less prevalent bachelor's degree requirements for IT staff, despite larger proportions of their workforces holding a degree.

More APAC Organizations Are Open to Certification and Training as a Degree Substitute

In response to these hiring challenges, many APAC organizations seem to recognize the barrier that strict degree requirements pose to hiring, and are adjusting their hiring practices accordingly.

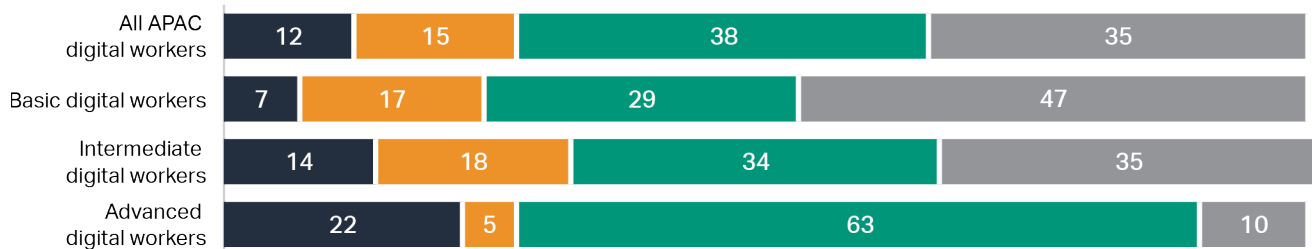
This is an important development, as digital workers in the Asia Pacific region are about twice as likely to hold a digital certification (50%) as they are to hold a bachelor’s degree (27%). By relaxing the degree requirements of their job openings, organizations that allow digital certifications or trainings to substitute or complement degrees may be more than doubling the pool of digital workers who are eligible to apply for these roles.



CHART 14

Credentials Held by Digital Workers in Asia

- % Has a bachelor’s degree and digital certification
- % Has a bachelor’s degree, but no digital certification
- % Has a digital certification, but no bachelor’s degree
- % Has neither a digital certification, nor a bachelor’s degree



Due to rounding, segments may sum to 100%, +/-1.

Importantly, the group of digital workers whose hiring eligibility stands to expand the most through flexible degree requirements is also the group that is most scarce in the region. Nearly two-thirds (63%) of the most advanced digital workers hold digital certifications, but not a bachelor’s degree. These workers are already demonstrating they have the required skills through their current employment, but would not be eligible to apply — at least according to the job postings — for similar roles in organizations that require bachelor’s degrees.

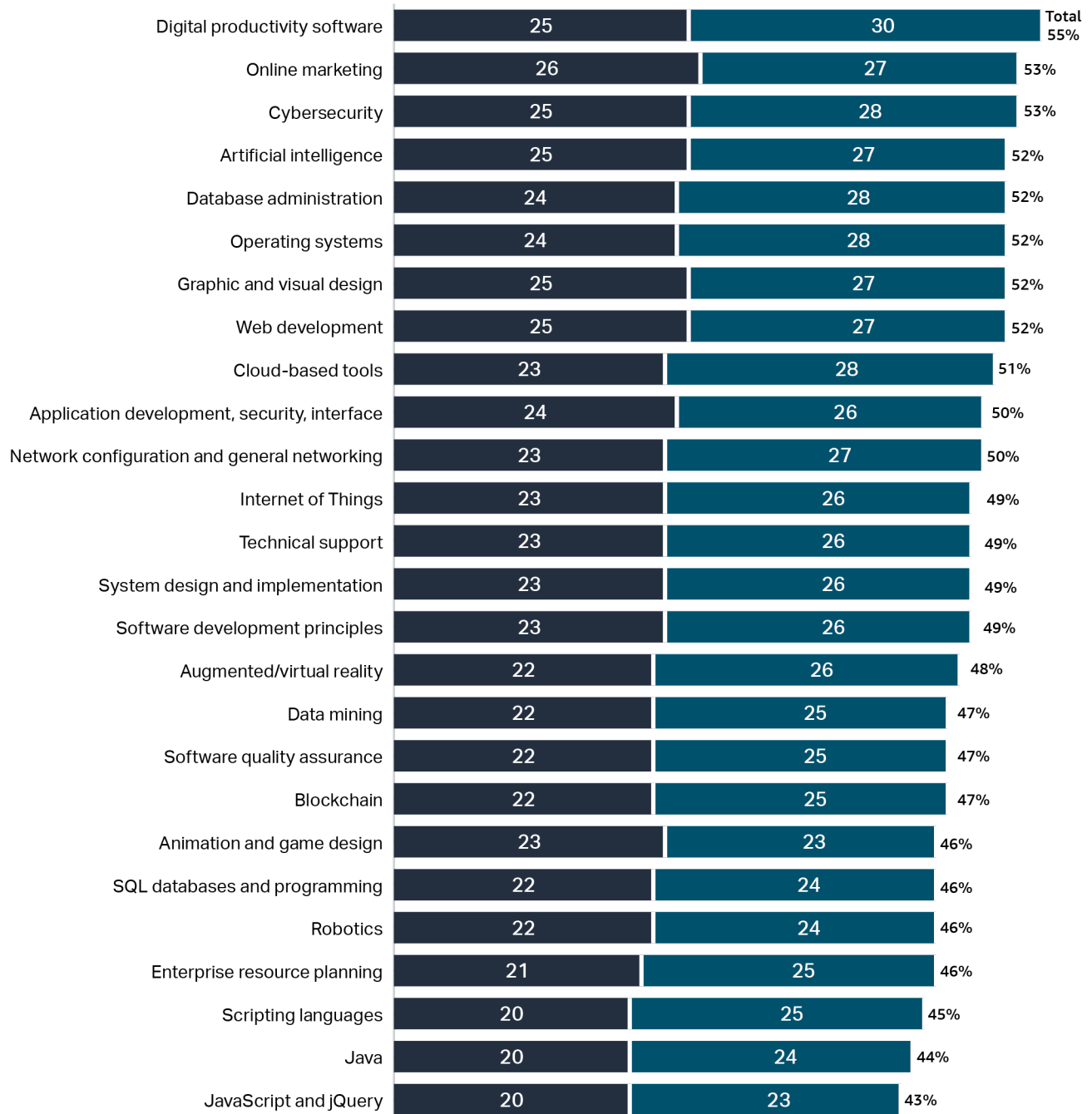
APAC Workers Overwhelmingly Express Interest in Additional Training

While organizations could alleviate some hiring difficulties by allowing industry certifications to satisfy educational requirements, upskilling their current workforce may be the better solution. When asked about getting training for 26 digital skills — ranging from productivity software and cloud-based tools to artificial intelligence and programming languages — **79% of APAC digital workers said they would be “extremely interested” or “very interested” in participating in training for at least one digital skill.**

CHART 15

APAC Workers' Interest in Additional Digital Skills Training

■ % Extremely interested ■ % Very interested



Due to rounding, segments may sum to the totals shown, +/-1.

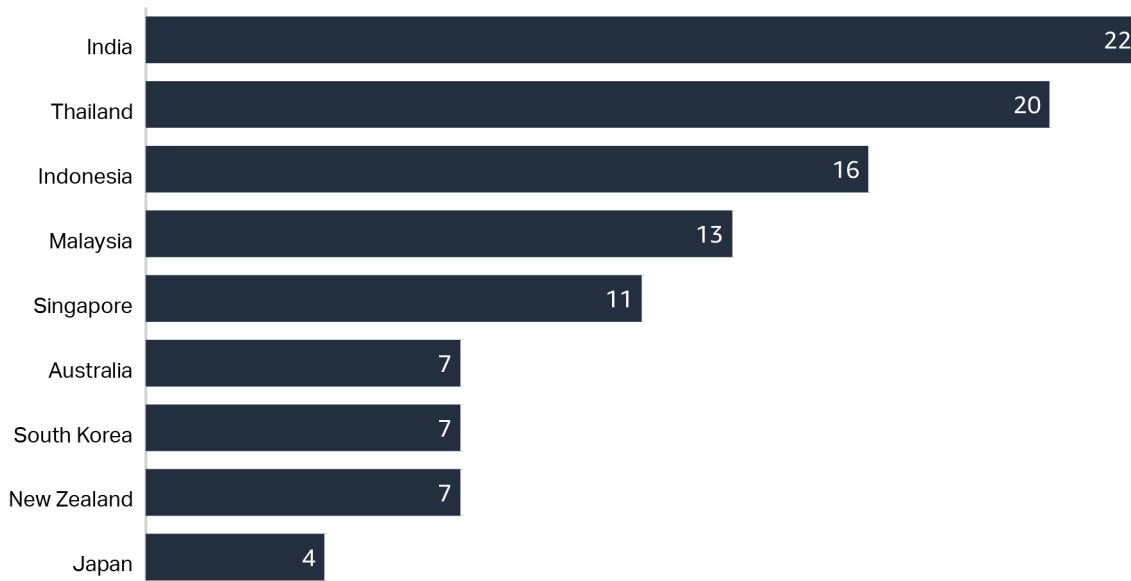
Workers' interest is not centered on a single skill, or even a cluster of skills. For each of the 26 skills, at least 43% of digital workers express interest, and the average APAC worker is interested in training for 13 of these skills.

While the skills themselves receive comparable levels of interest, the overall intensity of interest varies far more by country. Of the 26 skills, Indian and Thai workers express interest in additional training for 22 and 20 of those skills, respectively. Meanwhile, the average Japanese worker is interested in training for just four skills, the fewest of any country. This may reflect the outsized benefits workers in middle-income economies see from digital training, compared with those in high-income economies.

CHART 16

Number of Digital Skills Workers are Interested in Pursuing

Average number of skills, out of 26 skills



Future-Ready: 5G, Cryptocurrency, and the Metaverse Are Here to Stay in APAC

With most organizations currently struggling to hire for jobs related to existing technologies, hiring managers may not be relishing the prospect of a new set of challenges; however, if APAC employers' predictions are to be believed, that is what the future holds.

When asked how likely it is that their organization will adopt 10 emerging technologies — such as artificial intelligence, edge and quantum computing, and blockchain and cryptocurrency — about two-thirds (67%) of organizations say at least one of these technologies is likely to become a standard part of their business operations. More than half of employers (56%) believe multiple technologies will become standard, and 17% say all 10 will be a part of their organization's business.

CHART 17

“On a scale of 0 to 10, where 0 means ‘not likely at all’ and 10 means ‘extremely likely,’ how likely or unlikely is it that each of the following becomes a standard part of how your organization does business in the future?”

% 8 or higher



As with their workers' interest in training for new skills, employers in India and Thailand predict their organizations will adopt more emerging digital technologies than any other APAC country, while Japanese employers foresee adopting just one of these 10 technologies. Still, employers across the region clearly see the new wave of innovation on the horizon, and would do well to begin preparing for its arrival.

About Amazon Web Services

Amazon is committed to investing hundreds of millions of dollars to provide 29 million people around the world with access to free cloud computing skills training by 2025. The company is providing this free skills training through a range of AWS-designed programs, making the latest technical knowledge accessible to anyone who has ever considered a career in cloud computing. To learn more and to get started, visit aboutamazon.com/29million.

About Gallup

Gallup delivers forward-thinking research, analytics and advice to help leaders solve their most pressing problems. Combining more than 80 years of experience with its global reach, Gallup knows more about the attitudes and behaviors of the world's constituents, employees and customers than any other organization. Gallup consultants help private and public sector organizations boost organic growth through measurement tools, strategic advice and education. Gallup's professionals deliver services at client organizations through the web and in more than 30 offices around the world.

Methodology

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Country economic designations

World Bank Income Classification	Country	
High Income	Australia	
	Canada	
	France	
	Germany	
	Hong Kong, S.A.R. of China	
	Italy	
	Japan	
	New Zealand	
	Singapore	
	South Korea	
	Taiwan, Province of China	
	Thailand	
	United Kingdom	
	Middle Income	Brazil
China		
India		
Indonesia		
Malaysia		
Thailand		

Data sources and sample

Gallup Surveys

Findings from the AWS Global Digital Skills Study are based on web surveys conducted August 2-23, 2022, with the following worker and employer populations and markets globally:

Country	Languages	Worker	Employer
Australia	English	2,164	775
Brazil	Portuguese (Brazilian)	1,755	336
Canada	English	1,501	391
China	Chinese (Simplified)	1,233	394
France	French	1,715	355
Germany	German	1,533	367
Hong Kong, S.A.R. of China	Chinese (Traditional)	1,298	356
India	Hindi, English	2,005	769
Indonesia	Bahasa Indonesian	1,412	348
Italy	Italian	1,342	353
Japan	Japanese	2,796	974
Malaysia	English, Malay	1,405	357
New Zealand	English	1,448	374
Singapore	English, Chinese (Simplified)	1,258	351
South Korea	Korean	1,483	364
Taiwan, Province of China	Chinese (Traditional)	1,400	339
Thailand	Thai	1,296	359
United Kingdom	English	1,522	390
United States	English	3,010	1,178
Total:		31,576	9,130

Respondents were recruited using an opt-in, online sample in each country. Thus, only workers and employers aged 18 and older who are internet users were included in this research. Workers were eligible to participate in the first section of the survey if they were employed in any way, and they were eligible for the digital skills section if they worked in a job that involved handling information and used a computer. This digital skills restriction terminated the survey for 4,601 respondents out of 31,576.

For the employer survey, respondents were eligible if they were employed and indicated that they were a mid- or senior-level business leader, information technology (IT) leader, or IT decision-maker working in the private or public sector in an organization with at least five employees. For the digital skills section, employers were also required to employ workers that use a computer. This digital skills restriction terminated the survey for 502 respondents out of 9,130.

The worker data are weighted to match national demographics in each of the selected countries of gender, age, race (U.S. only), Hispanic ethnicity (U.S. only), education, employment status and region (all except Singapore). Demographic weighting targets are based on the most recent Gallup World Poll data figures for online population aged 18 and older in each of the target markets. Gallup also created projection weights based on population figures for analyzing global, aggregate-level data, which were used for some analyses. The weighting process was as follows:

- The base weights are set to 1 for all cases collected for the survey.
- Gallup constructed post-stratification weights to correct for age, gender, education, region and employment status. For the U.S., race and Hispanic ethnicity were also adjusted through post-stratification. For Singapore, region was not included in post-stratification.
- The weights obtained through the post-stratification step were further trimmed to avoid extreme small weights. The trimmed weights were then normalized to make sure they sum up to the number of completed interviews.
- The normalized weights were further projected to the population size of adults (18 and older) with access to internet within each country. The population size is estimated with the age 15 and older population size released by the World Bank (exception: the U.S. age 15 and older population size is based on 2021 Current Population Survey) and estimated percentages of age 18 and older internet users among the age 15 and older population based on 2021 Gallup World Poll estimates.

Below is the summary of credibility intervals and design effects for each country for the worker survey data:

Credibility Intervals for Sample Size Used for Analysis															
Country	Design Effect	100	200	350	500	750	1,000	1,500	2,000	2,500	3,000	3,500	4,000	4,500	5,000
Australia	1.44	12.0%	8.5%	6.4%	5.4%	4.4%	3.8%	3.1%	2.7%	2.4%	2.2%	2.0%	1.9%	1.8%	1.7%
Brazil	1.19	10.9%	7.7%	5.8%	4.9%	4.0%	3.4%	2.8%	2.4%	2.2%	2.0%	1.8%	1.7%	1.6%	1.5%
Canada	1.31	11.5%	8.1%	6.1%	5.1%	4.2%	3.6%	3.0%	2.6%	2.3%	2.1%	1.9%	1.8%	1.7%	1.6%
China	2.00	14.1%	10.0%	7.6%	6.3%	5.2%	4.5%	3.7%	3.2%	2.8%	2.6%	2.4%	2.2%	2.1%	2.0%
France	1.93	13.9%	9.8%	7.4%	6.2%	5.1%	4.4%	3.6%	3.1%	2.8%	2.5%	2.3%	2.2%	2.1%	2.0%
Germany	1.52	12.3%	8.7%	6.6%	5.5%	4.5%	3.9%	3.2%	2.8%	2.5%	2.3%	2.1%	2.0%	1.8%	1.7%
Hong Kong, S.A.R. of China	2.27	15.1%	10.7%	8.1%	6.7%	5.5%	4.8%	3.9%	3.4%	3.0%	2.8%	2.5%	2.4%	2.2%	2.1%
India	2.82	16.8%	11.9%	9.0%	7.5%	6.1%	5.3%	4.3%	3.8%	3.4%	3.1%	2.8%	2.7%	2.5%	2.4%
Indonesia	1.43	11.9%	8.4%	6.4%	5.3%	4.4%	3.8%	3.1%	2.7%	2.4%	2.2%	2.0%	1.9%	1.8%	1.7%
Italy	2.14	14.6%	10.4%	7.8%	6.5%	5.3%	4.6%	3.8%	3.3%	2.9%	2.7%	2.5%	2.3%	2.2%	2.1%
Japan	1.19	10.9%	7.7%	5.8%	4.9%	4.0%	3.5%	2.8%	2.4%	2.2%	2.0%	1.8%	1.7%	1.6%	1.5%
Malaysia	1.50	12.2%	8.7%	6.5%	5.5%	4.5%	3.9%	3.2%	2.7%	2.4%	2.2%	2.1%	1.9%	1.8%	1.7%
New Zealand	1.23	11.1%	7.9%	5.9%	5.0%	4.1%	3.5%	2.9%	2.5%	2.2%	2.0%	1.9%	1.8%	1.7%	1.6%
Singapore	1.69	13.0%	9.2%	6.9%	5.8%	4.7%	4.1%	3.4%	2.9%	2.6%	2.4%	2.2%	2.1%	1.9%	1.8%
South Korea	1.84	13.6%	9.6%	7.3%	6.1%	5.0%	4.3%	3.5%	3.0%	2.7%	2.5%	2.3%	2.1%	2.0%	1.9%
Taiwan, Province of China	2.09	14.5%	10.2%	7.7%	6.5%	5.3%	4.6%	3.7%	3.2%	2.9%	2.6%	2.4%	2.3%	2.2%	2.0%
Thailand	1.64	12.8%	9.1%	6.8%	5.7%	4.7%	4.1%	3.3%	2.9%	2.6%	2.3%	2.2%	2.0%	1.9%	1.8%
United States	1.13	10.6%	7.5%	5.7%	4.8%	3.9%	3.4%	2.7%	2.4%	2.1%	1.9%	1.8%	1.7%	1.6%	1.5%
United Kingdom	1.15	10.7%	7.6%	5.7%	4.8%	3.9%	3.4%	2.8%	2.4%	2.1%	2.0%	1.8%	1.7%	1.6%	1.5%

Credibility intervals replace margins of error in cases where nonprobability samples were used. Refer to the [American Association for Public Opinion Research \(AAPOR\)](#) statement on credibility intervals, “Understanding a credibility interval and how it differs from the margin of sampling error in a public opinion poll” for more information about credibility intervals for nonprobability samples.

Question wording and practical difficulties in conducting surveys can introduce error or bias into the findings of public opinion polls. Opt-in panel samples can also introduce bias due to the sample available in each country. For example, in developing countries, opt-in panel respondents tend to be in urban areas, earn a higher income and be more educated.

Job vacancies

Gallup purchased data for 33 countries from Burning Glass, a U.S.-based labor market analytics company, which was recently merged with Emsi and is now called Lightcast. The sample was all advertised vacancies between June 2021 and May 2022, for a total of 101 million distinct jobs. A limitation of the sample is that Burning Glass scrapes ads from company websites and other online sources, so job vacancies filled through offline advertisements are missed. Previous research in the U.S. finds that this introduces a slight bias against vacancies in low-paying service and construction jobs.¹ The countries include all European Union member countries except Hungary and Slovenia (25 countries). The data also include former EU member the United Kingdom, the U.S., Canada, New Zealand, Australia, Singapore, Hong Kong, and India. Thus, the sample overlaps with 11 of the 19 countries surveyed (Germany, France, and Italy are the others).

The analysis proceeded in several steps: 1) classify all skills as digital or not, 2) analyze the prevalence of digital skills, education requirements and salary premium for each country, and 3) aggregate country-level estimates to the all-country total using the number of ads as the weight.

The classification of digital skills required different techniques for the various countries. Skills are captured at the advertisement level by Burning Glass and listed discretely for each ad. Burning Glass classifies skills into aggregated categories called “families” and “clusters” — one of the families is “information technology.” All skills under this family were counted as digital skills, but AWS and Gallup concluded that other skills would also count. The search uncovered several clusters with digital skills: “drafting and engineering,” “robotics,” “data mining,” “animation and game design,” “graphic and visual design software,” “user interface and user experience,” “graphic and visual design,” “online marketing,” and the discrete skill: “blockchain.” All skills listed under these clusters were included. The final compendium resulted in 1,681 total discrete digital skills advertised in the U.S. The same method was used in the United Kingdom, Canada, Singapore, Australia, and New Zealand.

For the EU member countries, India, and Hong Kong, Burning Glass did not classify skills into aggregate groups. Therefore, Gallup researchers classified skills as digital by building a list from information technology and related occupations. For the EU, researchers used the list of skills associated with Information Technology Professionals and Technicians as well as Science and Engineering Professionals (both using the EU’s European Skills, Competencies, Qualifications and Occupations (ESCO) level 2 typology for occupations). To streamline the analysis, the largest economy, Germany, served as the reference. This resulted in 463 skills, which were then hand-coded as digital or not. Three hundred and thirty-nine were deemed digital. This list was then combined with the U.S.-based list and the combined list of discrete skills was used to classify all discrete skills advertised across the EU. A similar method was employed for India and Hong Kong, using the skills associated with information technology, data science, engineering and other science occupations. There were many spelling variants of coding languages and related skills, and the final list was 19,939 discrete skills in both countries combined.

Other external sources

Gallup World Poll, which uses random sampling methods to achieve representative samples, was used to estimate the number of employed people in the country and the percentage of households that have access to the internet. National government agencies were used to estimate mean wages for workers.

To adjust income to 2022 USD, researchers started with 2017 Purchasing Power Parity indexes from the World Bank International Comparisons Program, then projected 2017 PPPs to June of 2022 using national consumer price growth indexes from 2017 to June 2022. These data were obtained from the U.S. BLS, OECD Stats and national data sources.

¹ Rothwell, J. (2014, July 1). *Still Searching: Job Vacancies and STEM Skills*. Brookings. <https://www.brookings.edu/interactives/still-searching-job-vacancies-and-stem-skills/>

Definitions of key concepts

Digital skills

This survey defined digital skills in the native language of each respondent using the following statement: *“Some people use computers and similar devices as part of their work. The term ‘digital skills’ refers to the ability to effectively use digital devices, communication applications, and electronic information networks to perform work.”*

The survey then asked respondents to classify themselves into one of four digital skill categories, which were used in the analysis.

Which of the following best describes the extent to which you use digital skills in your current job?

- 1) *I do not use a computer or tablet as part of my job.*
- 2) *I use basic digital skills such as email, word processing, filling out electronic forms or entering data from them, or social media posting.*
- 3) *I use intermediate digital skills that require some training but do not require knowledge of a programming language. For example, drag-and-drop website design, troubleshooting applications or network performance, or data analysis.*
- 4) *I use advanced digital skills that require a programming language or involve skills such as cloud architecture design/maintenance, software/application development, artificial intelligence or machine learning.*

Commonly used digital skills

As an alternative item and digital skills classification and validation, the survey also asked respondents which of 26 digital skills they use at work, if any. This item was asked on both the worker and employer surveys, with slightly different wording. The number of skills selected was used to assess the depth and level of digital skill use at the individual and organizational levels. At the individual level, respondents who use five or more digital skills were considered advanced digital users. There was a moderately positive correlation between self-identified advanced digital users and the number of skills selected ($r=.33$).

Which of the following digital skills do you currently use at work? Please select all that apply.

- 1) *Animation and Game Design*
- 2) *Application Development, Security, Interface*
- 3) *Artificial Intelligence*
- 4) *Augmented Reality/Virtual Reality (AR/VR)*
- 5) *Blockchain*
- 6) *Cloud-based tools (e.g., file-sharing services, messaging applications like Slack, cloud-based CRM tools)*
- 7) *Data Mining*
- 8) *Internet of Things (IoT)*
- 9) *Routine business software (e.g., Microsoft Office, Google Docs, Apache Open Office, etc.)*
- 10) *Network Configuration, General Networking*
- 11) *Graphic and Visual Design*
- 12) *Online Marketing*
- 13) *Robotics*
- 14) *Software Development Principles*
- 15) *Technical Support*
- 16) *Web Development*
- 17) *System Design and Implementation*
- 18) *SQL Databases and Programming*
- 19) *Enterprise Resource Planning (ERP)*
- 20) *Database Administration*
- 21) *JavaScript and jQuery*
- 22) *Cybersecurity*
- 23) *Operating Systems*
- 24) *Scripting Languages*
- 25) *Software Quality Assurance*
- 26) *Java*

Analytic methods

Prevalence of digital skills by country

To estimate the percentage of workers in each country that use no, basic, intermediate or advanced digital skills, researchers started with weighted country-level means. Weighting targeted the working population with internet access. Thus, weighted country-level results pertain to the internet-using population, but they were not intended to represent the working population more generally.

To estimate more general working-population means, researchers multiplied the percent of households with internet access, available through Gallup World Poll, by the percentage of internet users with digital skills. Define DS as the share of workers with digital skills and subscripts “L,” “C” and “I” as referring to the level of digital skills, the country, and the internet-using population, respectively. “I” refers to the share of households with internet access. The following formula (1) calculates the share of workers with skill level “L.” The share with no digital skills (NS) is then calculated as 1 less the sum of the DS shares for each skill level (other than none).

$$1) DS_{i,c} = DS_{i,c,i} \times I_c$$

$$2) NS = 1 - \sum DS_{i,c}$$

This is equivalent to assuming that workers with no internet access do not use a computer or other digital skills at work. This is a conservative assumption, but it corrects for the strong bias in the opposite direction: that internet users are far more likely to use digital skills at work. The ideal estimate of digital skills prevalence would be drawn from a random sample of all workers, regardless of internet status, but as that was not possible in this study, this method provides the next best alternative estimate.

Salary premium of digital skills

The digital skill salary premium is the marginal percentage increase in income for those using advanced digital skills compared to those who do not use digital skills at work but are otherwise similar in their observable productive characteristics.

This requires the collection of accurate self-reported income data. One concern is that the sample, especially in developing countries, is biased toward respondents with higher socioeconomic status, since internet access is

a prerequisite for participation. One tool to guard against this bias is to constrain outliers. Researchers considered implementing a rule based on the number of standard deviations from the mean, but realized even the mean was obviously biased upwards in the sample when compared to national estimates (for most countries). Researchers decided to use objective data on the income distribution from the [World Inequality Database](#), which uses data from national tax records. Specifically, researchers downloaded the income thresholds for adults in the 95th and 99th percentiles of the national income distributions for every country in the sample. For self-reported incomes between the 95th and 99th percentiles, the minimum WID threshold was imputed. For incomes that were at or above the top 1%, the top 1% (or 99th percentile) threshold was imputed. This affected 10% of the sample (6% from the top 1%). Researchers strongly believe this gives more accurate data and certainly constrains the outliers.

The estimation equation, which follows the Mincerian wage regression, can be written down as follows:

$$3) \ln(\text{Income}_i) = \alpha + \beta(DS_{i,c}) + \delta_{i,c} + \kappa_c + \varepsilon$$

The log of income is regressed on a binary variable for the level of digital skills, with workers who do not use digital skills at work omitted as a reference category. A vector of demographic characteristics is included, consisting of binary variables for age categories, hours worked, gender, nativity and education. Country and province/regional level fixed effects are included. For global estimates, these estimates were weighted by the projection weight, described above, which essentially gives higher weight to respondents that represent more workers. Point estimates on advanced skills are well above zero with 95% confidence intervals with or without clustering errors by country and region.

To test the robustness of these results, researchers also controlled for sector and occupational fixed effects and re-estimated the model using the number of skills selected instead of the “advanced.” These results were qualitatively similar, suggesting the benchmark model was robust. The beta coefficient on advanced digital skills in the global sample was 0.65. The coefficient on use of five or more digital skills was 0.55.

As another, more substantial robustness check, the salary data associated with advertised vacancies using the Burning Glass database was analyzed. To estimate

the digital skill premium for each country, researchers took the average of the minimum and maximum salary range associated with each advertisement, coded discrete experience and educational requirements into binary categories, and regressed the log of income on digital skill intensity. Both binary coding (ad lists at least one digital skill) and levels of digital skill intensity were used. All ads were coded by the number of digital skills listed into 0, 1, 2, 3, 4, 5 to 9, or 10 or more. Salary premium models used both definitions of digital skills, but the preferred estimate compares ads with 10 or more digital skills to those with 0, as salary rises in a linear fashion with the number of digital skills in all countries in the sample.

Given the huge sample size (101 million vacancies), these estimates were precisely estimated and revealed a wage premium for advanced digital skills of 40% in the sample of 33 countries and a similar value in the matched-country sample. Reassuringly, the premium did not appear to vary in the countries with aggregated skill data relative to the countries where researchers created their own digital skills tag.

GDP estimates

To calculate GDP estimates at the country level, researchers ran the preferred regression model (equation 3) separately for each country and used the country-specific betas as effect estimates. In this way, GDP estimates were calculated based on the digital skills premium associated with basic, intermediate and advanced skills. These premia were multiplied by the average wage for each country, the total number of workers in each country and the percentage of workers in each skill domain, after making the adjustments discussed above. The result of the adjustments was to greatly reduce the estimated population of digitally skilled workers and therefore suppress the GDP estimates. The national average wage, obtained from external sources, was used instead of the survey-based sample average wage, because the latter was artificially high due to the opt-in internet-only sample bias, even after the trimming discussed above.

Country-level estimates were replicated using the alternative method for identifying advanced digital users (i.e., the selection of five or more skills). The results were largely well-aligned, except for Japan, where the coefficient on advanced digital skill use turned from negative (in the baseline model) to significant, large and positive. Further investigation revealed many high-earning Japanese

workers who use many digital skills classified themselves as intermediate rather than advanced digital users. Coefficients also became notably larger in New Zealand and Australia.

The countries in the sample represent 67% of global GDP and include a mix of lower-middle, upper-middle and high-income countries. Given the diversity of the sample, its high weight in global GDP, and the omission of countries with large tech sectors (e.g., most of Europe, Mexico, Western Asia, Russia, Argentina), it is reasonable to assume that the GDP-weighted contribution of digital skills to GDP is similar in the countries not sampled. Thus, the estimate of global GDP divides the observed GDP effect by the observed global share of GDP.

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