



DIGITAL JOBS AND DIGITAL SKILLS

A SHIFTING LANDSCAPE IN ASIA
AND THE PACIFIC

SEPTEMBER 2022

LinkedIn®

ADB

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AND THE PACIFIC

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ISBN 978-92-9269-606-1 (print); 978-92-9269-607-8 (electronic); 978-92-9269-608-5 (ebook)
Publication Stock No. SPR220348
DOI: <http://dx.doi.org/10.22617/SPR220348>

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Notes:

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On the cover: Digital skills are crucial for success in the labor markets of tomorrow, whether for young people or for mid-career and mature workers. This is particularly true in technology-intensive sectors like smart cities, e-learning and the green economy.

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Foreword

Global business is increasingly powered by digital solutions. While digital transformation was already gathering pace prior to COVID-19, the pandemic significantly boosted its speed. According to the International Data Corporation, digital technologies are greatly impacting production and consumption of goods and services. It expects that 65% of GDP in Asia and the Pacific will be digitalized by 2022, and that by 2023 one in three companies will be generating more than 30% of their revenue from digital products and services. There is no doubt that future marketplaces call for substantial investments in digital skills. In fact, the United Nations Educational, Scientific and Cultural Organization lists digital skills as indispensable competencies that every individual needs to effectively manage their personal and professional lives.

To better understand the impact of digital transformations, ADB and LinkedIn partnered to prepare this report on *Digital Jobs and Digital Skills: A Shifting Landscape in Asia and the Pacific*. The report draws on data from the LinkedIn platform on changing patterns of demand and supply in skills across different occupations, and on a survey on digital credentials commissioned by ADB.

The report highlights the critical importance of digital skills for job markets. It provides highly relevant and data-driven insights for stakeholders in government, industry, and the international community on shifts in the markets for jobs, skills, and credentials. Not surprisingly, the report shows that hiring for digital jobs has been increasing and has been highly resilient to the effects of COVID-19. Basic digital skills will be essential for most employees in the future workforce. While not everyone needs to be a data scientist or an expert in artificial intelligence, the report leaves no doubt that employers are placing great emphasis on digital skills as they hire new talent. There is also growing emphasis on digital credentials. These can be an alternative to mainstream qualifications or can complement them to increase the marketability of the job seeker.

Globally, labor markets are witnessing growing pressures from talent and skill shortages. Policy makers need to ensure effective workforce development that incorporates digital skills to increase access to quality jobs and to improve productivity and competitiveness.

We are delighted that this partnership between ADB and LinkedIn will support greater awareness of trends in digital skills in select industries. We hope this will help policy makers in the Asia and Pacific region to better understand the digital jobs landscape and strengthen skills development. Educational institutions need to offer new programs for digital skills at all levels to equip the workforce to succeed in labor markets in the digital era.



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Preface and Acknowledgments

Digital skills are increasingly important for success in modern job markets. Digital transformation has pervaded practically all industries, fueled by developments due to COVID-19. As digital transformation accelerates, what are the skills required for these digital jobs? What types of credentials will become more important? What is the demand for, and supply of, digital skills in key sectors? This report examines the landscape of future jobs by triangulating skills (demand and supply), credentials (qualifications, certification, and their recognition), and emerging jobs. It discusses key trends in job markets, particularly in emerging industries, the credentials and qualifications in demand, and the skills that job seekers are expected to have.

The report presents practical recommendations for timely action to leverage the digital transformation for greater access to digital jobs with appropriate digital skills. This will bring strong rewards as Asia and the Pacific speeds up its digital revolution. Digital upskilling and reskilling will become critical to people remaining in the workforce and benefiting from higher paid jobs in key technology sectors.

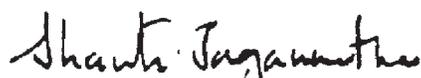
We would like to thank Bambang Sstantono, former ADB Vice-President for Knowledge Management and Sustainable Development and currently Chairman of the New Capital Authority, Government of Indonesia and Nathan Williams, Senior Director, Economic Graph, LinkedIn for having initiated the dialogue that led to this collaboration. We thank Woochong Um, ADB Managing Director General and Dave Woodward, Vice President and Head of Public Policy at LinkedIn, for the joint Foreword to this report. We are also grateful to many other people for their valuable insights and support. From ADB we thank Bruno Carrasco, Robert Guild, Elaine Tan, Sungsup Ra, Brajesh Panth, Thomas Abell, Paul Vandenberg, Sameer Khatiwada, Elisabetta Gentile, Jeffrey Xu, Sonoko Sunayama, Ryotaro Hayashi, and Fook Yen Chong. From LinkedIn we appreciate the contributions of Suu Wei Ho, Pei Ying Chua, and Yao Huang. We also appreciate Adam Green for his help in writing the analysis from LinkedIn. Outline India carried out a survey of digital credentials: our thanks to Prerna Mukharya, Suchandra Nandy, Diksha Pandey, and Shaivya Verma. Dorothy Geronimo and Mary Rose Ong from ADB's education sector group provided additional support, along with Department of Communications colleagues Andrew Achimu, Sayed Masood Alam, Rodel Bautista, Cynthia Hidalgo, Mira Gloria, Noren Jose, Luca Lamorte, Duncan Mcleod, Sarah O'Connor, Oliver Reyes, and Anthony Victoria. We thank Peter Fredenburg for rapid editing of the report for publication.

We look forward to continued dialogue on this topic and to building further on this type of analytical base to help developing country policy makers navigate transitions in the labor force with timely policy reforms and actions.



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Abbreviations

ADB	Asian Development Bank
AI	artificial intelligence
COVID-19	coronavirus disease
SQL	structured query language

Executive Summary

Explosive growth and spread of digital technologies have brought transformational changes to the working world. Digital technologies are reshaping labor markets, increasing demand for people with digital skills and competencies, while reducing demand for people who perform routine manual jobs that are amenable to automation. This transformation promises higher productivity but comes with challenges, as automation eliminates many jobs, digitalization transforms traditional practice in entire industries, and unequal access to digital technologies threatens to exacerbate job market vulnerabilities of the poor and disadvantaged. Informed policies and actions are needed to amplify benefits and mitigate harm.

The coronavirus disease (COVID-19) pandemic accelerated digitalization trends even as it exposed the dangers of unequal access to connectivity and devices. Firms adopted digital business models seemingly overnight to build agility and resilience into their operations. The need for skill enhancement to enable workers to remain in the workforce and to land digital jobs in demand is witnessing a steep rise. The world after COVID-19 will see fundamental transformation in work practices and models. While employers and job seekers are the most directly affected in the short run, policy makers need to respond to these trends with more strategic and long-run sustainable approaches to investment in skills and talent pools that will effectively serve high-growth industries and provide high-quality employment.

From e-learning in India to business process outsourcing in the Philippines, countries in Asia and the Pacific have already built sizable industries in the digital economy. However, for the region to achieve inclusive employment growth over the long term, workers' skills and competencies must align closely with demand in the private sector. What is needed is better understanding in real time of the dynamics of the labor market and in particular of trends in digital jobs and the skills they require.

The Asian Development Bank (ADB) and LinkedIn collaborated to prepare this report to gain a better understanding of the emerging landscape of jobs and skills in an increasingly digital workplace. This joint report uses evidence from LinkedIn's Economic Graph to analyze digital jobs, skills, and qualifications, as well as the impact of COVID-19 on job trends. In parallel, it highlights key findings from a survey commissioned by ADB on the growing significance of digital credentials that certify digital skills and online learning. Employers and online education providers were surveyed to gather information on talent hiring and credentials sought for digital skills in emerging industries that will drive future growth in the region. The survey also asked how respondents perceive digital credentials compared with traditional qualifications and degrees.

The report leverages real-time data from LinkedIn's Economic Graph to present insights on the shaping of the workforce in the digital economy and the nature of jobs and skills that are flourishing in the market. The LinkedIn analysis covers India, Indonesia, Malaysia, and the Philippines, as well as Australia, Singapore, and the United States (US), the latter three as benchmark countries. It analyzes three sectors deemed to be of importance in the future—renewable energy, e-learning, and smart cities—to track trends in digital skill supply and demand and the nature of digital occupations.

The digital credentials survey commissioned by ADB looks into whether traditional qualifications and paper certification are giving way to digital credentials and certification. It covers Bangladesh, India, Indonesia, and the Philippines, with the US as a benchmark country. It focuses on education providers and employers in three industries—the green economy, e-learning, and smart cities.

The following are key findings in this report:

- ✔ **Digital hiring is on the rise and has been highly resilient during the pandemic.** Demand for digital skills has steadily increased over the past 5 years. Close to 75% of all employers surveyed in the five countries covered in the digital credentials study reported increased demand in their industry for all levels of digital skills, from basic to advanced.

From January 2017 to February 2020, the digital hiring rate in the LinkedIn platform—the proportion of LinkedIn members who list digital skills in their profile and indicate a change in employer that month—had increased by an average of 9 percentage points year on year across the Asia and Pacific economies covered in this report. This compares to the 5-percentage-point increase of a similar nature in the US. There has clearly been robust activity in digital hiring in recent years.

Digital hiring initially collapsed under the pandemic but data show that it quickly revived. The pandemic caused digital hiring to plunge by half in the first 6 months of 2020, which was, however, followed by quick recovery and acceleration in late 2020 and early 2021. Analysis of the LinkedIn platform showed jobs requiring digital skills rebounding quickly even during the pandemic.

- ✔ **Digitalization is gathering pace in pandemic-affected industries.** Demand for digital skills grew most in industries hit hardest by the pandemic. The pandemic increased demand for talent able to help companies accelerate their digital transformation with improved digital infrastructure for consumers and for their own operation and management, especially in industries strongly affected by the crisis, including health care and education. Demand for talent able to support digital transformation has been especially strong, indicating a deepened appreciation for skills and competencies that can modernize organizations' digital capability.

- ✔ **Basic digital literacy is now essential, and workers with higher skills benefit more.** The survey of employers showed that, on average, employers required 8 of the last 10 candidates hired in the past year to possess at least basic digital literacy and skills, and 4 of the last 10 hires to possess advanced digital skills. Individuals with just basic digital skills met with less growth in demand than those with either intermediate or advanced disruptive digital skills. Hiring for digital talent showed differences when comparing basic, intermediate, and advanced digital skills. Individuals with only basic skills were in much lower demand than those with either intermediate or advanced skills. About 70% of all surveyed employers reported that basic and applied digital skills are now a workplace essential, highlighting the growing importance of advanced digital skills.

- ✔ **Fundamental coding and programming skills are an emerging need across all jobs.** Across all countries surveyed, Structured Query Language (SQL) and Java consistently appear among the digital skills most in demand for different job categories. This indicates the broad applicability and relevance of these fundamental coding and programming skills, required for data analysis and building software and hardware tools. To seize emerging opportunities in the digital era, organizations can benefit from a more flexible approach to appraising credentials arising from online learning, micro and modular learning, and lifelong training, one that facilitates an ongoing process of upskilling and reskilling.

- ✔ **Short- and medium-duration online digital skill training programs witnessed high growth rates in the past year.** Among the online training providers surveyed for this study, 28% said their most popular digital skill courses are typically of medium length, or 3–6 months in duration. The next most common course length, as per 25% of the surveyed training providers, is those that last less than a week and are distillations of medium- or full-length courses intended to provide a taste of the topic. Short courses are found to be ideal for professionals who wish to refresh their domain knowledge or catch up with the latest advances.

The COVID-19 pandemic spurred unprecedented growth in online learning as remote work and learning became the new normal. The number of users of LinkedIn Learning, for example, more than doubled from 2019 to 2020, and hours on the platform per learner jumped by 58%. Industry leader in online learning, Coursera, witnessed a 444% increase in course enrollment from before COVID-19. A similar trend was reported by edX, which saw newly registered learners increase tenfold and overall course enrollment increase by a factor of 15. Among all training providers surveyed, 93% predicted that demand for online learning—and consequent accelerated growth in online training platforms—would persist after the pandemic. This sentiment was expressed across all countries surveyed.

- ✔ **Smart cities and e-learning need digital skills more than the renewable energy sector.** Digital talent comprises 75% of the e-learning industry and 70% of the smart cities industry. Although the percentage of digital talent in renewable energy is lower at 56%, analysis shows that many top emerging digital skills relate to understanding, visualizing, and using data. These data skills are critical as the industry moves from perfecting engineering innovations and clean energy hardware, toward innovations in applications like smart grids, the Internet of Things, and energy forecasting, which are becoming more important as electric utilities adapt to decarbonization.

Workers in renewable energy and smart cities tend to have engineering degrees, while those in e-learning have a broader mix of educational qualifications. These differences reflect the nature of the industries. Smart cities and renewable energy are closely linked to physical infrastructure, which necessitates greater engineering expertise. There may also be stricter requirements for employees, such as safety inspectors, to be formally certified. However, opportunities exist for newer digital roles to emerge in these industries that may require non-engineering credentials. Demand is growing for data and visualization skills, which require different credentials and can be learned over shorter periods of time. While some roles will require formal training, policy makers would do well to invest in upskilling talent with shorter-term credential programs to meet demand that comes from digitization in these industries.

- ✔ **E-learning has enjoyed a sharp rise in hiring across all countries surveyed.** Employees in e-learning have a broader range of educational backgrounds than do those in renewable energy and smart cities, and they hold a wider variety of degrees. Women and young people have a predominant share of the employee base in the e-learning sector. It is also a relatively new industry with a growth outlook, so it is attracting young talent.
- ✔ **Data analytics is a fast-growing skill across all industries in the report.** The ability to use and analyze data is among the fastest-emerging skill categories in e-education, smart cities, and renewable energy.
- ✔ **Millennials dominate in the smart city, e-learning, and renewable energy workforce.** The workforce in the three industries is largely comprised of millennials, born from 1981 to 1996, and who are in the early and middle stage of their careers. Gen Z, born from 1997 to 2012, makes up a larger share of the workforce in India and Indonesia. The e-learning industry, particularly in India, Indonesia, and the Philippines, has the largest shares of Gen Z and millennials.
- ✔ **A revolution is under way in how learning and competencies are recognized.** Among all respondents to the digital credentials survey commissioned by ADB, 89% agreed that digital credentials will become a critical part of higher education. However, this is not expected to diminish the market value of traditional credentials in the near term. Three-quarters (77%) of employers surveyed believe that traditional and digital credentials will coexist and complement each other in the near future.

- ✔ **Digital credentials currently accompany more than a third of job applications.** Among all employers surveyed, 62% reported that job applications list at least one digital credential often or very often. In Bangladesh and India, where competition for a limited number of jobs is stiff and candidates need to stand out, 80% of all job applications reported digital credentials, or 20 percentage points more than in the US. In Indonesia and the Philippines, a lower share of candidates present digital credentials than in the US, perhaps reflective of lower digital connectivity, and the number of digital credential issuers.
- ✔ **Digital credentials are more prevalent for junior positions.** Employers are most comfortable hiring entry-level professionals who present at least one digital credential. The weight accorded digital credentials in hiring decreases with the seniority of the position being filled. Among all surveyed employers, 65% reported hiring entry-level staff based on digital credentials, decreasing to 50% for midlevel positions and 45% for senior ones. This trend is common to all surveyed countries, perhaps reflecting that digital credentials are relatively new and therefore more likely held by younger workers.

By industry, 71% of employers in online education hired entry-level candidates with digital credentials, 66% in smart cities, and 55% in the green economy. Notably, smart city employers are most comfortable hiring senior executives on the basis of digital credentials, perhaps reflecting that smart city projects need leaders who are comfortable with technology and automation to improve quality of life in urban contexts. Skills in new technologies for smart cities are more easily acquired from online courses, and, because it is an emerging field, in-depth expertise rooted in past experience and qualifications may not be available.

- ✔ **Digital certificates are the most common digital credentials, followed by digital licenses.** Among all surveyed employers, 59% reported having hired a candidate who presented a digital certificate, and 47% of employers reported hiring a candidate with a digital license. Less common digital credentials offered by successful candidates were endorsements (34%), open badges (27%), micromasters (22%), and nanodegrees (17%). Survey results show online education to be the industry most open to hiring candidates with digital certification, with 83% of surveyed firms in this field reporting having done so, followed by 55% in smart cities and 52% in the green economy. Acceptance of digital credentials was only 1 percentage point higher in the US than the specific countries surveyed in Asia, revealing that developing countries have been quick adopters of digital credentials.
- ✔ **Equal access to digital skills and credentials by gender requires affirmative action.** Almost two-thirds of surveyed online trainers, or 64%, do not offer digital skill programs that are packaged specifically for women, disadvantaged youth, indigenous communities, people in poverty, or people living in remote locations with little or no access to the internet. In Asia, female enrollment in digital skill courses is reported at only about half of male enrollment, and 60% of all surveyed employers reported that fewer than 30% of applications submitted by female candidates offer digital credentials.

Introduction

Digital technology is reshaping labor markets, causing job seekers and hirers alike to continually keep track of trends in job markets to understand emerging opportunities and requirements for digital skills. For this report, data from the LinkedIn platform provide a rich and real-time resource for tracking trends in skill supply and demand. LinkedIn's Economic Graph dataset captures LinkedIn's 774 million individual members and 57 million companies globally, analyzed through the prism of 38,000 skills and across 120,000 educational institutions.

This report summarizes key trends in digital hiring found in LinkedIn's Economic Graph dataset, covering India, Indonesia, Malaysia, and the Philippines, with Australia, Singapore, and the United States (US) as developed economy comparators. LinkedIn data provide valuable real-time information on trends in hiring and occupational profiles, albeit with certain limitations. The methodology used in analyzing data from the LinkedIn platform is explained in Annex 1.

In addition to analysis using the LinkedIn Economic Graph, this report includes findings and analysis from surveys of employers and online education providers to capture recent trends in digital skills, hiring, and more specifically the use of digital credentials. The surveys, commissioned by the Asian Development Bank, covered Bangladesh, India, Indonesia, and the Philippines, with the US as the developed economy comparator. The

surveys focused on three priority industries important for future growth in Asia: smart city development, online education, and the green economy. Within these industries, 133 hiring and recruitment executives of leading global and local firms were surveyed to illustrate how employers cope with digital talent and skill shortages; what kind of skills and credentials are needed for the future of work; and how new online, nondegree credentials are evolving in relation to traditional, degree, and certificate qualifications. As part of qualitative surveys, 25 employers were interviewed at length. Further, 96 online education executives in charge of business development, growth, and strategy at institutes that provide digital skill training and digital credentials were surveyed to explore demand for new digital skills, emerging types of credentials, and how they collaborate with industry and educational institutions. In-depth discussions were held with 20 of them. The analysis thus reveals key trends in digital hiring in the three growth industries, demand for specific roles and skills, and the educational profile of the labor force.

Digital Talent Trends Before and After the Pandemic

KEY FINDINGS

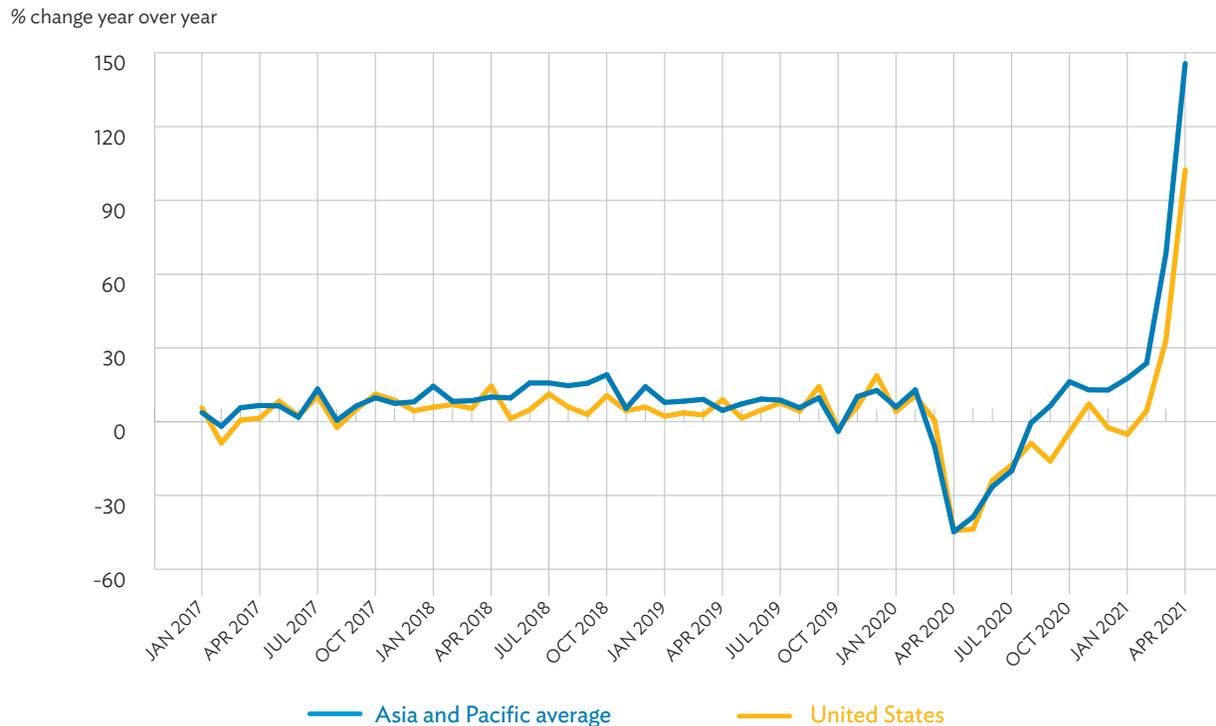
- ✔ **Digital hiring collapsed under the pandemic but quickly revived.** From January 2017 to February 2020, the digital hiring rate—the proportion of LinkedIn members who list digital skills in their profile and indicate a change in employer that month—increased by an average of 9 percentage points year on year across the Asia and Pacific economies covered in this report, more quickly than the 5-percentage-point increase in the US. The pandemic then caused digital hiring to plunge by half in the first 6 months of 2020, but this was followed by quick recovery and acceleration late in 2020 and early in 2021.
- ✔ **Demand for digital skills grew most in industries hit hardest by the pandemic.** The pandemic increased demand for talent able to help companies accelerate their digital transformation with improved digital infrastructure for consumers and for their own operation and management, especially in industries strongly affected by the crisis, including health care and education.
- ✔ **Workers with higher skills benefited more.** Individuals with basic digital skills enjoyed less growth in demand than those with either intermediate or advanced disruptive skills.

The pandemic disrupted labor markets globally as restrictions on movement accelerated the need for digital transformation. To analyze how these changes affected Asia and the Pacific, this section looks at hiring trends for digital talent before the onset of the coronavirus disease (COVID-19) pandemic and in its wake (see Annex for methodology).

Digital Hiring Rebounded Quickly in the Aftermath of the Pandemic

Digital hiring fell sharply at the beginning of the pandemic but rebounded quickly in the later part of 2020 and early 2021 (Figure 1). From January 2017 to February 2020, the digital hiring rate had increased by an average of 9 percentage points across the Asia and Pacific economies included in this report, more than the 5-percentage-point increase in the US. The pandemic caused digital hiring to plunge by more than half in the first 6 months of 2020, but it rebounded quickly, recovering to pre-pandemic levels by the end of 2020. In the first few months of 2021, growth in digital hiring continued to accelerate.

Figure 1: Change in the Digital Hiring Rate in Asia and the Pacific versus the United States



JAN = January, APR = April, JUL = July, OCT = October

Notes:

¹ The digital hiring rate is the proportion of LinkedIn members who list digital skills in their profile and indicate a change in employer that month. The change in the rate is measured here year over year.

² In this figure, the Asia and Pacific average includes Australia, India, Indonesia, Malaysia, the Philippines, and Singapore.

Source: LinkedIn Economic Graph.

Higher Demand for More Advanced Digital Skills

The pandemic has accelerated demand for digital talent, especially in the industries most heavily affected. LinkedIn's *Jobs on the Rise* report revealed surging demand for professionals in health care, education, and digital services in Southeast Asia and India.¹ India's health-care market, for example, is expected to be worth \$372 billion in 2022, up from \$61.8 billion in 2017, and this will continue to spur job growth in the industry.² Digital hiring in education continued to grow even during the pandemic, with education technology or edtech companies and online training portals occupying the top 10 positions in education as employers hiring digital professionals.³ Meanwhile, with the number of social media users in India growing by 48% year on year to reach 400 million at the beginning of 2020, India looks set to continue to see growth in demand for digital marketers and content creators (footnote 3). The pandemic has thus forced companies across multiple industries to expand their digital infrastructure for consumers, as well as for their own operational and management needs. A more nuanced view of digital trends emerged from analysis of the share of new jobs that went to digital skill categories in 2020 relative to 2019 (Table 1).

Table 1: Difference in Average Share of Digital Hires in 2020 over 2019, by Skill Category
(percentage point)

Comparison	United States	Australia	India	Singapore
All digital over non-digital	-3	4	2	-4
Advanced over basic	38	31	6	23
Advanced over intermediate	3	-1	4	0
Intermediate over basic	34	32	2	23

Note: Analysis included only Australia, India, Singapore, and the United States for lack of sufficient data from Indonesia, Malaysia, or the Philippines.

Source: LinkedIn Economic Graph.

Significant differences in hiring trends emerged when comparing people with basic, intermediate, or advanced digital skills. Individuals with only basic skills were in much lower demand than those with either intermediate or advanced skills. The gaps were widest in the US and Australia but also significant in Singapore, signaling demand for higher digital talent in advanced economies.

¹ LinkedIn. 2021. *Jobs on the Rise in 2021* <https://business.linkedin.com/talent-solutions/resources/talent-acquisition/jobs-on-the-rise-sea>.

² Invest India. Healthcare Industry in India is Projected to Reach \$372 billion by 2022. <https://www.investindia.gov.in/sector/healthcare>.

³ K. Desai. 2020. Digital Hiring in Education Sector Is Growing Despite Pandemic. *Times of India*. 27 September. <https://timesofindia.indiatimes.com/home/sunday-times/digital-hiring-in-education-sector-is-growing-despite-pandemic/articleshow/78337640.cms>.

These findings indicate that basic digital skills are pretty much essential and do not confer on job seekers a competitive edge. Workers with either intermediate or advanced digital skills are much more in demand than those with only basic digital skills. Those with only basic digital skills are nearly on par with those who did not report any digital skills at all. It may be that basic digital skills such as digital literacy are so common that many who have them do not list them on their LinkedIn profiles. Those who have either intermediate or advanced skills are more likely to list them to stand out to potential recruiters or employers. Despite this, trends indicate that basic digital skills are foundational, and that investing in higher digital skills is what brings better returns on the job market.

Interestingly, there is not much difference between hiring trends for intermediate versus advanced disruptive skills. Intermediate skills enable those who master them to deploy hardware and software to build tools, platforms, and applications that can be easily used by others with only basic digital skills. Advanced disruptive skills are needed to develop new technologies such as artificial intelligence (AI), robotics, and genetic engineering. That there is nearly equal demand for intermediate and advanced digital talent suggests strong codependence between the categories as technology advances.

Rising Demand for Digital Skills

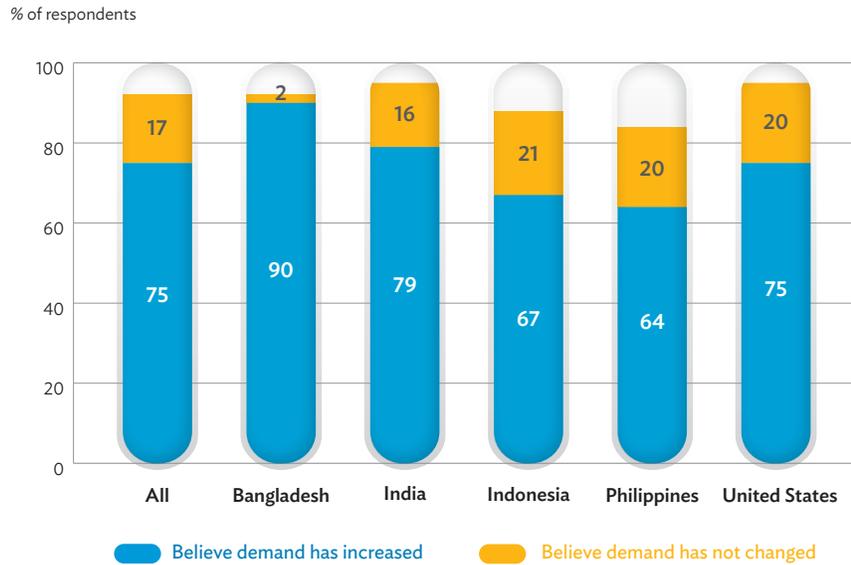
This report considers ADB–Outline survey results mostly in two sections below—Rapid Survey on Digital Credentials: Evolution, Demand, and Use; and Recommendations and the Way Forward. Here, though, it is interesting to see how these survey results support and expand upon findings from the LinkedIn study on demand for tech skills.

Employers were surveyed in Bangladesh, India, Indonesia, and the Philippines—as well as in the US as a benchmark country—to assess how demand for digital skills increased over the past 5 years. Close to 75% of all employers surveyed in the five countries reported increased demand for all digital skills, from basic to advanced, in their industry over the past 5 years (Figure 2). Both basic and applied digital skills have become near-universal requirements for employment.⁴ About 70% of all surveyed employers reported that basic and applied digital skills are now a workplace essential.

Evidence of rising demand was highest in Bangladesh and India, followed by the US. These three countries also reported the highest demand for advanced digital skills relative to demand for basic skills (Figure 3). This lends additional support to LinkedIn Economic Graph findings that demand is rising most quickly for talent with more advanced digital skills.

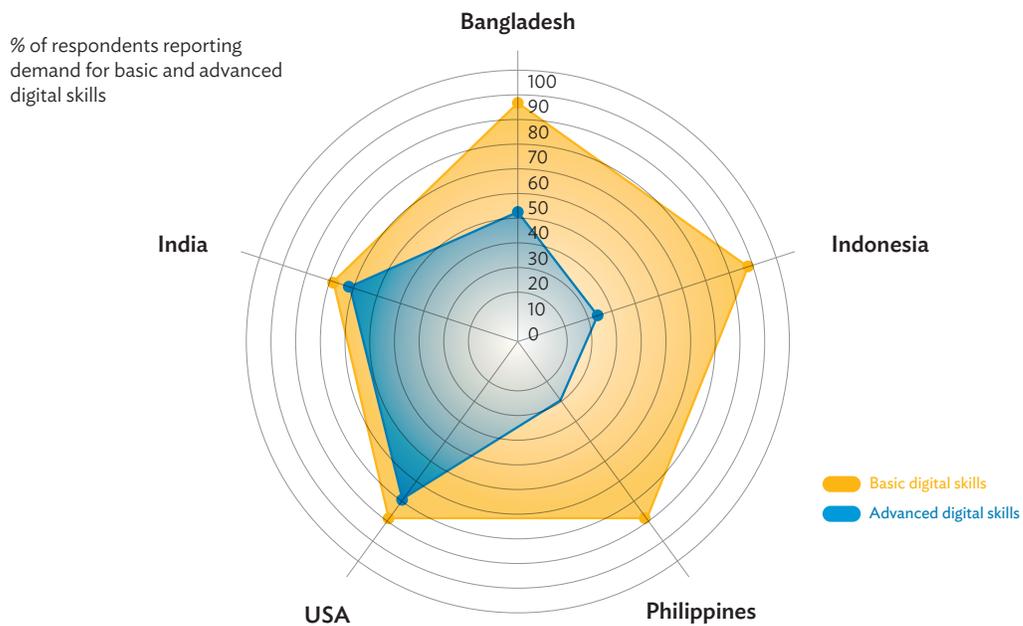
⁴ The credential survey ranked digital skills in four categories. As in the LinkedIn taxonomy, basic digital skills convey simple tech concepts and enable the use of enterprise technologies, platforms, and solutions on the job. The next two categories—(i) applied digital skills and (ii) computer hardware and software skills that enable the building of tools, platforms, and applications—correspond to intermediate digital skills in the LinkedIn study. Advanced skills facilitate, as do advanced disruptive digital tools in the LinkedIn study, the invention and creation of new technology.

Figure 2: Change in Demand for Digital Skills in the Past 5 Years



Note: N = 133. Almost all of the remainder had no opinion, and essentially none reported decline.
 Source: Asian Development Bank. Forthcoming. *A Rapid Survey on the Evolution, Demand, and Use of Digital Credentials*. Manila.

Figure 3: Demand for Basic versus Advanced Digital Skills



USA = United States.
 Note: N = 133.
 Source: Asian Development Bank. Forthcoming. *A Rapid Survey on the Evolution, Demand, and Use of Digital Credentials*. Manila.

Employers hiring staff for niche, tech-intensive roles reported demand for computer hardware and software skills (the upper end of intermediate skills in the LinkedIn–ADB taxonomy of digital skills) and for advanced disruptive technologies such as AI and machine learning. On average, employers reported that 8 of the last 10 candidates hired were required to possess at least basic digital literacy and skills, and 4 of the last 10 hires were required to possess advanced digital skills (Figure 4).

Figure 4: Number among the Last 10 Hires Required to Possess Digital Skills

	All	Bangladesh	India	Indonesia	Philippines	United States
Basic digital skills	8	9	8	8	6	8
Applied digital skills	5	6	5	4	4	5
Software and hardware skills	5	6	6	4	5	5
Advanced digital skills	4	5	4	4	2	4

	Green Economy	Online Education	Smart Cities
Basic digital skills	7	8	8
Applied digital skills	4	5	5
Software and hardware skills	4	5	6
Advanced digital skills	4	3	4

Note: N = 133.

Source: Asian Development Bank. Forthcoming. *A Rapid Survey on the Evolution, Demand, and Use of Digital Credentials*. Manila.

Employers in the US reported higher demand for advanced digital skills than in the other countries surveyed. They reported recruiting 32% more recent hires with advanced digital skills than surveyed Asian countries. This indicates that the US continues to lead in attracting talent with advanced digital skills such as in AI and machine learning. The survey revealed demand for basic digital skills to be largely the same across the three industries, requiring them for 76% of new hires in the green economy, 79% in online education, and 81% in smart cities. Demand for applied skills is robust in online education because computer graphics and animation are extensively used to deliver content. Survey results show concentrated deployment of advanced technologies such as AI, robotics, and autonomous systems in smart city development.

Digital Jobs, Skills, and Credentials

KEY FINDINGS

- ✓ **Demand and digital job growth dynamics reflect potential market maturity.** Analysis of LinkedIn Economic Graph data reveals that people who can fill digital jobs are in greater demand in developing markets, while more advanced economies have a stronger emphasis on business and management personnel who oversee digital jobs. India, Indonesia, and Malaysia have more digital tech jobs than do Australia or Singapore, where there is more demand for corporate management. India and the Philippines show strong demand for information technology business support roles, reflecting their competitive advantage in business process outsourcing.
- ✓ **Talent in developed economies follows a broader range of educational tracks.** Fields of study tend to align with national competitive advantage. In India, 8 of the top 10 degrees awarded are in computer science, a result driven by the country's strength in information and communication technology. Australia and Singapore have larger shares of education backgrounds in business, management, corporate and legal skills, and liberal arts. The fastest-growing job categories reflect national strengths across countries. Hiring in online content and social media is rising quickly in Indonesia and the Philippines, while Malaysia posts faster growth in digital business support roles such as in human resources and business development, and India in digital roles in software and system development.
- ✓ **Fundamental coding and programming skills are emerging needs across all jobs.** Across all countries, Structured Query Language (SQL) and Java consistently appear among the digital skills most in demand for many job categories. This indicates the broad applicability and relevance of these fundamental coding and programming skills required for data analysis and building software and hardware tools. To seize emerging opportunities in the digital era, organizations can benefit from a more flexible approach to appraising credentials and becoming more open to online learning, micro and modular learning, and lifelong training. This would facilitate an ongoing process of upskilling and reskilling.

- ✔ **Shorter online digital skill training programs achieved strong gains in the past year.** Among online trainers surveyed by ADB and Outline India, 28% said their most popular digital skill courses are typically of medium length, or 3–6 months in duration. The course length next most in demand, reported by 25% of surveyed trainers, is less than a week. Such short courses provide a taste of topics covered in medium- or full-length courses. Short courses are ideal for professionals who wish to refresh their domain knowledge or catch up with the latest advances.
- ✔ **A revolution is under way in how learning and competencies are recognized.** Traditional and digital credentials will soon complement each other. Among all respondents to the ADB–Outline survey, 89% agreed that, as digital credentials become a critical part of higher education, they will not diminish the market value of traditional credentials in the near term. Among employers surveyed, 77% believe that traditional and digital credentials will coexist and complement each other in the near future.
- ✔ **Companies have significantly increased workforce reskilling and upskilling.** In response to increased demand for digital skills, 68% of surveyed employers reported providing digital skill training to their current employees. The proportion of firms undertaking workforce development is higher in the US than in surveyed Asian countries by 15 percentage points. Collaboration between industry and trainers appears to be weak across all surveyed countries, as fewer than 40% of employers reported a relationship with an external provider for their upskilling and reskilling initiatives.
- ✔ **High demand for digital skill training and credentials is predicted to outlast the pandemic.** Among all trainers surveyed by ADB and Outline India, 93% predicted that demand for online learning—and consequent accelerated growth in online training platforms—will persist after the pandemic. This sentiment was expressed across all countries surveyed.

The labor market is changing rapidly in tandem with the nature of jobs and demand for digital skills. Workers must continuously upskill to remain competitive in their current jobs or reskill to enable them to take on new jobs. This section examines demand dynamics in the labor market toward identifying the skills needed for the jobs most in demand. It looks into the growing trend of virtual learning and the attitudes of employers to understand their perceptions of digital credentials and online course certifications.

Demand for Digital versus Business and Management Skills

Digital jobs are in demand in developing Asia, while more developed economies have greater need for business and management professionals in supervisory roles. Table 2 shows the top jobs in demand by country. Technical digital jobs are more prominent in developing countries, while the developed economies of Australia, Singapore, and the US require more business and management professionals.

The data indicate strong demand for consumer interface in Indonesia and Malaysia, as reflected in marketing and sales jobs. In India and the Philippines, demand is more balanced between consumer interface and backend infrastructure and systems engineering, as the strong presence in both countries of business support roles such as “customer services” and “administrative assistant” reflect their vibrant business process outsourcing industries.

Table 2: Top Jobs in Demand by Number of Hires, September 2020–February 2021

Rank	Australia	Indonesia	India	Malaysia	Philippines	Singapore	United States
1	Project manager	Graphic designer	Software engineer	Software engineer	Customer service representative	Software engineer	Software engineer
2	Software engineer	Marketing specialist	Sales manager	Administrative assistant	Software engineer	Project manager	Real estate agent
3	Business development manager	Software engineer	System engineer	Project engineer	Financial advisor	Business development manager	Project manager
4	Business analyst	Lecturer	Business development manager	Project manager	Graphic designer	Marketing executive	Salesperson
5	Account manager	Sales specialist	Human resources executive	Marketing executive	Social media manager	Account manager	Account manager
6	Accountant	Auditor	Business analyst	Graphic designer	Administrative assistant	Sales manager	Account executive
7	Teacher	Quality assurance specialist	Business development executive	Account executive	Project manager	Research assistant	Teacher
8	General manager	Secretary	Graphic designer	Lecturer	Accountant	Product manager	Registered nurse
9	Operations manager	Administrative specialist	Professor	Business development manager	Teacher	Business analyst	Administrative assistant
10	Administrative assistant	Human resources specialist	Project manager	Teacher	Operations manager	Marketing manager	Attorney

Source: LinkedIn Economic Graph.

Analyzed from a growth rate perspective, a number of interesting trends are evident. In Indonesia and the Philippines, online content creation and social media jobs grew fastest from 2019/20 to 2020/21. Malaysia posted higher growth in business support roles such as human resources and business development. In India, roles in workplace safety and compliance with standards are increasing. These trends indicate commercial trends in each country. Table 3 provides the outlook for all the jobs that have grown the most quickly in the past year.

Table 3: Fastest-Growing Jobs, September 2020–February 2021 over a Year Earlier

Rank	Australia	Indonesia	India	Malaysia	Philippines	Singapore	United States
1	Psychologist	Online content specialist	Business technology analyst	Business development executive	Social media manager	Product manager	Investment banking analyst
2	Human resources manager	Content writer	Academic advisor	Lecturer	Software engineer	Marketing executive	Mortgage loan originator
3	Data engineer	Social media marketing specialist	Drug safety associate	Software engineer	Graphic designer	Business development manager	Manufacturing associate
4	Sales director	Production specialist	Transaction risk investigator	Project engineer	Project manager	Research assistant	Real estate salesperson
5	Product manager	Copywriter	Information technology analyst	Project manager	Financial advisor	Software engineer	Loan consultant
6	Occupational therapist	Digital marketing specialist	Production specialist	Human resources executive	Operations manager	Project manager	Notary public
7	Business development manager	Interface specialist	Talent acquisition executive	Customer service representative	Accountant	Account manager	Assurance specialist
8	Property manager	Front-end developer	Data engineer	Business development manager	Administrative assistant	Sales manager	Loan clerk
9	Physical therapist	Research and development specialist	Product analyst	Account executive	Customer service representative		Sales development representative
10	Lawyer	Business development specialist	JavaScript developer	Marketing executive			Credit analyst

Note: Insufficient data limited the identification of fastest-growing jobs to nine in the Philippines and eight in Singapore.
Source: LinkedIn Economic Graph.

Digital Skills Most in Demand

Table 4 shows the digital skills needed for the top jobs in demand in the countries covered in this report. SQL and Java appear in every list, indicating the broad applicability and relevance across all occupational areas of these fundamental coding and programming skills required for data analysis and building software and hardware tools.

Table 4: Digital Skills Most in Demand by Country, September 2020–February 2021

Rank	Australia	Indonesia	India	Malaysia	Philippines	Singapore	United States
1	Microsoft Office	Adobe Photoshop	SQL	Adobe Photoshop	JavaScript	JavaScript	Microsoft Office
2	JavaScript	Adobe Illustrator	JavaScript	Adobe Illustrator	SQL	Java	JavaScript
3	SQL	Microsoft Office	Java	JavaScript	HTML	SQL	SQL
4	Java	JavaScript	HTML	SQL	Java	Python programming language	Java
5	C#	Logo Design	C programming language	Microsoft Office	Cascading Style Sheets	C#	Python programming language
6	Agile methodologies	PHP	MySQL	Java	MySQL	HTML	Social media
7	Python programming language	MySQL	Cascading Style Sheets	HTML	Adobe Photoshop	C++	Agile methodologies
8	Git	Java	C++	MySQL	C#	MySQL	C#
9	Requirements analysis	HTML	Python programming language	C#	Microsoft Office	Cascading Style Sheets	Git
10	Amazon Web Services	SQL	jQuery	Cascading Style Sheets	Adobe Illustrator	Git	C++

SQL = structured query language.

Source: LinkedIn Economic Graph.

Differences exist between countries. Within Asia, the tech hubs of India and Singapore require a similar mix of skills, reflecting a range of expertise that includes building tech infrastructure and enterprise systems (e.g., C++ skills) and AI (e.g., Python programming language). By contrast, Indonesia, Malaysia, and the Philippines share a similar mix of skill profiles that include digital literacy (e.g., Microsoft Office) and graphic design (e.g., Adobe Photoshop and Adobe Illustrator). Australia and the US show demand for skills for managing technical projects—planning their construction, rollout, and maintenance—which requires analysis of requirements, engineering ability, and other agile methodologies.

Prevailing Dependence on Universities to Impart Digital Skills

Employees in the jobs most in demand pursued fields of study closely related to the top skills found in their country, suggesting a prevailing dependence on digital qualifications from universities. Analysis reveals a range of dominant fields of study across the countries studied (Table 5). In India, 8 of the top 10 fields are technical or in computer science, reflecting the country's strong comparative advantage in information and communication technology and its reputation as a global leader in training and exporting tech talent. In Singapore, 6 of the top 10 fields are technical, while the others relate to business, management, and corporate roles, such as marketing. This reflects Singapore's position as a regional headquarters with a correspondingly strong demand for business roles, compared with India. In Australia and the US, only 3 of the top 10 fields are technical, leaving scope for a wider range of other fields, notably finance, project management, law, and political science. In Indonesia and Malaysia, design fields like visual communications and graphic design also appear among the top 10 fields, perhaps revealing strength in creative professions.

Not surprisingly, the types of skills available in each country reflect the prevalence of various university courses. The fields of study of employees holding the fastest-growing jobs closely reflect the top skills found in that country. Design-related fields of study in Indonesia and Malaysia, for example, mirror the presence of graphic design skills in those countries. This suggests possible current dependence on university education for imparting digital skills.

The digital skill mix of jobs in demand reflects the availability and prevalence of formal university training. Complex skills such as computer programming (e.g., C and C++) may be more effectively acquired through dedicated tertiary education programs, while less complex languages such as Python are increasingly accessible through intensive short courses and boot camps. A notable Asian platform in this area is NEXT Academy, whose partners include Grab, Amazon, and Google. Computer science degrees promise to position candidates for higher-end domains like AI and machine learning. Anecdotal evidence suggests that India was able to double its AI workforce from 2019 to 2020 by upskilling its computer engineers. In addition to education and classroom learning, work experience is important for cementing skills and knowledge applicable to the real business world, in Asia and elsewhere.

Emerging Landscape for Digital Credentials

The gathering pace of digital transformation and rapidly growing demand for digital skills across different occupational disciplines and markets are spurring the acquisition of digital skills by job seekers and those already employed. While university degree programs are valuable for learning and skill development, educational and training institutions need to become more agile and adopt a mix of skill development approaches. This section explores some of these trends in Asia.

Table 5: Top Fields of Study of Employees Holding Jobs in Demand, by Country

Rank	Australia	Indonesia	India	Malaysia	Philippines	Singapore	United States
1	Accounting	Information technology	Computer science	Computer science	Information technology	Computer science	Computer science
2	General business administration and management	Accounting	Computational science	Accounting	Accounting	Computational science	Computational science
3	Information technology	General design communications	Electrical, electronics, and communications engineering	Computational science	Computer science	Information technology	General business administration and management
4	Computer science	Computer science	Information technology	General business administration and management	Computational science	General business administration and management	Registered nurse
5	Computational science	Computational science	Computer engineering	Information technology	General business administration and management	Marketing	Marketing
6	Marketing	General business administration and management	Marketing	Mechanical engineering	Computer engineering	Electrical and electronics engineering	Psychology
7	General business and commerce	Graphic design	Electrical and electronics engineering	Electrical and electronics engineering	Electrical, electronics, and communications engineering	Computer engineering	Political science and government
8	Accounting and finance	Physical sciences	General business and commerce	Computer software engineering	Psychology	Mechanical engineering	Computer engineering
9	Project management	Marketing	Physical sciences	Civil engineering	Secondary education and teaching	Economics	Law
10	General finance	Informatics	Mathematics	Graphic design	General marketing and marketing management	General finance	General studies

Source: LinkedIn Economic Graph.

Increased web accessibility is driving a shift to online learning on an array of online platforms. The number of users of LinkedIn Learning, for example, more than doubled from 2019 to 2020, and hours on the platform per learner jumped by 58%.⁵

The World Economic Forum has reported: “Even before COVID-19, there was already high growth and adoption in education technology, with global ed-tech investments reaching US\$18.66 billion in 2019 and the overall market for online education projected to reach \$350 billion by 2025.”⁶ This trend accelerated during COVID-19 with a surge in the use of virtual learning apps and platforms. According to LinkedIn’s *2021 Workplace Learning Report*, 5,154 learning and development professionals surveyed in 27 countries gave top priority to upskilling and reskilling, with digital fluency the top skill to build in Southeast Asia and India.⁷

Upskilling and reskilling on a large scale requires education and training institutions to become more agile and adopt mixed approaches to skill development, including online training and micro-credentials. Support from employers is crucial to enable the shift to online learning and more flexible learning formats with digital credentials.

To understand the emerging landscape for digital credentials and qualifications, ADB commissioned a survey of employers and online trainers to gauge supply and demand for digital credentials.

Rapid Survey on Digital Credentials: Evolution, Demand, and Use

The survey commissioned by ADB and undertaken remotely in early 2021 covered Bangladesh, India, Indonesia, the Philippines, and the US. It attracted responses from 96 trainers that issue digital credentials and 158 employers hiring digital talent, 133 responding to the survey and 25 interviewed in depth. Employers were chosen from three industries considered important for the future: smart city development, online education delivery, and green economy occupations and services.

The main purpose of the survey was to collect information on digital credentials that are emerging in response to rising demand for digital skills. It sought to document employers’ attitudes toward digital credentials vis-à-vis traditional academic credentials and gauge emerging sentiment on the uptake of digital credentials. The survey also sought to learn about current collaboration among stakeholders in the digital skilling and credentialing ecosystem in industry, education, and government.

⁵ L. Moot. 2021. *Our Takeaways from the 2021 Workplace Learning Report Premiere*. LinkedIn Learning Blog. 9 March. <https://www.linkedin.com/business/learning/blog/learning-and-development/takeaways-from-the-2021-workplace-learning-report-premiere>.

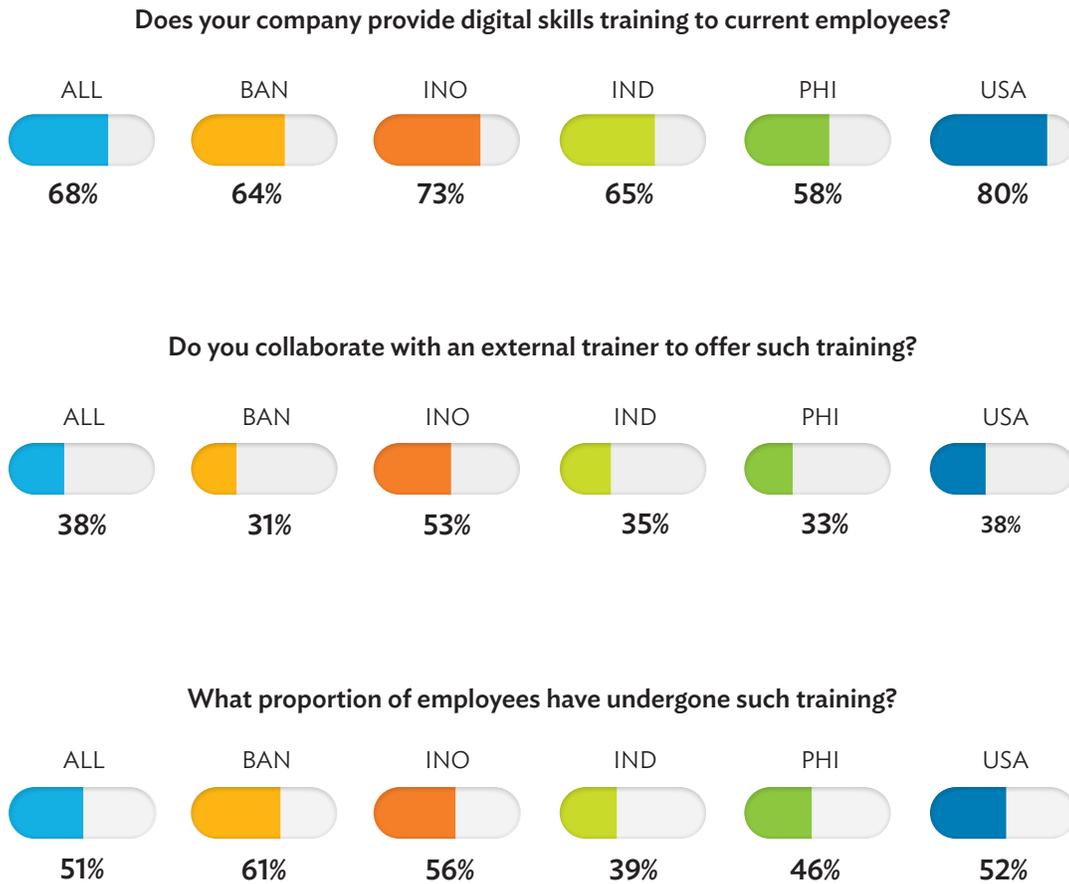
⁶ C. Li and F. Lalani. 2020. *The COVID-19 pandemic has changed education forever. This is how*. World Economic Forum. 29 April. <https://www.weforum.org/agenda/2020/04/coronavirus-education-global-covid19-online-digital-learning>.

⁷ LinkedIn. *2021 Workplace Learning Report*. <https://learning.linkedin.com/resources/workplace-learning-report>.

The following are selected key findings from the surveys:

- ✔ **Higher education curricula are slow to respond to changing market needs.** Online trainers in the survey said that universities are slow, at best, to update and renew curricula to keep it in tune with market demand. Among surveyed trainers, 49% agreed that universities adjust their curricula to market demand and 51% disagreed. In-depth interviews with online trainers revealed that the adoption of changes to course offerings and curricula did not keep pace with evolving employers' needs. It was suggested that universities must revisit their curricula more frequently, ideally undertaking rigorous course audits every 6 months in consultation with industry stakeholders.
- ✔ **Changing market demand spurs high demand for digital skill training courses.** The survey asked online trainers to identify the reasons behind high demand for certain digital skill training courses. Over 80% all surveyed trainers linked demand for skill training courses to demand for particular skills in the job market. While 94% of trainers in the US saw demand for skill training rising in response to market demand, only 78% of trainers in Asia agreed, revealing that learners and trainers in the US are particularly responsive to industry signaling on demand for skills.
- ✔ **Shorter-duration online digital skill training programs are becoming popular.** Among online trainers, 28% said their most popular digital skill courses are typically of medium length, or 3–6 months in duration. The next most common course length, reported by 25% of online trainers surveyed, is less than a week and is a distillation of medium- or full-length courses, intended to provide only a taste of the topic. Short courses are ideal for professionals who wish to refresh their domain knowledge or catch up with the latest advances.
- ✔ **Companies increasingly emphasize reskilling and upskilling their current workforce.** In response to increased demand for digital skills, 68% of all surveyed employers reported providing digital skill training to their current employees, promoting workplace learning to fill talent shortages while also hiring new talent (Figure 5). The proportion of firms pursuing workforce development is higher in the US than in surveyed Asian countries by 15 percentage points. Employers reported during in-depth interviews that digital skill training was offered to employees irrespective of their role in the company, suggesting that, increasingly, almost all jobs require a digital skill set of one kind or another.

Figure 5: Reskilling and Upskilling Initiatives from Employers



Note: N = 133, BAN = Bangladesh, IND = India, INO = Indonesia, PHI = Philippines, USA = United States.

Source: Asian Development Bank and Outline India. Forthcoming. *A Rapid Survey on the Evolution, Demand, and Use of Digital Credentials*. Manila.

Collaboration between industry and trainers was reported to be weak across all surveyed countries. Fewer than 40% of employers reported having a relationship with an external provider for their upskilling and reskilling initiatives. Platforms such as LinkedIn, Coursera, and Google Academy were some popular options that surveyed employers named during in-depth discussions, as were programs offered by Amazon, Microsoft, Salesforce, and Oracle.

What was the biggest hurdle to reskilling and upskilling their workforce? US and Indian employers said lack of time for training. Employers in Bangladesh, Indonesia, and the Philippines reported more structural challenges, notably budgetary constraints and difficulty in identifying suitable training partners. Other commonly reported challenges were lack of motivation and absence of a growth mindset among employees, causing only passive participation in training programs.

✔ **Equal access to digital skilling and credentialing requires affirmative action.**

Almost two-thirds of surveyed online trainers, or 64%, do not offer digital skill programs that are packaged specifically for disadvantaged youth, indigenous communities, people in poverty, or people living in remote locations with little or no access to the internet—or, in particular, for women. Female enrollment in digital skilling courses is reported at only about half of male enrollment. Among all surveyed employers, 60% reported that fewer than 30% of applications submitted by female candidates indicate digital credentials.

✔ **While still dependent on traditional credentials, more employers see their limitations.**

Employers face myriad challenges when hiring digital talent, not least from inadequate traditional credentials. Among all surveyed employers, 90% identified one or more challenges associated with hiring based on traditional college degrees, with 48% of them saying that candidates who met degree requirements for being hired might not possess the practical knowledge or skills required to do the job. That said, employers predicted that college degrees will retain significant market value if candidates further bolster their profiles with alternative credentials for specific skills.

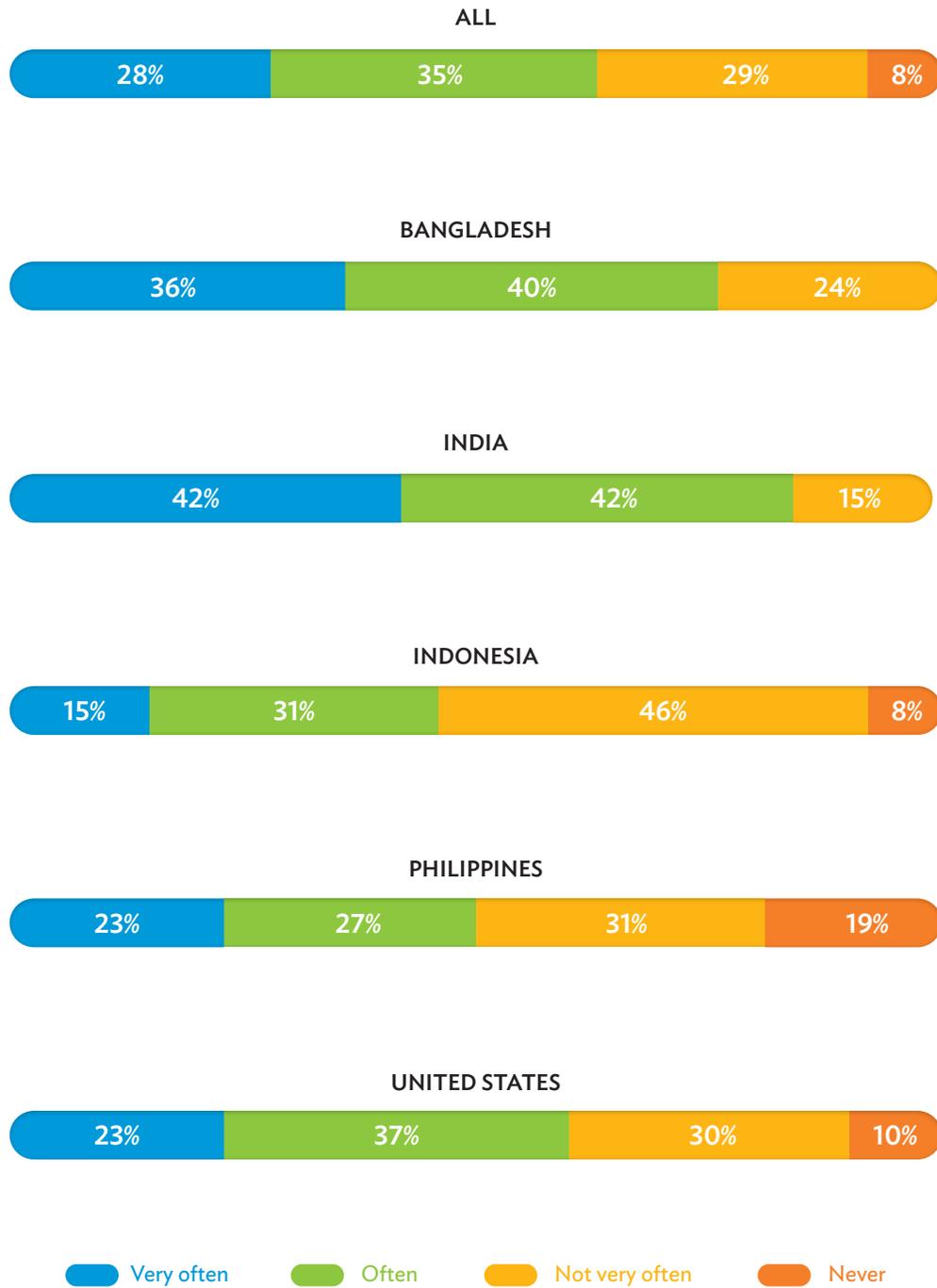
✔ **Digital credentials currently accompany more than a third of job applications.**

The survey asked employers how often they see job applications that list at least one digital credential, 36% responded “often” and 26% “very often” (Figure 6). In India and Bangladesh, where competition for a limited number of jobs is stiff and candidates need to stand out, 80% of all job applications reported digital credentials, or 20 percentage points more than in the US, where there is more job security. In Indonesia and the Philippines, a lower share of candidates currently present digital credentials, perhaps reflecting low digital connectivity, which may depress enrollment and the number of digital credential issuers.

✔ **Digital certificates are the most widely accepted digital credentials, followed by licenses.**

Among surveyed employers, 59% reported having hired a candidate who presented a digital certificate, and 47% reported hiring a candidate with a license. Less common forms of digital credentials offered by successful candidates were endorsements at 34%, open badges (27%), micromasters (22%), and nanodegrees (17%). Viewed by industry, online education is the most open to hiring candidates with digital certification, with 83% of surveyed firms reporting having done so, followed by 55% in smart cities and 52% in the green economy. This is hardly surprising considering that edtech firms are themselves providers of many of these certifications. There was little regional variation, as the percentage of US employers surveyed that reported accepting digital credentials was only 1 percentage point higher than among surveyed Asian employers.

Figure 6: How Frequently Employers See Candidates with Digital Credentials



Note: N = 133.
 Source: Asian Development Bank and Outline India. Forthcoming. *A Rapid Survey on the Evolution, Demand, and Use of Digital Credentials*. Manila.

- ✔ **Digital credentials are most prevalent for junior positions.** Employers are most comfortable hiring entry-level professionals who present at least one digital credential. The weight accorded digital credentials in hiring decreases with the seniority of the position being filled. Among all surveyed employers, 65% reported hiring entry-level staff based on digital credentials, decreasing to 50% for midlevel positions and 45% for senior ones. This trend was common to all surveyed countries. As digital credentials are relatively new, they are used mostly by younger workers.

By industry, 71% of employers in online education hired entry-level candidates with digital credentials, 66% in smart cities, and 55% in the green economy. Notably, smart city employers were most comfortable hiring senior executives on the basis of digital credentials, perhaps reflecting that smart city projects need leaders with long-term vision and belief in the power of technology and automation to improve the quality of life. While new technologies for smart cities are easily acquired from online courses, an emerging field such as smart cities enjoys little in-depth expertise rooted in past experience or traditional qualifications.

- ✔ **Employers' current view of digital credentials is neutral, tending toward positive.** Among all surveyed employers, 41% reported being “neither confident nor doubtful” about digital credentials when hiring digital talent, while 38% reported being “somewhat confident.” The most confident employers were in the smart cities sector, at 44%, with the green economy following at 31% and online education at 29%.

- ✔ **Improving employers' confidence in digital credentials depends on reliable providers.** Among all surveyed employers, 86% recognize the credibility of providers as the driving factor behind their confidence in digital credentials, with only 43% reporting any need for a system of verification or authentication. This suggests that, if providers demonstrate brand reliability, employers will rely on their credentials when recruiting and are unlikely to establish separate processes to verify credentials.

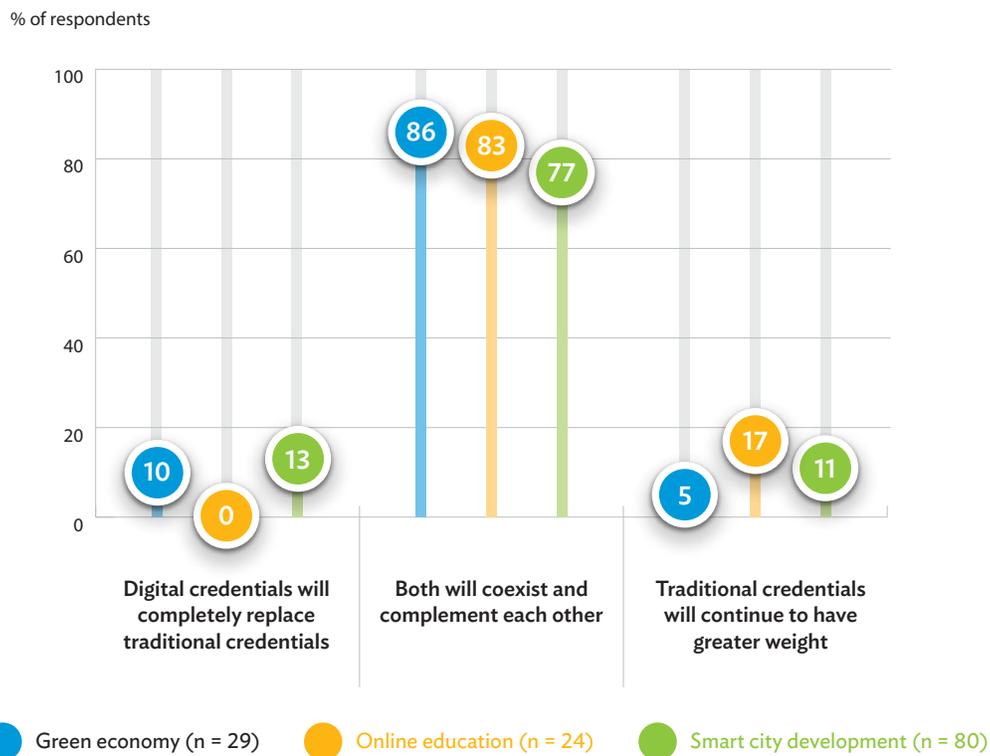
A lack of clear standardized definitions was cited by 57% of the survey respondents as a barrier to the uptake of digital credentials. Employers are aware that digital credentialing is still in its early days, and that its penetration of the market will deepen with maturity. Among all employers, 53% stressed the need for collaboration among stakeholders in the digital credentialing ecosystem to expedite its evolution.

- ✔ **High demand for digital skill training and credentials is predicted to outlast the pandemic.** The COVID-19 pandemic spurred unprecedented growth in edtech as remote work and learning became the new normal. Industry leader Coursera witnessed a 444% increase in course enrollment from before COVID-19. A similar trend was reported by edX, which saw newly registered learners increase tenfold and overall course enrollment increase by a factor of 15. Among all trainers surveyed, 93% predicted that demand for online learning—and consequent accelerated growth in online training platforms—would persist after the pandemic. This sentiment was expressed across all countries surveyed. In-depth interviews with online trainers found some of them apprehensive over what they viewed as unsustainable “forced digital adoption,” but fewer than 10%.

✔ **Digital credentials will not supplant traditional qualifications in the near future.**

Among all respondents, 89% agreed that, as digital credentials become a critical part of higher education, a distinctive trend favors digital recognition of learning and competencies (Figure 7). However, this will not diminish the market value of a traditional credentials in the short run, as 77% of employers surveyed believe that traditional and digital credentials will coexist and complement each other in the near future.

Figure 7: Employer Perception of the Future of Digital Credentials



Note: N = 133.

Source: Asian Development Bank. Forthcoming. *A Rapid Survey on the Evolution, Demand, and Use of Digital Credentials*. Manila.

Digital Skill Demand in Three Emerging Industries

KEY FINDINGS

- ✓ **Emerging e-learning, smart cities, and renewable energy industries need digital skills.** Analysis of LinkedIn data found that e-learning companies boomed during the pandemic as millions of students moved online. The benefits of digital education will likely prompt permanent shifts in service delivery that will drive further innovation and employment growth in this industry.
- ✓ **Digital jobs are a larger share in e-learning and smart cities than in renewable energy.** Data science is the fastest-growing digital skill category in the e-learning and smart city industries. In renewable energy, more attention is paid to increasing the use of data to optimize business, plant, and manufacturing processes, as well as to enable smart grids and energy optimization.
- ✓ **Gender balance is better in e-learning than in smart cities or renewable energy.** E-learning has a higher share of female employment across the region, reflecting the strong appeal of education to female workers. The industry also has the youngest workforce among emerging industries, showing significant appeal to the younger generation. Entry barriers are probably lower in e-learning than in renewable energy, which may require engineering qualifications available only from tertiary institutions and experience. E-learning talent comes from a more diverse educational track than in renewable energy or smart cities, which have a higher preponderance of engineering qualifications.

While digitization affects all industries, some adopt technology more quickly in response to consumer needs, spurring faster change in workforce capability. An understanding of the dynamics within industries is critical to allow job seekers and hirers to position themselves for the greatest possible success.

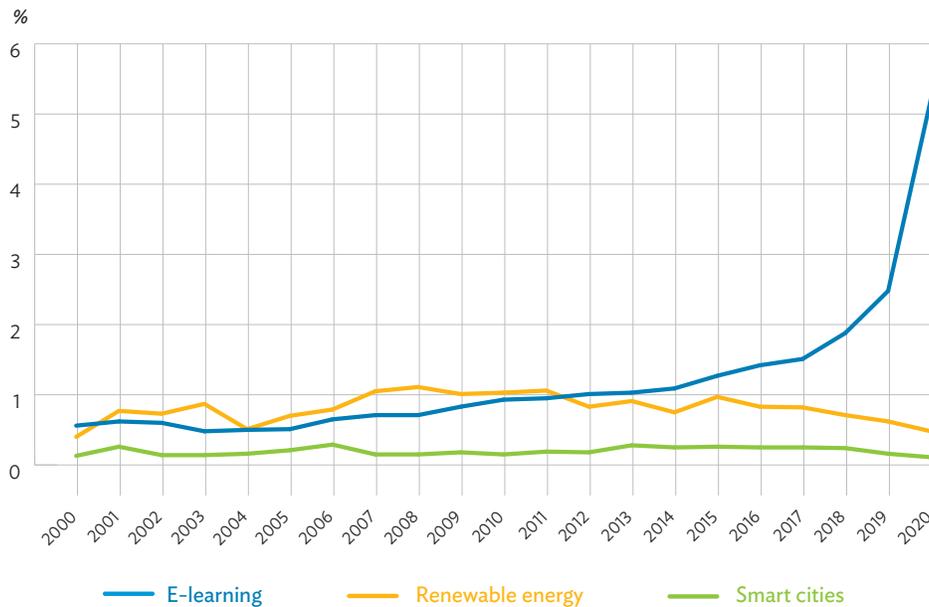
For this report, ADB and LinkedIn identified three industries that are critical to development and economic growth over the long term. This section takes a closer look to analyze emerging trends in

- (i) smart cities: spurring digitalized solutions for energy, transportation, and citizen services;
- (ii) e-learning: developing online platforms for education and training delivery; and
- (iii) renewable energy: providing clean and green power, products, and services.

Companies Younger in E-learning, Older in Smart Cities and Renewable Energy

Among new companies established over the past year, the share in e-learning rose sharply while shares in the two other industries declined (Figure 8). The pandemic forced over 1 billion students to study online, prompting education systems to transform rapidly⁸ and likely contributing to a spike in e-learning start-ups in 2020 (Box 1). By contrast, the number of start-ups in the smart city and renewable energy sectors declined in 2020, likely reflecting fiscal pressures on investment and infrastructure development, as well as the challenges of operating such businesses under lockdown and social distancing requirements.

Figure 8: Proportion of New Companies in Asia and the Pacific, by Industry



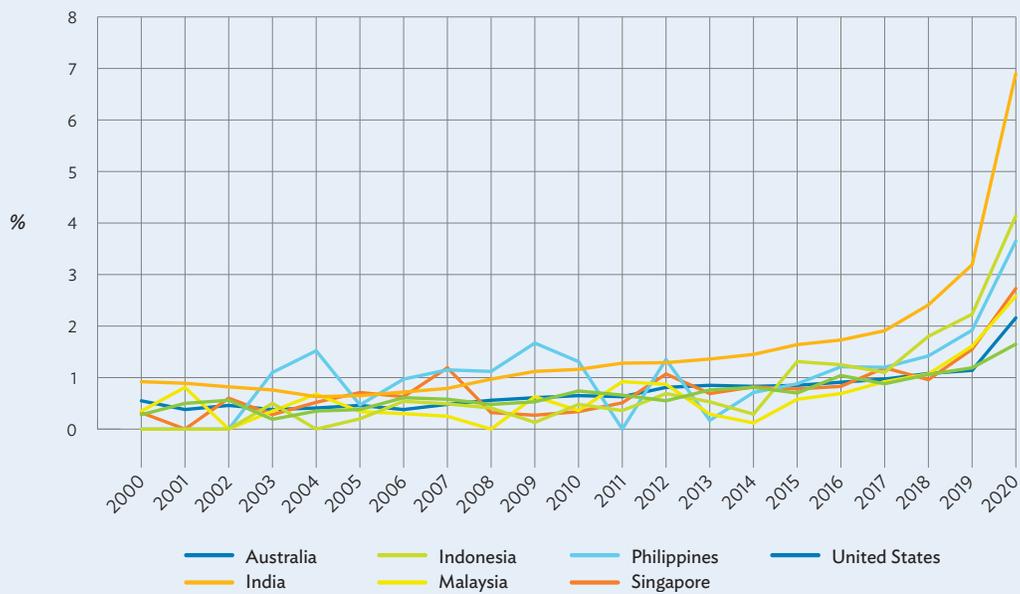
Note: Aggregate of Australia, India, Indonesia, Malaysia, the Philippines, and Singapore.
Source: LinkedIn Economic Graph.

⁸ C. Li and F. Lalani. 2020. *The COVID-19 Pandemic Has Changed Education Forever. This Is How*. World Economic Forum. <https://www.weforum.org/agenda/2020/04/coronavirus-education-global-covid19-online-digital-learning/>.

Box 1: E-learning Boom in India

The e-learning industry in India expanded especially quickly as the number of new companies exploded during the pandemic, consolidating the country’s global leadership in education technology (box figure). The pandemic is predicted to increase the country’s online education offerings by a factor of 6.3 to create a \$1.7 billion market by 2022.^a

E-learning Growth



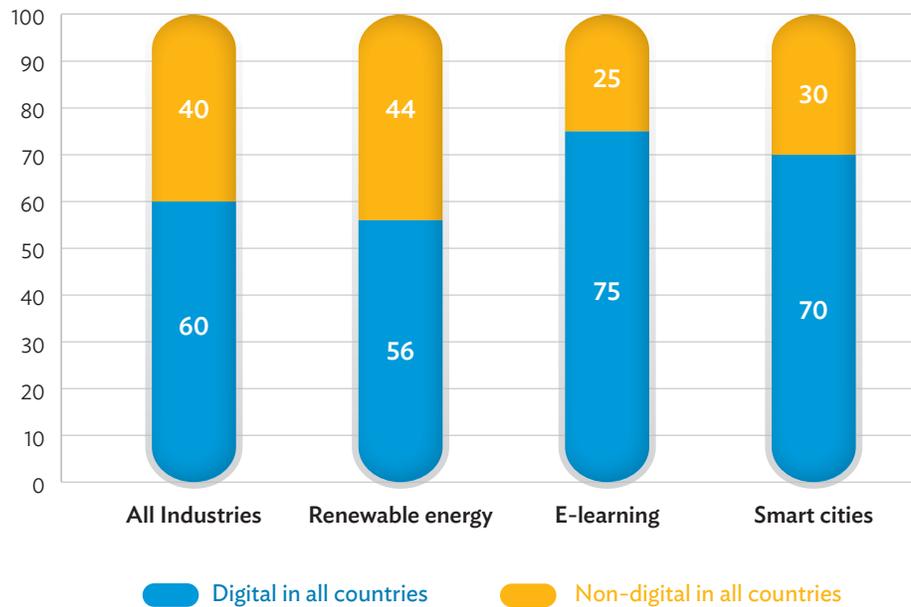
^a Omidyar Network India. 2019. EdTech in India. <https://www.omidyarnetwork.in/wp-content/uploads/2020/06/20200527-EdTech-Report-Omidyar-V6.pdf>.

Source: LinkedIn Economic Graph.

E-learning and Smart Cities More Dependent on Digital Talent

Analysis from the LinkedIn Economic Graph shows that the smart city and e-learning industries depend more on digital talent than does the economy as a whole, while renewable energy depends somewhat less (Figure 9). This result is expected because smart cities and e-learning are newer industries highly driven by digital technology, requiring a more digitally capable workforce. Digital talent holds 75% of jobs in e-learning and 70% in smart cities. Renewable energy, by contrast, is an older industry combining established segments like hydro, solar, and wind power with emergent segments like electric vehicles and smart grids.

Figure 9: Proportion of Digital Talent, by Industry



Note: Covers Australia, India, Indonesia, Malaysia, the Philippines, Singapore, and the United States.
Source: LinkedIn Economic Graph.

Emerging and Declining Digital Skills

The fastest-emerging tech skills across the three industries are newer types of digital competency, especially for using and analyzing data (Table 6). Meanwhile, conventional digital skills such as web services are declining. Among non-digital skills, those related to communication and critical thinking rank high, while operational skills like planning decline in significance. Operational skills are more likely to be replaced by automation than are critical thinking and communication-dependent roles, which may be more robust because they are uniquely human capabilities less vulnerable to automation.

Across all three industries, the ability to use data to improve business performance is a growing focus as companies look to collect data on a large scale and are helped in doing so by the emergence of more user-friendly and/or open-source analytic tools available at low cost, which are empowering businesses of all sizes (Box 2). E-learning in particular appears to be transforming rapidly, as evidenced by the trending emergence of skills for consumer-interface applications and the decline of skills for older technology domains (Box 3). In renewable energy, the digital skill landscape is more varied to match the industry, with engineering skills sharing prominence with digital skills (Box 4).

Table 6: Top Emerging and Declining Skills in E-learning, Smart Cities, and Renewable Energy

Rank	Emerging Skills		Declining Skills	
	Digital	Non-digital	Digital	Non-digital
1	Design	Personal development	Microsoft Excel	Project management
2	Data analytics	Presentations	Social media	Management
3	Data science	Administration	Microsoft PowerPoint	Team building
4	Data structures	Sales and marketing	Product development	Public speaking
5	Machine learning	Presentations	Microsoft Word	Event planning
6	React.js	Problem solving	Software development life cycle	Continuous improvement
7	HTML5	Digital marketing	Microsoft Office	Program management
8	Python programming language	Communication	Testing	Contract management
9	Cascading Style Sheets	English	Internet Protocol Suite (TCP/IP)	Energy
10	Git	Writing	Requirement analysis	Contract negotiation
11	C programming language	E-learning	Data centers	Project engineering
12	JavaScript	Strategy	Unix	Business process Improvement
13	C++	Teaching	Web services	Project planning
14	HTML	Teamwork	XML	Strategic planning
15	SQL	Team leadership	Integration	Power generation

SQL = structured query language, TCP/IP = transmission control protocol/internet protocol, XML = extensible markup language.

Note: Covers Australia, India, Indonesia, Malaysia, the Philippines, Singapore, and the United States.

Source: LinkedIn Economic Graph.

Box 2: Emerging and Declining Skills in Smart Cities

Many of the top emerging tech skills in smart cities relate to network infrastructure and data, which are essential to smart city systems and processes (box table). They include the ability to analyze and visualize data, which is critical for monitoring and optimizing smart city processes. Declining tech skills are basic literacy because workers are less likely to showcase on their LinkedIn profiles what are now commonplace proficiencies.

Top Emerging and Declining Skills in Smart Cities

Rank	Emerging Skills		Declining Skills	
	Digital	Non-digital	Digital	Non-digital
1	Backend web development	Decision-making	XML	Business intelligence
2	REST API	Presentations	Managed services	Power plants
3	Cisco certification	Interpersonal communication	Integration	Power generation
4	Computer networking	Administration	Unix	Energy
5	Front-end development	Organizational leadership	Web services	Business process improvement
6	Full-stack development	Presentation skills	Microsoft Office	Enterprise software
7	Data visualization	Talent management	Social media	Project planning
8	Data analytics	Business relationship management	Microsoft Word	Strategic planning
9	Pandas software	Sales and marketing	Testing	Telecommunications
10	NoSQL	Critical thinking	Voice over internet protocol	Wireless technologies
11	Microsoft Office 365	Planning	Data centers	Contract management
12	Network engineering	Digital transformation	Requirement analysis	Vendor management
13	Google Cloud platform	Training and development	Software development life cycle	Contract negotiation
14	Continuous integration and continuous delivery	Communication	Internet protocol	Project engineering
15	Infrastructure	Architecture	Internet protocol suite (TCP/IP)	Unified communications

REST = representational state transfer, REST API = RESTful application programming interface, TCP/IP = transmission control protocol/internet protocol, XML = extensible markup language.

Note: Covers Australia, India, Indonesia, Malaysia, the Philippines, Singapore, and the United States.

Source: LinkedIn Economic Graph.

Box 3: Emerging and Declining Skills in E-learning

The top emerging digital skills in e-learning apply to consumer or client-interface applications such as design, full stack development, application programming interfaces, and using data to optimize and monitor business performance: database management, data visualization, dashboard tools like power business intelligence, and skills like analytics and modeling (box table). They tend to be skills that are broadly applicable across multiple uses and systems.

Notably in decline are basic literacy skills like Microsoft and Adobe suites, reflecting that they are very commonly held skills today, and skills related to older tools and technologies used primarily for web applications and less often used for mobile apps, such as XML, AngularJS, and AJAX.

Top Emerging and Declining Skills in E-learning

Rank	Emerging Skills		Declining Skills	
	Digital	Non-digital	Digital	Non-digital
1	Design	Presentations	XML	Google Ads
2	Database management systems	Administration	Software development life cycle	Community outreach
3	Data analytics	Decision-making	Adobe Creative Suite	Business process improvement
4	Full stack development	Written communication	AngularJS	Strategic planning
5	REST API	Personal development	Microsoft SQL Server	Educational technology
6	Microsoft Power BI	Presentations	Microsoft Office	Curriculum development
7	Data visualization	Sales and marketing	Microsoft Word	Lesson planning
8	Internet of things	Relationship building	Social media	Event planning
9	Adobe Experience Design	Problem-solving	AJAX	Public speaking
10	Back-end web development	Interpersonal communication	Microsoft PowerPoint	Program management
11	Data structures	Business relationship management	Jira	Leadership development
12	Data science	Typing	Adobe InDesign	Elementary education
13	Pandas software	Inside sales	Adobe After Effects	Staff development
14	Artificial intelligence	Sales process	Linux	Adult education
15	Data modeling	English	jQuery	Project planning

AJAX = asynchronous JavaScript and XML, JS = JavaScript, REST = representational state transfer, REST API = RESTful application programming interface, TCP/IP = transmission control protocol/internet protocol, XML = extensible markup language.

Note: Covers Australia, India, Indonesia, Malaysia, the Philippines, Singapore, and the United States.

Source: LinkedIn Economic Graph.

Box 4: Emerging and Declining Skills in Renewable Energy

The renewable energy industry combines well-established categories like hydro, solar, and wind power with more recent niches like electric vehicles, micro-mobility, and smart grids. Analysis of skill dynamics shows that many top emerging digital skills relate to understanding, visualizing, and using data, which are critical as the industry moves from perfecting engineering innovations and clean energy hardware toward innovations like smart grids, the Internet of Things, and energy forecasting, which are becoming more critical as electric utilities adapt to decarbonization (box table). Declining digital skills are mostly basic digital literacy. Future digital transformation in this industry may focus on upskilling to enable better analysis and understanding of data to optimize business, plant, and manufacturing activities.

Top Emerging and Declining Skills in the Renewable Energy

Rank	Emerging Skills		Declining Skills	
	Digital	Non-digital	Digital	Non-digital
1	Design	Personal development	Social media	Gas
2	Data analytics	Presentations	Microsoft Word	Petrochemicals
3	Spreadsheets	Decision-making	Microsoft Office	Business intelligence
4	Data visualization	Equipment maintenance	Integration	Strategic planning
5	Industrial automation	Written communication	Microsoft PowerPoint	Project planning
6	Data science	Relationship building	Product development	Upstream processes
7	Computer literacy	Administration	Testing	Power generation
8	DevOps	Sales and marketing	Software development life cycle	Engineering, procurement, and construction
9	Microsoft Office 365	Talent management	Requirement analysis	Power plants
10	Adobe acrobat	Operational excellence	Microsoft Excel	Public speaking
11	Internet of Things	Skilled multitasker	CATIA	Community outreach
12	Process automation	Interpersonal communication	Microsoft Access	Business process improvement
13	Infrastructure	Presentation skills	Matlab	Event planning
14	Microsoft Power BI	Executive management	Microsoft SQL server	Aerospace
15	Analytics	Planning	Ansys	Human resources

Ansys = analysis system, BI = business intelligence, CATIA = computer-aided three-dimensional interactive application, DevOps = software development and information technology operations, MatLab = matrix laboratory, SQL = structured query language.

Note: Covers Australia, India, Indonesia, Malaysia, the Philippines, Singapore, and the United States.

Source: LinkedIn Economic Graph.

Skills in demand in the future will be those that facilitate greater flexibility to build web and mobile applications and that generate insights and actionable recommendations from data.

When setting up training courses and programs, educators face difficult decisions between niche skills that allow learners to specialize versus broader skills that are applicable across different areas. In an industry that is changing rapidly, such as e-learning, it may be more prudent to teach broader skills to allow trainees to keep up with change. One example of a broad skill would be data analytics and building dashboards, which can be applied across many different jobs and industries.

Another notable trend across all three industries is that basic digital literacy skills appear to be in decline. This does not mean that basic digital literacy is becoming less important. It reflects instead that workers are less likely to see such skills as a competitive advantage worth listing on their LinkedIn profiles. These days, most workers must possess at least basic digital literacy skills to remain viable.

Degrees and Qualifications Being Used in the Three Industries

Workers in renewable energy and smart cities tend to have engineering degrees, while those in e-learning have a broader mix of educational qualifications (Table 7). These differences reflect the nature of the industries. Smart cities and renewable energy are closely linked to physical infrastructure, which necessitates greater engineering expertise. There may also be stricter requirements for employees, such as safety inspectors, to be formally certified. However, opportunities exist for newer digital roles to emerge in these industries. There is increasing need for data and visualization skills, which require different credentials and can be learned over shorter periods of time. While some roles will require formal training, policy makers can invest in upskilling talent with shorter-term credential programs to meet demand that comes from digitization in these industries.

Table 7: Five Most Common Fields of Study in Selected Countries, by Industry

Rank	Country	Smart Cities	Renewable Energy	E-learning
1	Australia	Civil engineering	Civil engineering	Information technology
2	Australia	Information technology	Electrical and electronics engineering	General business administration and management
3	Australia	Electrical and electronics engineering	General business administration and management	Marketing
4	Australia	General business administration and management	Mechanical engineering	Computer science
5	Australia	Mechanical engineering	Accounting	Accounting

continued on next page

Table 7 continued

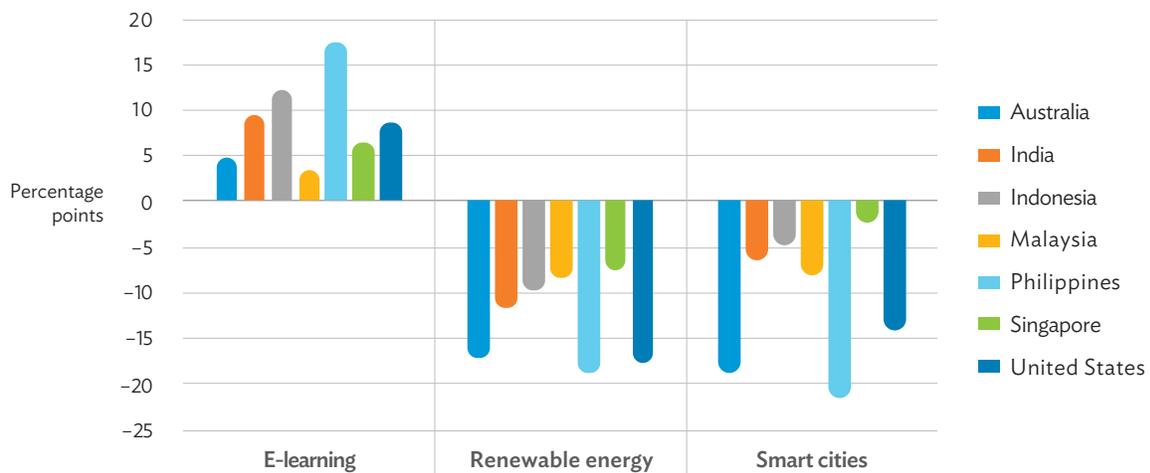
Rank	Country	Smart Cities	Renewable Energy	E-learning
1	India	Electrical and electronics engineering	Mechanical engineering	Computer science
2	India	Electrical, electronics, and communications engineering	Electrical and electronics engineering	Marketing
3	India	Civil engineering	Civil engineering	Mechanical engineering
4	India	Computer science	Electrical, electronics, and communications engineering	Electrical, electronics, and communications engineering
5	India	Information technology	Marketing	Computational science
Rank	Country	Smart Cities	Renewable Energy	E-learning
1	Singapore	Electrical and electronics engineering	Mechanical engineering	Information technology
2	Singapore	Mechanical engineering	Electrical and electronics engineering	General business administration and management
3	Singapore	Information technology	Civil engineering	Computer science
4	Singapore	General business administration and management	General business administration and management	Marketing
5	Singapore	Computer science	Chemical engineering	Computational science
Rank	Country	Smart Cities	Renewable Energy	E-learning
1	United States	Electrical and electronics engineering	General business administration and management	General business administration and management
2	United States	General business administration and management	Mechanical engineering	Computer science
3	United States	Computer science	Electrical and electronics engineering	Marketing
4	United States	Information technology	Accounting	Computational science
5	United States	Computational science	Chemical engineering	Psychology

Source: LinkedIn Economic Graph.

Male Domination in Smart Cities and Renewable Energy

Males dominate the smart city and renewable energy industries, but e-learning has better gender balance. Figure 10 shows that smart cities and renewable energy tend to attract fewer female workers than the national average. While some Asian countries exhibit more gender parity than the US in both renewable energy and smart cities, female shares still fall far below country averages. This may reflect several factors. Civil engineering and electrical engineering are preponderant fields of study in both industries and have historically been dominated by males.

Figure 10: Difference in Female-to-Male Representation in Industries, by Country



Source: LinkedIn Economic Graph.

These gender imbalances require attention, as a weak gender lens in urban planning and smart city development, for instance, generates suboptimal outcomes that fail to reflect the particular needs of women, notably in transportation.⁹ These challenges are global, with women holding only 32% of jobs in renewable energy, albeit significantly more than in the traditional oil and gas industry, at 22%.¹⁰ More women might acquire renewable energy qualifications if successful and influential women in green energy were more widely showcased.

Higher female representation in e-learning indicates lower barriers to entry in terms of skills, work flexibility, and social acceptance, indicating progress toward gender parity (Box 5). Indeed, Asian tech companies have a relatively strong record in gender-equitable hiring, especially in Southeast Asia.¹¹

⁹ R. Tyers and P. Leonard. 2020. *Making Smart Fair: Building Inclusive, Fair and Sustainable Transport for Cities of the Future*. Southampton: Web Science Institute, University of Southampton. <https://southampton.ac.uk/~assets/doc/wsi/WSI%20white%20paper%203.1%20smart%20cities-1.pdf>.

¹⁰ International Renewable Energy Agency. 2020. *Wind Energy: A Gender Perspective*. Abu Dhabi. <https://www.irena.org/publications/2020/Jan/Wind-energy-A-gender-perspective>.

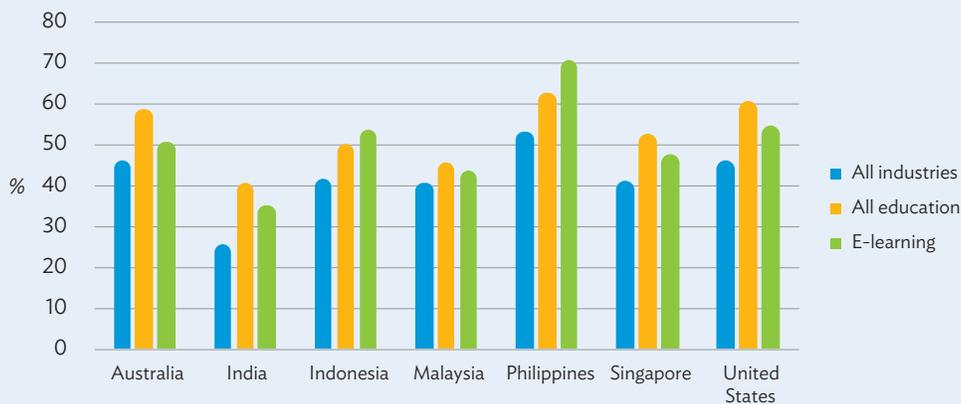
¹¹ V. Rastogi et al. 2020. *Boosting Women in Technology in Southeast Asia: Shifting from Awareness to Action on Gender Diversity*. Boston: Boston Consulting Group. <https://www.bcg.com/en-gb/publications/2020/boosting-women-in-southeast-asia-tech-sector>.

Such progress is limited. Earlier LinkedIn reports showed the widest gender gaps in emerging jobs that rely heavily on advanced disruptive tech skills—that is, skills used to develop the new technologies that are expected to affect labor markets in the coming years—with women’s share below 30%.¹² Unequal gains in emerging skills in demand will likely persist unless proactive steps are taken to monitor gaps and close them as they appear. The supply of women with advanced disruptive tech skills must expand by ensuring that more women acquire these skills in the education system. In addition, business leaders should leverage existing talent in adjacent fields like life sciences, where women with similar foundational skills are well represented.

Box 5: Dissecting the Gender Trend in E-learning

While female participation in e-learning is higher than average in all industries in all of the countries studied, it is lower than in education in general, except in Indonesia and the Philippines (box figure). This suggests that higher gender parity in e-learning reflects a female tendency to be educators. As e-learning markets grow, there is a need to keep an eye on gender gaps to ensure that females benefit from rising opportunities in emerging technology. Earlier LinkedIn reports showed the widest gender gaps to be in emerging jobs that rely heavily on advanced disruptive tech skills, with the share of women below 30%.^a It is therefore important to keep the gender lens active as education technology grows by leaps and bounds.

Female Participation in Education and E-learning versus All Industries



^a S. Duke. 2019. *To Close Gender Gaps, We Need More Women in Emerging Jobs*. LinkedIn. <https://economicgraph.linkedin.com/blog/the-gendergap-to-close-gender-gaps-in-the-future-we-need-more-women-in-emerging-jobs-today>.

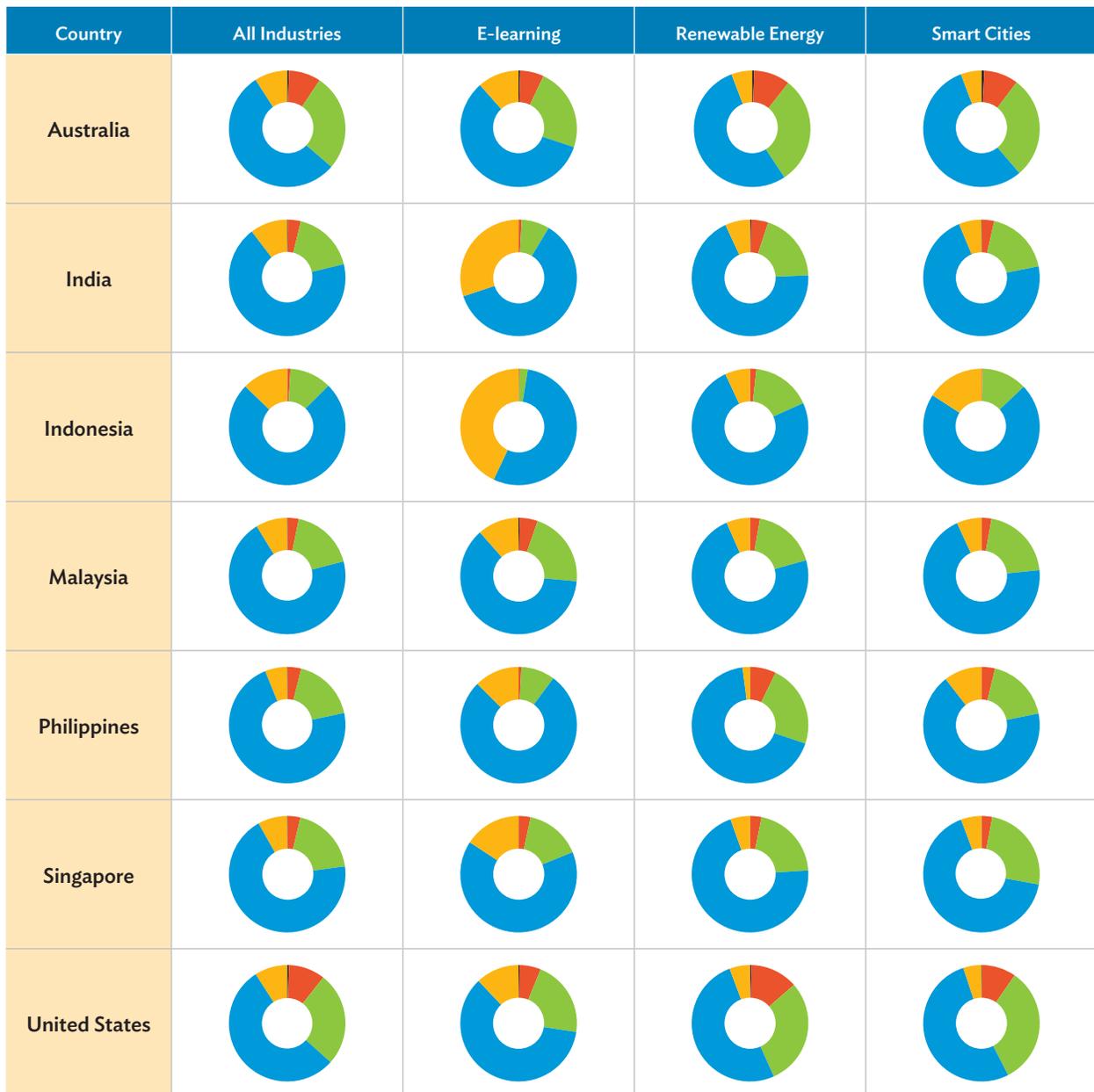
Source: LinkedIn Economic Graph.

¹² S. Duke. 2019. *To Close Gender Gaps, We Need More Women in Emerging Jobs*. LinkedIn. <https://economicgraph.linkedin.com/blog/the-gendergap-to-close-gender-gaps-in-the-future-we-need-more-women-in-emerging-jobs-today>.

Workforce Younger in E-learning, Older in Smart Cities and Renewable Energy

Employees in e-learning tend to be slightly younger than the average age in all industries, while those in smart cities and renewable energy are slightly older (Figure 11).

Figure 11: Age Distribution in All Countries by Industry



Legend:  = Gen Z (born 1997–2012),  = Millennial (born 1981–1996),  = Gen X born (1965–1980),  = Boomer born (1946–1964).
Source: LinkedIn Economic Graph.

India, Indonesia, and the Philippines have the largest shares of younger employees—Gen Z and millennials—in e-learning, which may reflect both younger working populations overall and country-specific dynamics. India is home to some of the world’s leading edtech brands, which have become magnets for young tech talent. Indonesia has a young, tech-savvy population and is one of the more digitally connected Asian economies.¹³ Its complex and vast geography also increases the impetus for digital infrastructure relative to more compact Asian markets. The Philippine e-learning market posted double-digit annual growth from 2013 and 2018 thanks to government support; rising internet penetration; growing interest among schools; and high student interest in alternative learning techniques such as video, animation, gamification, and courseware.¹⁴

In contrast, employees in renewable energy and smart cities are slightly older than the country average. As noted above, workers in these industries are more likely to hold degrees in engineering, which typically take 1–2 years longer to obtain than business or marketing degrees. Even after qualifying, engineering graduates may need to take additional examinations to become recognized as professional engineers. In Singapore, for example, civil, electrical-mechanical, and chemical engineers need to pass additional examinations and interviews conducted by the Professional Engineers Board.¹⁵ Such requirements may contribute to a slightly older age profile in these industries. Requiring advanced tests and qualifications is likely to make it more challenging for workers in midcareer in other industries to reskill and move into renewable energy or smart cities. Such movement would call for significant investment in their reeducation and retraining. This may limit the pool of talent that can move laterally into these industries at a fast pace. It may be useful for education and training institutions to take a closer look at the specific skills required for these industries at different levels and explore how to teach those skills more quickly or through training on the job.

¹³ R. B. Harto. 2020. Transforming Indonesia’s Education through Online Learning. *Jakarta Post*. 21 May. <https://www.thejakartapost.com/academia/2020/05/21/transforming-indonesias-education-through-online-learning.html>.

¹⁴ Businesswire. 2020. *Study on the Philippines E-Learning Market 2013 to 2023—Featuring Yapster, Blackboard & Canvas among Others—ResearchAndMarkets.com*. <https://www.businesswire.com/news/home/20200203005369/en/Study-on-the-Philippines-E-Learning-Market-2013-to-2023---Featuring-Yapster-Blackboard-Canvas-Among-Others---ResearchAndMarkets.com>.

¹⁵ Professional Engineers Board Singapore. Acts and Rules. <https://www.peb.gov.sg/actrules.aspx>.

Recommendations and the Way Forward

A PwC report argues that digitization contributes positively to job creation, with a 10% increase in digitization reducing the unemployment rate by 0.84%. Countries with advanced digitization reap 20% more economic benefits than do countries at the start of their digitization journeys.¹⁶ The *2020 Future of Jobs Report* by the World Economic Forum cites a survey in which 83% of companies reported that remote work will be scaled up and 84% said that digitalization will accelerate. Accelerated investment in upskilling and reskilling workers can add at least \$6.5 trillion to global output and 5.3 million new jobs by 2030, according to a World Economic Forum and PwC report, and make economies around the world inclusive and sustainable. Accelerating skill development has the potential to boost global productivity by 3% on average by 2030. The newly created jobs are expected to be those complemented and augmented by technology, not replaced.¹⁷ Clearly, the age of digital skills has arrived. This calls for updates to the ecosystem for qualifications and credentials.

Digital credentials are issued in various formats by platforms that leverage technology in education to fill gaps in learning offered by traditional academic institutes. Employers recognize the value of digital credentials as signals of workers' modern skills and competencies, but they do not yet view them as alternatives to formal educational qualifications.

¹⁶ K. Sabbagh et al. 2012. Maximizing the Impact of Digitization. PwC. <https://www.strategyand.pwc.com/m1/en/reports/maximizing-impact-digitization.html>

¹⁷ World Economic Forum and PwC. 2021. *Upskilling for Shared Prosperity*. World Economic Forum. <https://www.pwc.com/gx/en/issues/upskilling/upskilling-for-shared-prosperity.html>

Barriers to the uptake of digital credentials include unfamiliarity with them caused in part by a lack of standard definitions, verification frameworks, or mechanisms of quality assurance. As a result, an employer's perspective on digital credentials depends largely on the reputation of their providers. National standards and frameworks are needed to protect learners and help employers select the right digital talent, but regulations should not compromise the speed and flexibility with which trainers can respond to the demands of both learners and employers.

As countries develop systems to make digital credentials more reliable, special efforts are needed to ensure that the expansion of the digital credentialing ecosystem does not make higher education systems less equitable in terms of gender, language, income, or digital literacy. Governments and the industry must enable disadvantaged groups to take advantage of new digital platforms. Ultimately, a combination of traditional and innovative systems will maximize the benefits of disruption under the Fourth Industrial Revolution and minimize vulnerability in the workforce.

The following are recommendations for expanding the universe of digital skills and digital credentials:

- ✔ **Step up the pace of digital skill development to ensure future readiness.** As per the 2021 e-Conomy SEA report by Google, Temasek, and Bain & Company, the internet economies of six Southeast Asian countries recorded unprecedented growth from 2020 to 2021, with the Philippines recording growth in the digital economy by 93% in terms of gross merchandise value. The projected value of the internet economy in these countries by 2030 is \$1 trillion. This report shows that the pandemic has accelerated demand for digital talent. This means that policy makers and education and training providers need to have deliberate action plans that scale up opportunities for training in digital skills.
- ✔ **Enable digital skill development for advanced and disruptive technologies.** Analysis presented in this report clearly shows that basic digital skills have become a foundational or essential skill in job markets. Job seekers and people already in the workforce need to advance to intermediate and advanced digital skills to stand out and succeed professionally. Education and training institutions must therefore create new offerings that span the spectrum of higher skills for the digital economy. With demand for advanced digital skills growing rapidly, courses and curricula need to be developed more quickly and with a flexible approach to keep pace with changing technologies.
- ✔ **Expand skills and training for fundamental coding and programming skills.** Given the finding that SQL and Java consistently appear among the digital skills most in demand for many job categories across the countries surveyed, because they are necessary for data analysis and building software and hardware tools, educators should consider expanding opportunities for developing fundamental coding and programming skills in secondary and post-secondary education programs.

- ✔ **Expand offerings for modular skill development and talent stacking.** Digital skill courses provided online and lasting 3–6 month are becoming more popular, opening a clear market space for a continuous process of upgrading skills. Education and training institutions need to provide opportunities for stacking skills and credentials, both vertically and horizontally. Vertical stacking builds in-depth skills toward advanced degrees in specific disciplines. Horizontal stacking conveys skills and credentials across diverse industry segments. In information technology, for instance, horizontal stacking can combine cybersecurity and cloud computing, cloud computing and data science, or AI and programming. Institutions need to pursue such bundling of education and training to remain relevant in fast-changing marketplaces.
- ✔ **Nurture an ecosystem to recognize learning in traditional and other ways.** A revolution is changing how learning and competencies are recognized on digital platforms. Traditional and digital credentials will coexist and complement each other in the near future. With 89% of all survey respondents, both employers and online trainers, agreeing that digital credentials will become a critical part of higher education, policy makers need to establish arrangements to provide, regulate, and assure the quality of digital credentials. As digital credentials will not diminish the market value of traditional credentials in the short run, but will coexist and complement traditional credentials like university degrees, an overarching recognition system is needed that is sufficiently robust but also flexible enough to move with market trends. Higher education institutions and regulatory authorities need to develop plans to align online courses with conventional college education and enable credit mobility.
- ✔ **Expand market understanding and acceptance of digital credentials.** Employers are calling for a trusted national infrastructure that issues, stores, displays, and verifies digital credentials. Harmonizing definitions and standards and benchmarking to global standards are important for developing countries in Asia. To develop a transparent and effective model of governance for digital credentials, partnerships with tech companies are needed. Such a system needs to look to the future by providing flexibility to accommodate further innovations in digital skills and credentials.
- ✔ **Promote partnership between traditional educational institutions and digital trainers.** Universities and training institutions clearly need to update their curricula and align them with current and emerging job market demand. While 59% of surveyed online trainers report no collaborative interaction with traditional academic institutions, such collaboration is crucial to build a holistic education and training system that is agile and responsive and therefore able to deliver curricula that suit market needs. Collaboration can bring academic rigor to digital platforms, and flexibility and adaptability to academic institutions.
- ✔ **Subsidize and diversify online learning offerings to promote equity and inclusiveness.** Almost two-thirds of the surveyed trainers, or 64%, do not offer digital skills programs packaged specifically for women, disadvantaged youth, indigenous communities, people in poverty, or people living in remote locations with little or no access to the internet. The expansion of digital skilling and credentialing must not

deepen digital divides in education systems by excluding disadvantaged or marginalized populations. Grants and scholarships based on merit and need are critical to equalize opportunity for digital skill development. The online learning ecosystem can be further diversified by making content available in local languages. The training of women with advanced disruptive tech skills must expand. Business leaders should leverage existing talent in adjacent fields like life sciences, where women with similar foundational skills are well represented.

- ✔ **Reenergize training on the job and employee reskilling and upskilling.** Most surveyed employers report that they provide digital skill training to their current employees. This mode of reskilling and upskilling for the digital world is crucial for building the necessary digital skills. ADB studies of the Fourth Industrial Revolution and its implications highlight that on-the-job training, reskilling, and upskilling are necessary to meet demand in Southeast Asia for skills to manage disruptive technologies to 2030. Developing economies need to catch up with advanced economies like the US by increasing the proportion of firms undertaking workforce development. Another clear need is to reenergize partnerships between industry and trainers for upskilling and reskilling initiatives.
- ✔ **Expand digital talent for online learning platforms and smart cities.** With online learning and smart cities relying more on digital talent than most other industries, trainers would do well to develop and deliver skill training programs specifically designed to serve their needs. Both industries are relatively new, growing, and in need of workers who are more digitally capable. In the somewhat older renewable energy industry, emerging segments like electric vehicles and smart grids call for specific skills and talent initiatives that enable a green transition. While engineering skills remain prominent for renewable energy, more diversified digital skills will be needed to develop the skill base across the spectrum, including technicians and installers. Skills for data analytics and building dashboards, as well as consumer-interface applications, will be needed across many different jobs and industries.
- ✔ **Tailor skill development opportunities for different age groups and industries.** Skill development programs need to adapt to the needs of specific age groups participating in various industries. With millennials—those born from 1981 to 1996—dominant in all industries and economies surveyed, their needs for job training and skills should be paramount. The presence, however limited, of boomers—born from 1946 to 1964—means that training and support could help some of them remain a little longer in the workforce. Training for Gen Z—born from 1997 and 2012—needs to be creative and adaptable to suit these “digital natives.” The Gen Z workforce is particularly strong in online learning industries in India and Indonesia. Investing in skills for these industries, and in those that attract Gen Z workers, is important for successful transition to high-quality jobs and entrepreneurship that expands growth industries in the future.

ANNEX

Research Methodology Using the LinkedIn Economic Graph

LinkedIn has a global membership of 850 million individuals and 58 million companies.¹ The LinkedIn Economic Graph analyzes this membership through a prism of 38,000 standardized skills self-reported by LinkedIn members on their LinkedIn profiles. Analysis using the LinkedIn Economic Graph has unique strengths in that it enables new insights into emerging digital sectors and skills, with near real-time updates. Many knowledge-intensive industries have good coverage across income levels and geographic locations, which allows for global benchmarking.²

Limitations. LinkedIn Economic Graph data have some limitations. While rendered anonymous before being aggregated, the data are influenced by how individual members use the platform, which varies by professional, social, and regional culture, as well as according to site accessibility. The data are neither a random sample of a country's workforce nor fully representative either of industries or professions. This is because people who are familiar with the internet and possess basic digital literacy are more likely than others to use LinkedIn. Some occupations and industries are better represented on LinkedIn than are others. Further, as skill data are self-reported, members may inflate their skills or present them differently, rendering data not entirely comparable across members and occupations.

Other data sources. This study includes published data and insights from international organizations such as the Organisation for Economic Co-operation and Development, Eurostat, the World Bank, and the World Economic Forum. While this manner of sharing promises to make this data set complementary to government statistics, the current study is derived directly from LinkedIn and ADB taxonomies, which have not been compared with government datasets or other occupational and skill taxonomies.

¹ In surveyed countries, LinkedIn has at least 11 million members in Australia, 76 million in India, 18 million in Indonesia, 5 million in Malaysia, 9 million in the Philippines, 2 million in Singapore, and 178 million in the United States.

² World Bank. 2021. *World Bank Group-LinkedIn Data Insights: Jobs, Skills and Migration Trends Methodology and Validation Results (English)*. <https://documents.worldbank.org/en/publication/documents-reports/documentdetail/827991542143093021/world-bank-group-linkedin-data-insights-jobs-skills-and-migration-trends-methodology-and-validation-results>.

Skill categories. LinkedIn allocates standardized skills into two categories: tech/digital skills and disruptive tech/digital skills. Tech/digital skills use digital devices, communication applications, and networks to access and manage information. They enable people to create and share digital content, communicate and collaborate, and solve problems. Examples range from basic digital literacy to web development. Disruptive tech/digital skills are used to develop new technologies that are expected to affect labor markets in the coming years, notably artificial intelligence, robotics, and genetic engineering. In this report, disruptive tech/digital skills are referred to as advanced disruptive digital skills.

The current study further subdivided tech/digital skills into basic digital skills and intermediate digital skills. Basic digital skills are those fundamentally required to understand simple tech concepts and use enterprise technologies, platforms, and solutions on the job. Intermediate digital skills enable those who master them to deploy hardware and software to build tools, platforms, and applications that can be easily used by others with only basic digital skills.

Thus, the three skill groups in the current ADB–LinkedIn study are (i) basic digital skills, (ii) intermediate digital skills, and (iii) advanced disruptive digital skills. Table A1 shows examples of each category. (The ADB–Outline credential survey ranked digital skills in four categories by dividing intermediate into two categories [footnote 4].)

Hiring events. A job hiring was deemed to have occurred when a LinkedIn member profile indicated a change of employer. Aggregating individual digital hires enabled researchers to compare them in a given period with the same period in the previous year, yielding change in the hiring rate year on year for each of the three categories of digital skills: basic, intermediate, and advanced disruptive. Among hires, one who had at least one basic skill was counted as a basic hire, one who had at least one intermediate skill was an intermediate hire, and one who had at least one advanced disruptive skill was an advanced disruptive hire. In short, LinkedIn members with skills across multiple categories were tagged for their highest skill category.

The data, thus generated, enabled research methodologies to determine the following:

Change in the digital hiring rate in Asia and the Pacific versus the United States (Figure 1). The digital hiring rate is the proportion of LinkedIn members who list digital skills in their profile and indicate a change in employer that month. Change in the rate is measured here year over year.

Differences in the average share of digital hires by skill category in 2020 (Table 1). Hires in each category were aggregated in each month of 2020 and indexed against January 2020 to create a time series depicting the hiring trend across 2020.

Jobs most in demand and fastest-growing jobs (Tables 2 and 3). The top jobs in demand were the job titles most commonly reported by LinkedIn members hired in each country in two 6-month time frames: (i) from 1 September 2019 to 28 February 2020 and (ii) from 1 September 2020 to 28 February 2021. These time frames allowed comparisons year on year but left out March–August 2020, a period of severe lockdowns and hiring freezes. The first period was thus before the pandemic and the second after the pandemic—or at least after the worst of it in terms of economic disruption

Asian Development Bank–LinkedIn Digital Skills Taxonomy

Basic	Intermediate		Advanced
Basic Digital Literacy and Skills	Applied Digital Skills	Skills for Computer Software and Hardware	Advanced Disruptive Digital Skills
Digital communication and collaboration	Animation	Computer hardware	Aerospace engineering
Basic internet skills for commerce and online purchases	Big data use and management	Computer networking	Artificial intelligence
Mobile banking	Computer graphics	Data storage technologies	Augmented reality and virtual reality
Online financial and citizen services	Digital art, music, and videos	Enterprise cloud computing	Autonomous vehicles
Social media	Digital data tools	Enterprise digital transformation	Computational thinking
Basic computer skills	Digital logistics and warehousing	Game development	Cybersecurity
Basic skills to use programs such as Microsoft Office	Digital manufacturing and processing	Information technology administration	Data science
	Digital marketing	Mobile application development	Development tools
	E-commerce development	Product development	Digital biotechnology
	Enterprise software	Scientific computing	Genetic engineering
	Financial tech	Signal processing	Human–computer interaction
	Graphic design	Software development through programming or coding	Material science
	Social media marketing and advertising	Software testing	Nanotechnology
	System administration	Network engineering	Platform management
	Technical support	Web services and digital solutions	Robotics

Source: Asian Development Bank and LinkedIn, developed for this report.

Jobs in demand were determined from profile updates made by members hired into new jobs during the period in question. The more hires there were, the higher the demand; differences between the two time frames revealed growth rates for different jobs. To minimize noise from small samples, each job had to have at least 250 entries in a particular country to be included in the analysis—a restriction that allowed results for only the top nine jobs in the Philippines and the top eight in Singapore. Also excluded, to minimize data noise, were roles that reflected company ownership, co-ownership, founding, or

confounding, as were internal transfers or role changes within a company, as they may reflect internal restructuring, not job market demand. To better capture only job movements in the labor market, unpaid positions, internships, and student roles were excluded.

Top unique representative digital skills needed for top jobs in demand (Table 4). This was researched by mapping the “skill genome” of each job to highlight the unique skills it required. Unique skills were extracted by applying a weighting scheme analogous to term frequency-inverse document frequency (TF-IDF), a commonly used data-mining technique for textual analysis. This step was necessary because a set of generic and commonly held skills can often obscure the unique skills needed for a specific job. For example, data scientists frequently include in their LinkedIn profiles Microsoft Word and Microsoft Excel, but these are among the most commonly cited digital skills across categories and therefore do not distinguish data scientist from other jobs.

To extract unique skills, each skill had a weighted score for each emerging job based on how likely members were to add it to their profile, compared with the likelihood of that skill being added in any job; the more often members add the skill across a wide range of jobs, the lower its weight.

Based on the skills genome of each of the jobs in top demand, occurrences of each digital skill were counted, and the most frequent were included among the skills most in demand.

Links between employees in jobs in demand and their fields of study (Table 5). Based on jobs in demand as identified in Table 2, employees currently in those jobs were identified and their university fields of study were noted.

Company placement in an industry (digital skill demand in three emerging industries). To identify which companies in the seven countries covered in this report were in e-learning, renewable energy, or smart cities, researchers looked at each company’s self-declared industry, company description, and company business keywords. Where possible, keywords from job postings were also used, but with filters applied to ensure high-quality outputs: To ensure that the job was in one of the company’s core business lines, keywords had to appear in more than 15% of its job postings, and the company had to have posted at least five jobs with these keywords since 2017. Analysis classified over 21,000 companies in e-learning, 2,500 in smart cities, and 13,000 in renewable energy.

Relative growth in company numbers by industry (Figure 8). The proportion of new companies in a specific industry is the number of new companies in that industry divided by the number of new companies in the country. A company’s founding year was as reported on its LinkedIn page or, failing that, inferred from the earliest date an employee could be determined to have worked for it.

Relative proportions of digital talent by industry (Figure 9). Employees who listed at least one digital skill on their LinkedIn profile were tagged as digital talent. All others were tagged as non-digital talent.

Fastest-emerging tech skills (Table 6). Among employees working in smart city, e-learning, or renewable energy companies in 2018, any skills they added to their profiles during their employment was extracted for analysis. For example, if an employee worked in a smart city company at least from the beginning of 2018 to 1 July, moved to an e-learning company on 2 July and added a skill on or after 2 July, that skill was attributed to the e-learning company. This process was repeated for 2020 for comparison with 2018 to determine the top emerging or declining skills, both digital and non-digital.

Education qualifications by industry (Table 7). The proportion of employees with a given field of study was calculated for each industry, and the top five fields were identified for each industry—but only in Australia, India, Singapore, and the United States for lack of sufficient data in Indonesia, Malaysia, or the Philippines.

Gender balance by industry (Figure 10). The proportion of male and female employees was calculated for each industry and compared with the country average in all industries. A positive value indicates female representation in the industry higher than the country average, and a negative value female representation in the industry lower than the country average.

Workforce age by industry (Figure 11). The proportion of employees by age bracket was calculated for each industry and compared with the country average for all industries. Age brackets followed definitions from Pew Research:³ Gen Z born 1997–2012, millennials born 1981–1996, Gen X born 1965–1980, and boomers born 1946–1964.

³ “Generations and Age” (website). Pew Research Center. 2022. <https://www.pewresearch.org/topic/generations-age/>.

Digital Jobs and Digital Skills

A Shifting Landscape in Asia and the Pacific

Explosive growth of digital technologies in the workplace promises higher productivity while presenting real challenges: automation eliminates jobs; digitalization transforms traditional practices; and unequal access to technologies exacerbates job market vulnerabilities. The Asian Development Bank (ADB) and LinkedIn collaborated to better understand the emerging landscape for jobs and to highlight ascending skills and jobs in increasingly digital workplaces in India, Indonesia, Malaysia, and the Philippines, as well as Australia, Singapore, and the United States. This report analyzes the renewable energy, e-learning, and smart cities sectors to track supply and demand in digital skills and the nature of digital occupations.

About the Asian Development Bank

ADB is committed to achieving a prosperous, inclusive, resilient, and sustainable Asia and the Pacific, while sustaining its efforts to eradicate extreme poverty. Established in 1966, it is owned by 68 members —49 from the region. Its main instruments for helping its developing member countries are policy dialogue, loans, equity investments, guarantees, grants, and technical assistance.

About LinkedIn

Founded in 2003, LinkedIn connects the world's professionals to make them more productive and successful. With more than 850 million members worldwide, including executives from every Fortune 500 company, LinkedIn is the world's largest professional network. The company has a diversified business model with revenue coming from Talent Solutions, Marketing Solutions, Sales Solutions and Premium Subscriptions products. Headquartered in Silicon Valley, LinkedIn has offices across the globe.



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