Insight Report

The Future of Jobs Report
2018

Centre for the New Economy and Society
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Preface

KLAUS SCHWAB
Founder and Executive Chairman, World Economic Forum

The emerging contours of the new world of work in the Fourth Industrial Revolution are rapidly becoming a lived reality for millions of workers and companies around the world. The inherent opportunities for economic prosperity, societal progress and individual flourishing in this new world of work are enormous, yet depend crucially on the ability of all concerned stakeholders to instigate reform in education and training systems, labour market policies, business approaches to developing skills, employment arrangements and existing social contracts. Catalysing positive outcomes and a future of good work for all will require bold leadership and an entrepreneurial spirit from businesses and governments, as well as an agile mindset of lifelong learning from employees.

The fundamental pace of change has only accelerated further since the World Economic Forum published its initial report on this new labour market—The Future of Jobs: Employment, Skills and Workforce Strategy for the Fourth Industrial Revolution—in January 2016. With an increased need for tangible evidence and reliable information from the frontlines of this change, this new edition of the Future of Jobs Report once again taps into the collective knowledge of those who are best placed to observe the dynamics of workforces—executives, especially Chief Human Resources Officers, of some of the world’s largest employers—by asking them to reflect on the latest employment, skills and human capital investment trends across industries and geographies.

A particular focus of this new edition of the report is on arriving at a better understanding of the potential of new technologies, including automation and algorithms, to create new high-quality jobs and vastly improve the job quality and productivity of the existing work of human employees. As has been the case throughout economic history, such augmentation of existing jobs through technology is expected to create wholly new tasks—from app development to piloting drones to remotely monitoring patient health to certified care workers—opening up opportunities for an entirely new range of livelihoods for workers. At the same time, however, it is also clear that the Fourth Industrial Revolution’s wave of technological advancement is set to reduce the number of workers required for certain work tasks. Our analysis finds that increased demand for new roles will offset the decreasing demand for others. However, these net gains are not a foregone conclusion. They entail difficult transitions for millions of workers and the need for proactive investment in developing a new surge of agile learners and skilled talent globally.

To prevent an undesirable lose-lose scenario—technological change accompanied by talent shortages, mass unemployment and growing inequality—it is critical that businesses take an active role in supporting their existing workforces through reskilling and upskilling, that individuals take a proactive approach to their own lifelong learning and that governments create an enabling environment, rapidly and creatively, to assist in these efforts. Our analysis indicates that, to date, many employers’ retraining and upskilling efforts remain focused on a narrow set of current highly-skilled, highly-valued employees. However, in order to truly rise to the challenge of formulating a winning workforce strategy for the Fourth Industrial Revolution, businesses will need to recognize human capital investment as an asset rather than a liability. This is particularly imperative because there is a virtuous cycle between new technologies and upskilling. New technology adoption drives business growth, new job creation and augmentation of existing jobs, provided it can fully leverage the talents of a motivated and agile workforce who are equipped with futureproof skills to take advantage of new opportunities through continuous retraining and upskilling. Conversely, skills gaps—both among workers and among an organization’s senior leadership—may significantly hamper new technology adoption and therefore business growth.

At the World Economic Forum’s Centre for the New Economy and Society, we provide a platform for leaders to understand current socio-economic transformations and shape a future in which people are at the heart of economic growth and social progress. A significant portion of our activities aim to support leaders in managing the future of work. This biannual report provides a five-year outlook based on the latest thinking inside companies and is designed to inform other businesses, governments and workers in their decision-making. Additionally the Centre is working across multiple industries to design sector-level
roadmaps to respond to the new opportunities and challenges of managing workforce transitions. The Centre is also supporting developed and emerging economies in setting up large-scale public private collaborations to close skills gaps and prepare for the future of work. Finally, the Centre acts as a test bed for early-stage work at the frontier of managing the future of work, ranging from the development of new principles for the gig economy to the adoption of common skills taxonomies across business and education.

We would like to express our appreciation to Vesselina Ratcheva, Data Lead, Centre for the New Economy and Society; Till Alexander Leopold, Project Lead, Centre for the New Economy and Society; and Saadia Zahidi, Head, Centre for the New Economy and Society for their leadership of this report. Additional thanks to Genesis Elhussein, Specialist, and Piyamit Bing Chomprasob, Project Lead, for their work on the report’s survey collection phase, and the support of other members of the Centre for the New Economy and Society team for its integration into a comprehensive platform for managing workforce change. We greatly appreciate, too, the innovative data collaboration with LinkedIn and the support of the report’s regional survey partners, which enhanced its geographical coverage. Finally, we continue to count on the proactive leadership of the Stewards and Partners of the System Initiative on Shaping the Future of Education, Gender and Work under the umbrella of the Forum’s Centre for the New Economy and Society.

Workforce transformations are no longer an aspect of the distant future. As shown in the five-year outlook of this report, these transformations are a feature of today’s workplaces and people’s current livelihoods and are set to continue in the near term. We hope this report is a call to action to governments, businesses, educators and individuals alike to take advantage of a rapidly closing window to create a new future of good work for all.
Key Findings

As technological breakthroughs rapidly shift the frontier between the work tasks performed by humans and those performed by machines and algorithms, global labour markets are undergoing major transformations. These transformations, if managed wisely, could lead to a new age of good work, good jobs and improved quality of life for all, but if managed poorly, pose the risk of widening skills gaps, greater inequality and broader polarization.

As the Fourth Industrial Revolution unfolds, companies are seeking to harness new and emerging technologies to reach higher levels of efficiency of production and consumption, expand into new markets, and compete on new products for a global consumer base composed increasingly of digital natives. Yet in order to harness the transformative potential of the Fourth Industrial Revolution, business leaders across all industries and regions will increasingly be called upon to formulate a comprehensive workforce strategy ready to meet the challenges of this new era of accelerating change and innovation.

This report finds that as workforce transformations accelerate, the window of opportunity for proactive management of this change is closing fast and business, government and workers must proactively plan and implement a new vision for the global labour market. The report’s key findings include:

- **Drivers of change**: Four specific technological advances—ubiquitous high-speed mobile internet; artificial intelligence; widespread adoption of big data analytics; and cloud technology—are set to dominate the 2018–2022 period as drivers positively affecting business growth. They are flanked by a range of socio-economic trends driving business opportunities in tandem with the spread of new technologies, such as national economic growth trajectories; expansion of education and the middle classes, in particular in developing economies; and the move towards a greener global economy through advances in new energy technologies.

- **Accelerated technology adoption**: By 2022, according to the stated investment intentions of companies surveyed for this report, 85% of respondents are likely or very likely to have expanded their adoption of user and entity big data analytics. Similarly, large proportions of companies are likely or very likely to have expanded their adoption of technologies such as the internet of things and app- and web-enabled markets, and to make extensive use of cloud computing. Machine learning and augmented and virtual reality are poised to likewise receive considerable business investment.

- **Trends in robotization**: While estimated use cases for humanoid robots appear to remain somewhat more limited over the 2018–2022 period under consideration in this report, collectively, a broader range of recent robotics technologies at or near commercialization—including stationary robots, non-humanoid land robots and fully automated aerial drones, in addition to machine learning algorithms and artificial intelligence—are attracting significant business interest in adoption. Robot adoption rates diverge significantly across sectors, with 37% to 23% of companies planning this investment, depending on industry. Companies across all sectors are most likely to adopt the use of stationary robots, in contrast to humanoid, aerial or underwater robots, however leaders in the Oil & Gas industry report the same level of demand for stationary and aerial and underwater robots, while employers in the Financial Services industry are most likely to signal the planned adoption of humanoid robots in the period up to 2022.

- **Changing geography of production, distribution and value chains**: By 2022, 59% of employers surveyed for this report expect that they will have significantly modified how they produce and distribute by changing the composition of their value chain and nearly half expect to have modified their geographical base of operations. When determining job location decisions, companies overwhelmingly prioritize the availability of skilled local talent as their foremost consideration, with 74% of respondents providing this factor as their key consideration. In contrast, 64% of companies cite labour costs as their main concern. A range of additional relevant factors—such as the flexibility of local labour laws, industry agglomeration effects or proximity of raw materials—were considered of lower importance.

• **Changing employment types:** Nearly 50% of companies expect that automation will lead to some reduction in their full-time workforce by 2022, based on the job profiles of their employee base today. However, 38% of businesses surveyed expect to extend their workforce to new productivity-enhancing roles, and more than a quarter expect automation to lead to the creation of new roles in their enterprise. In addition, businesses are set to expand their use of contractors doing task-specialized work, with many respondents highlighting their intention to engage workers in a more flexible manner, utilizing remote staffing beyond physical offices and decentralization of operations.

• **A new human-machine frontier within existing tasks:** Companies expect a significant shift on the frontier between humans and machines when it comes to existing work tasks between 2018 and 2022. In 2018, an average of 71% of total task hours across the 12 industries covered in the report are performed by humans, compared to 29% by machines. By 2022 this average is expected to have shifted to 58% task hours performed by humans and 42% by machines. In 2018, in terms of total working hours, no work task was yet estimated to be predominantly performed by a machine or an algorithm. By 2022, this picture is projected to have somewhat changed, with machines and algorithms on average increasing their contribution to specific tasks by 57%. For example, by 2022, 62% of organization’s information and data processing and information search and transmission tasks will be performed by machines compared to 46% today. Even those work tasks that have thus far remained overwhelmingly human—communicating and interacting (23%); coordinating, developing, managing and advising (20%); as well as reasoning and decision-making (18%)—will begin to be automated (30%, 29%, and 27% respectively). Relative to their starting point today, the expansion of machines’ share of work task performance is particularly marked in the reasoning and decision-making, administering, and looking for and receiving job-related information tasks.

• **A net positive outlook for jobs:** However this finding is tempered by optimistic estimates around emerging tasks and growing jobs which are expected to offset declining jobs. Across all industries, by 2022, growth in emerging professions is set to increase their share of employment from 16% to 27% (11% growth) of the total employee base of company respondents, whereas the employment share of declining roles is set to decrease from currently 31% to 21% (10% decline). About half of today’s core jobs—making up the bulk of employment across industries—will remain stable in the period up to 2022. Within the set of companies surveyed, representing over 15 million workers in total, current estimates would suggest a decline of 0.98 million jobs and a gain of 1.74 million jobs. Extrapolating these trends across those employed by large firms in the global (non-agricultural) workforce, we generate a range of estimates for job churn in the period up to 2022. One set of estimates indicates that 75 million jobs may be displaced by a shift in the division of labour between humans and machines, while 133 million new roles may emerge that are more adapted to the new division of labour between humans, machines and algorithms. While these estimates and the assumptions behind them should be treated with caution, not least because they represent a subset of employment globally, they are useful in highlighting the types of adaptation strategies that must be put in place to facilitate the transition of the workforce to the new world of work. They represent two parallel and interconnected fronts of change in workforce transformations: 1) large-scale decline in some roles as tasks within these roles become automated or redundant, and 2) large-scale growth in new products and services—and associated new tasks and jobs—generated by the adoption of new technologies and other socio-economic developments such as the rise of middle classes in emerging economies and demographic shifts.

• **Emerging in-demand roles:** Among the range of established roles that are set to experience increasing demand in the period up to 2022 are Data Analysts and Scientists, Software and Applications Developers, and Ecommerce and Social Media Specialists, roles that are significantly based on and enhanced by the use of technology. Also expected to grow are roles that leverage distinctively ‘human’ skills, such as Customer Service Workers, Sales and Marketing Professionals, Training and Development, People and Culture, and Organizational Development Specialists as well as Innovation Managers. Moreover, our analysis finds extensive evidence of accelerating demand for a variety of wholly new specialist roles related to understanding and leveraging the latest emerging technologies: AI and Machine Learning Specialists, Big Data Specialists, Process Automation Experts, Information Security Analysts, User Experience and Human-Machine Interaction Designers, Robotics Engineers, and Blockchain Specialists.

• **Growing skills instability:** Given the wave of new technologies and trends disrupting business models and the changing division of labour between workers and machines transforming current job profiles, the vast majority of employers surveyed for this report expect that, by 2022, the skills required to perform most jobs will have shifted significantly. Global average **skills stability**—the proportion of core skills required to
perform a job that will remain the same—is expected to be about 58%, meaning an average shift of 42% in required workforce skills over the 2018–2022 period.

- **A reskilling imperative**: By 2022, no less than 54% of all employees will require significant re- and upskilling. Of these, about 35% are expected to require additional training of up to six months, 9% will require reskilling lasting six to 12 months, while 10% will require additional skills training of more than a year. Skills continuing to grow in prominence by 2022 include analytical thinking and innovation as well as active learning and learning strategies. Sharply increasing importance of skills such as technology design and programming highlights the growing demand for various forms of technology competency identified by employers surveyed for this report. Proficiency in new technologies is only one part of the 2022 skills equation, however, as ‘human’ skills such as creativity, originality and initiative, critical thinking, persuasion and negotiation will likewise retain or increase their value, as will attention to detail, resilience, flexibility and complex problem-solving. Emotional intelligence, leadership and social influence as well as service orientation also see an outsized increase in demand relative to their current prominence.

- **Current strategies for addressing skills gaps**: Companies highlight three future strategies to manage the skills gaps widened by the adoption of new technologies. They expect to hire wholly new permanent staff already possessing skills relevant to new technologies; seek to automate the work tasks concerned completely; and retrain existing employees. The likelihood of hiring new permanent staff with relevant skills is nearly twice the likelihood of strategic redundancies of staff lagging behind in new skills adoption. However, nearly a quarter of companies are undecided or unlikely to pursue the retraining of existing employees, and two-thirds expect workers to adapt and pick up skills in the course of their changing jobs. Between one-half and two-thirds are likely to turn to external contractors, temporary staff and freelancers to address their skills gaps.

- **Insufficient reskilling and upskilling**: Employers indicate that they are set to prioritize and focus their re- and upskilling efforts on employees currently performing high-value roles as a way of strengthening their enterprise’s strategic capacity, with 54% and 53% of companies, respectively, stating they intend to target employees in key roles and in frontline roles which will be using relevant new technologies. In addition, 41% of employers are set to focus their reskilling provision on high-performing employees while a much smaller proportion of 33% stated that they would prioritize at-risk employees in roles expected to be most affected by technological disruption. In other words, those most in need of reskilling and upskilling are least likely to receive such training.

There are complex feedback loops between new technology, jobs and skills. New technologies can drive business growth, job creation and demand for specialist skills but they can also displace entire roles when certain tasks become obsolete or automated. Skills gaps—both among workers and among the leadership of organizations—can speed up the trends towards automation in some cases but can also pose barriers to the adoption of new technologies and therefore impede business growth.

The findings of this report suggest the need for a comprehensive ‘augmentation strategy’, an approach where businesses look to utilize the automation of some job tasks to complement and enhance their human workforces’ comparative strengths and ultimately to enable and empower employees to extend to their full potential. Rather than narrowly focusing on automation-based labour cost savings, an augmentation strategy takes into account the broader horizon of value-creating activities that can be accomplished by human workers, often in complement to technology, when they are freed of the need to perform routinized, repetitive tasks and better able to use their distinctively human talents.

However, to unlock this positive vision, workers will need to have the appropriate skills enabling them to thrive in the workplace of the future and the ability to continue to retrain throughout their lives. Crafting a sound in-company lifelong learning system, investing in human capital and collaborating with other stakeholders on workforce strategy should thus be key business imperatives, critical to companies’ medium to long-term growth, as well as an important contribution to society and social stability. A mindset of agile learning will also be needed on the part of workers as they shift from the routines and limits of today’s jobs to new, previously unimagined futures. Finally, policy-makers, regulators and educators will need to play a fundamental role in helping those who are displaced repurpose their skills or retrain to acquire new skills and to invest heavily in the development of new agile learners in future workforces by tackling improvements to education and training systems, as well as updating labour policy to match the realities of the Fourth Industrial Revolution.
Part 1
Preparing the Future Workforce
Introduction

A significant volume of research on the theme of the future of work has emerged since the World Economic Forum published its initial report on the subject—The Future of Jobs: Employment, Skills and Workforce Strategy for the Fourth Industrial Revolution1—at the Forum’s Annual Meeting in January 2016. What the future of work might hold is a concern that resonates broadly and that has fuelled extensive discussion among policy-makers, business leaders and individual workers.2 Over the past few years, academics, think tanks, strategy consultants and policy-makers have debated what the future of work might look like, how it can be productively shaped for the benefit of economies and societies, and the implications of changes to work for individuals, for their livelihoods, and for the youngest generations studying to enter the future workforce.3

Common to these recent debates is an awareness that, as technological breakthroughs rapidly shift the frontier between the work tasks performed by humans and those performed by machines and algorithms, global labour markets are likely to undergo major transformations. These transformations, if managed wisely, could lead to a new age of good work, good jobs and improved quality of life for all, but if managed poorly, pose the risk of widening skills gaps, greater inequality and broader polarization. In many ways, the time to shape the future of work is now.

To support responses to the critical questions confronting businesses, governments and workers over the coming years, and to reassess its 2016 findings, the World Economic Forum has conducted a second iteration of the Future of Jobs Survey. While much valuable analysis has been authored over the past two years by a broad range of analysts and researchers, the debate has often focused on the far-term horizon, looking to the future of work in 2030, 2040 or 2050. Those approaches can be complemented by an operational time horizon—with the potential to hold up a mirror to current practises, to provide an opportunity for leaders to re-asses their current direction and its likely outcomes, and to consider potential adjustments. As forecasts of the extent of structural change across global labour markets depend on taking into consideration the time horizon, this report—and future editions—aim to provide a (rolling) five-year outlook. This edition covers the 2018–2022 period.

A particular focus of this new edition of the report is to arrive at a better understanding of the potential of new technologies to create as well as disrupt jobs and to improve the quality and productivity of the existing work of human employees. Our findings indicate that, by 2022, augmentation of existing jobs through technology may free up workers from the majority of data processing and information search tasks—and may also increasingly support them in high-value tasks such as reasoning and decision-making as augmentation becomes increasingly common over the coming years as a way to supplement and complement human labour. The changes heralded by the use of new technologies hold the potential to expand labour productivity across industries, and to shift the axis of competition between companies from a focus on automation-based labour cost reduction to an ability to leverage technologies as tools to complement and enhance human labour.

The data in this report represents the current understanding of human resources leaders—primarily of large employers with operations in multiple geographic locations—of the factors informing their planning, hiring, training and investment decisions at present and through to the report’s 2022 time horizon. The findings described
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Surveys and research design

The Future of Jobs Report 2018, and the corresponding survey and research framework, represent an evolution of the approach taken in the report’s 2016 edition. The original research framework was developed in collaboration with leading experts from the World Economic Forum’s Global Future Councils, including representatives from academia, international organizations, professional service firms and the heads of human resources of major organizations. The 2018 edition reflects lessons learned from the design and execution of the original survey. The employer survey at the heart of this report was conducted in the first half of 2018 through the World Economic Forum’s global membership community—covering a comprehensive range of industries and geographies (for details, see Appendix B: Industry and Regional Classifications)—and in close collaboration with a number of leading research institutes and industry associations worldwide.

Since the publication of the 2016 edition of the report, business leaders’ view of the human resources function has begun to shift decisively—continuing a broader rethinking that has been going on for some time. Talent management and workforce analytics are increasingly integral elements of companies’ future-readiness plans. Yet relatively few organizations have so far formulated comprehensive workforce strategies for the Fourth Industrial Revolution. Therefore, this report also aims to serve as a call to action. Rapid adaptation to the new labour market is possible, provided there is concerted effort by all stakeholders. By evaluating the issues at hand from the perspective of some of the world’s largest employers, we hope to improve current knowledge around anticipated skills requirements, recruitment patterns and training needs. Furthermore, it is our hope that this knowledge can incentivize and enhance partnerships between governments, educators, training providers, workers and employers in order to better manage the transformative workforce impact of the Fourth Industrial Revolution.
The resulting data set represents the operational understanding of strategic human resources professionals, specifically those of large employers operating in multiple locations (Figures 1a and 1b). While only a minority of the world’s global workforce of more than three billion people is directly employed by large multinational employers, these companies often act as anchors for local firm ecosystems. Therefore, in addition to their own significant share of employment, workforce-planning decisions by these firms have the potential to transform local labour markets through indirect employment effects and spillovers, and by setting the pace for adoption of new technologies and changing skills and occupational requirements.

In total, the report’s data set contains 313 unique responses by global companies from a wide range of industry sectors, collectively representing more than 15 million employees (Table 1). In addition, the report’s regional analysis is based on a diversified sample with a focus on balanced representation of company-level responses for 20 developed and emerging economies—Argentina, Australia, Brazil, China, France, Germany, India, Indonesia, Japan, Mexico, Philippines, Russian Federation, Singapore, South Africa, Korea, Rep., Switzerland, Thailand, United Kingdom, United States and Vietnam—collectively representing about 70% of global GDP. Two sections in the latter part of the report are dedicated to industry- and country-level analysis: The Future of Jobs across Industries and The Future of Jobs across Regions. Appendix B: Industry and Regional Classifications provides an overview of categorizations used.

Structure of the report
This report consists of two parts. Part 1 explores the future of jobs, work tasks, skills and workforce strategies over the 2018 to 2022 period, as reflected in the operational understanding of CHROs and others at the frontlines of workforce transformation in some of the world’s largest employers. It touches first on expected trends, technological disruptions and strategic drivers of change transforming business models. It then explores a range of priority issues with regard to the development of comprehensive workforce strategies for the Fourth Industrial Revolution, including employee reskilling and workforce augmentation. Next, it examines specific implications for a range of different industries and geographies. Part 1 concludes with a set of recommendations for upgrading and reviewing existing talent and workforce strategies. Part 2 of the report presents detailed industry-by-industry and country-by-country trends and provides a range of industry-specific and country-specific practical information to decision-makers and experts through dedicated Industry Profiles and Country Profiles. In addition, the reader may refer to the report’s methodological appendix for further information on our survey design, sample selection criteria and research methodology.

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Strategic Drivers of New Business Models

As the Fourth Industrial Revolution unfolds, companies are seeking to harness new and emerging technologies to reach higher levels of efficiency of production and consumption, expand into new markets, and compete on new products for a global consumer base composed increasingly of digital natives. More and more, employers are therefore also seeking workers with new skills from further afield to retain a competitive edge for their enterprises and expand their workforce productivity. Some workers are experiencing rapidly expanding opportunities in a variety of new and emerging job roles, while others are experiencing a rapidly declining outlook in a range of job roles traditionally considered ‘safe bets’ and gateways to a lifetime career.

Even as technological advancements pose challenges to existing business models and practices, over the coming years, these same dynamics of technological change are set to become the primary drivers of opportunities for new growth. For example, based on one recent estimate, even a somewhat moderately paced rollout of new automation technologies over the next 10 to 20 years would lead to an investment surge of up to US$8 trillion in the United States alone.⁵

According to the global employers surveyed for this report, four specific technological advances—ubiquitous high-speed mobile internet; artificial intelligence; widespread adoption of big data analytics; and cloud technology—are set to dominate the 2018–2022 period as drivers positively affecting business growth (Table 2). They are flanked by a range of socio-economic trends driving business opportunities in tandem with the spread of new technologies, such as national economic growth trajectories; expansion of education and the middle classes, in particular in developing economies; and the move towards a greener global economy through advances in new energy technologies. By contrast, technological and social trends expected to negatively impact business growth include increasing protectionism; cyber threats; shifts in government policies; the effects of climate change; and increasingly ageing societies.

By 2022, according to the stated investment intentions of companies surveyed for this report, 85% of respondents are likely or very likely to have expanded their adoption of user and entity big data analytics (Figure 2). Similarly, large proportions of companies are likely or very likely to have expanded their adoption of technologies such as the internet of things and app- and web-enabled markets, and to make extensive use of cloud computing. Machine learning and augmented and virtual reality are poised to likewise receive considerable business investment. While estimated use cases for humanoid robots, a fixture of the current media discourse on the future of jobs, appear to remain somewhat more limited over the 2018–2022 period under consideration in this report,⁶ collectively, a broader range of recent robotics technologies at or near commercialization—including stationary robots, non-humanoid land robots and fully automated aerial drones, in addition to machine learning algorithms and artificial intelligence—are attracting significant business interest in adoption.⁶

There are complex feedback loops between new technology, jobs and skills. New technologies can drive business growth, job creation and demand for specialist skills but they can also displace entire roles when certain tasks become obsolete or automated. Skills gaps—both among workers and among the leadership of organizations—can speed up the trends towards automation in some cases but can also pose barriers to the adoption of new technologies and therefore impede business growth.

Opportunities for new and emerging technologies to drive inclusive economic and business growth over the 2018–2022 period are manifold, yet concrete and viable mechanisms for preparing the global labour market—thereby enabling employers to better leverage these opportunities across industries and regions—remain

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### Table 2: Trends set to impact business growth positively/negatively up to 2022, top ten

<table>
<thead>
<tr>
<th>Trends set to positively impact business growth up to 2022</th>
<th>Trends set to negatively impact business growth up to 2022</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increasing adoption of new technology</td>
<td>Increasing protectionism</td>
</tr>
<tr>
<td>Increasing availability of big data</td>
<td>Increase of cyber threats</td>
</tr>
<tr>
<td>Advances in mobile internet</td>
<td>Shifts in government policy</td>
</tr>
<tr>
<td>Advances in artificial intelligence</td>
<td>Effects of climate change</td>
</tr>
<tr>
<td>Advances in cloud technology</td>
<td>Increasingly ageing societies</td>
</tr>
<tr>
<td>Shifts in national economic growth</td>
<td>Shifts in legislation on talent migration</td>
</tr>
<tr>
<td>Expansion of affluence in developing economies</td>
<td>Shifts in national economic growth</td>
</tr>
<tr>
<td>Expansion of education</td>
<td>Shifts of mindset among the new generation</td>
</tr>
<tr>
<td>Advances in new energy supplies and technologies</td>
<td>Shifts in global macroeconomic growth</td>
</tr>
<tr>
<td>Expansion of the middle classes</td>
<td>Advances in artificial intelligence</td>
</tr>
</tbody>
</table>

elusive. A mindset of agile learning on the part of both company leaders and workers will be needed, starting with an ability to reimagine the routines and limits of today’s jobs as part of a comprehensive workforce strategy for the Fourth Industrial Revolution.

**Workforce Trends and Strategies for the Fourth Industrial Revolution**

In order to harness the transformative potential of the Fourth Industrial Revolution, business leaders across all industries and regions will increasingly be called upon to formulate a comprehensive workforce strategy ready to meet the challenges of this new era of accelerating change and innovation. Policy-makers, educators, labour unions and individual workers likewise have much to gain from deeper understanding of the new labour market and proactive preparation for the changes underway. Key factors to consider include mapping the scale of occupational change underway and documenting emerging and declining job types; highlighting opportunities to use new technologies to augment human work and upgrade job quality; tracking the evolution of job-relevant skills; and, finally, documenting the business case for investment in retraining, upskilling and workforce transformation. The following three sub-sections of the report aim to provide informative data and evidence to support such an endeavour.

**The 2022 jobs landscape**

As discussed in the report’s Introduction, recent projections of the extent of structural change in the global labour market depend significantly on the time horizon taken into consideration. In addition to the rate of technological advancement itself, a range of other considerations—such as ease of commercialization, public adoption of new technologies and existing labour laws—influence the rate at which these developments accelerate workforce transformation.

In the estimates of employers surveyed for this report, global labour markets are set to undergo significant transformation over the coming five years. A cluster of emerging roles will gain significantly in importance over the coming years, while another cluster of job profiles are set to become increasingly redundant (Figure 3). Across all industries, by 2022, the cluster
of emerging professions is set to increase its share of employment from 16% to 27% of the total employee base of our company respondents, whereas the employment share of declining roles is set to decrease from currently 31% to 21% (Figure 3). In purely quantitative terms, therefore, the expectation emerging from the estimates of employers surveyed for this report is that, by 2022, structural decline of certain types of jobs (10% decline) will be fully counter-balanced by job creation and the emergence of new professions (11% growth). About half of today’s core jobs—making up the bulk of employment across industries—will remain somewhat stable in the period up to 2022.

Applied to our sample, representing over 15 million workers in total, the above numbers would suggest a decline of 0.98 million jobs and a gain of 1.74 million jobs. Extrapolating from these trends for the global (non-agricultural) workforce employed by large firms, we generate a range of estimates for job churn in the period up to 2022. One of these indicates that 75 million jobs may be displaced by the above trends, while 133 million additional new roles may emerge concurrently.9

It should be noted, however, that these projections primarily represent the share of roles within the remit of large multinational employers. A complementary perspective might emerge from analysis that focuses on small- and medium-sized enterprises, or more fully takes into account employment sectors such as health, care and education. In particular such segments of economic activity hold the promise for further job creation opportunities.

As they stand today responses to the Future of Jobs Survey indicate the potential for a positive outlook for the future of jobs. Yet that outlook is underscored by the need to manage a series of workforce shifts, set to accompany the adoption of new technologies. By 2022, 59% of employers surveyed for this report expect that they will have significantly modified the composition of their value chain, and nearly half expect to have modified their geographical base of operations. In addition, 50% of companies expect that automation will lead to some reduction in their full-time workforce, based on the job profiles of their employee base today.

Also by 2022, 38% of businesses surveyed expect to extend their workforce to new productivity-enhancing roles, and more than a quarter expect automation to lead to the creation of new roles in their enterprise. In addition, businesses are set to expand their use of contractors doing task-specialized work, with many respondents highlighting their intention to engage workers in a more flexible manner, utilizing remote staffing beyond physical offices and decentralization of operations. Respondents expect increased job creation in such project-based, temporary and freelancing roles, pointing to structural labour market transformations in terms of contractual arrangements and employment relations as well as occupational profiles. In summary, while overall job losses are predicted to be offset by job gains, there will be a significant shift in the quality, location, format and permanency of new roles.

Among the range of roles that are set to experience increasing demand in the period up to 2022 are established roles such as Data Analysts and Scientists, Software and Applications Developers, and Ecommerce and Social Media Specialists that are significantly based on and enhanced by the use of technology. Also expected to grow are roles that leverage distinctively ‘human’ skills such as Customer Service Workers, Sales and Marketing Professionals, Training and Development, People and Culture, and Organizational Development Specialists as well as Innovation Managers. Moreover, our analysis finds extensive evidence of accelerating demand for a variety of wholly new specialist roles related to understanding and leveraging the latest emerging technologies: AI and Machine Learning Specialists, Big Data Specialists, Process Automation Experts, Information Security Analysts, User Experience and Human-Machine Interaction
Designers, Robotics Engineers and Blockchain Specialists (Table 3).

Across the industries surveyed, jobs expected to become increasingly redundant over the 2018–2022 period are routine-based, middle-skilled white-collar roles—such as Data Entry Clerks, Accounting and Payroll Clerks, Secretaries, Auditors, Bank Tellers and Cashiers (Table 3)—that are susceptible to advances in new technologies and process automation. These shifts reflect unfolding and accelerating trends that have evolved over a number of recent years—continuing developments that have impacted roles in retail banking (ATMs), consumer sales (self-checkout kiosks) and other sectors. Given that the skills requirements of emerging roles frequently look very different from those of roles experiencing redundancy, proactive, strategic and targeted efforts will be needed to map and incentivize workforce redeployment.

Industries are set to take diverse routes in the adoption of new technologies, and the distinctive nature of the work performed within each sector will result in disruption to jobs and skills that will demand industry-specific adaptation. For example, given comparatively high levels of education in the financial services industry, displaced roles may be somewhat more easily offset by redeploying workers in alternative, higher value-added functions. In contrast, the two largest job roles in the consumer industry, Cashiers and Sales Associates—accounting for no less than 45% of total industry employment—have a comparatively small share of workers with advanced education. Cross-industry analysis of the roles experiencing falling and rising demand suggests the possibility of leveraging those industry-specific differences for the benefit of displaced workers, by expanding the search for new opportunities across the industry landscape.

While the labour market shifts described in this section are not foregone conclusions, they are reasonable forecasts emerging from the actions and investment decisions taken by companies in response to global trends today. As new technology adoption builds momentum, companies feel competitive pressures similar to the way they felt compelled to create global supply chains in the 1990s and 2000s. These trends affecting business leaders’ decision environments are prompting a wide range of company responses that collectively shape the future nature of jobs (Figure 4).

While individual companies may not have the option to disconnect their corporate strategy from the fundamental trajectory of these wider trends, such as the unfolding Fourth Industrial Revolution, they do, however, have the possibility of formulating a proactive response. Two investment decisions, in particular, will be crucial to shaping the future of jobs: the question of whether to prioritize automation or augmentation and the question of whether or not to invest in workforce reskilling.

### Table 3: Examples of stable, new and redundant roles, all industries

<table>
<thead>
<tr>
<th>Stable Roles</th>
<th>New Roles</th>
<th>Redundant Roles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Managing Directors and Chief Executives*</td>
<td>Data Analysts and Scientists*</td>
<td>Data Entry Clerks</td>
</tr>
<tr>
<td>General and Operations Managers*</td>
<td>AI and Machine Learning Specialists</td>
<td>Accounting, Bookkeeping and Payroll Clerks</td>
</tr>
<tr>
<td>Software and Applications Developers and Analysts*</td>
<td>General and Operations Managers*</td>
<td>Administrative and Executive Secretaries</td>
</tr>
<tr>
<td>Data Analysts and Scientists*</td>
<td>Big Data Specialists</td>
<td>Assembly and Factory Workers</td>
</tr>
<tr>
<td>Sales and Marketing Professionals*</td>
<td>Digital Transformation Specialists</td>
<td>Client Information and Customer Service Workers*</td>
</tr>
<tr>
<td>Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products</td>
<td>Sales and Marketing Professionals*</td>
<td>Business Services and Administration Managers</td>
</tr>
<tr>
<td>Human Resources Specialists</td>
<td>New Technology Specialists</td>
<td>Accountants and Auditors</td>
</tr>
<tr>
<td>Financial and Investment Advisers</td>
<td>Organizational Development Specialists*</td>
<td>Material-Recording and Stock-Keeping Clerks</td>
</tr>
<tr>
<td>Database and Network Professionals</td>
<td>Software and Applications Developers and Analysts*</td>
<td>General and Operations Managers*</td>
</tr>
<tr>
<td>Supply Chain and Logistics Specialists</td>
<td>Information Technology Services</td>
<td>Postal Service Clerks</td>
</tr>
<tr>
<td>Risk Management Specialists</td>
<td>Process Automation Specialists</td>
<td>Financial Analysts</td>
</tr>
<tr>
<td>Information Security Analysts*</td>
<td>Innovation Professionals</td>
<td>Cashiers and Ticket Clerks</td>
</tr>
<tr>
<td>Management and Organization Analysts</td>
<td>Information Security Analysts*</td>
<td>Mechanics and Machinery Repairers</td>
</tr>
<tr>
<td>Electrotechnology Engineers</td>
<td>Ecommerce and Social Media Specialists</td>
<td>Telemarketers</td>
</tr>
<tr>
<td>Organizational Development Specialists*</td>
<td>User Experience and Human-Machine Interaction Designers</td>
<td>Electronics and Telecommunications Installers and Repairers</td>
</tr>
<tr>
<td>Chemical Processing Plant Operators</td>
<td>Training and Development Specialists</td>
<td>Bank Tellers and Related Clerks</td>
</tr>
<tr>
<td>University and Higher Education Teachers</td>
<td>Robotics Specialists and Engineers</td>
<td>Car, Van and Motorcycle Drivers</td>
</tr>
<tr>
<td>Compliance Officers</td>
<td>People and Culture Specialists</td>
<td>Sales and Purchasing Agents and Brokers</td>
</tr>
<tr>
<td>Energy and Petroleum Engineers</td>
<td>Client Information and Customer Service Workers*</td>
<td>Door-To-Door Sales Workers, News and Street Vendors, and Related Workers</td>
</tr>
<tr>
<td>Robotics Specialists and Engineers</td>
<td>Service and Solutions Designers</td>
<td>Statistical, Finance and Insurance Clerks</td>
</tr>
<tr>
<td>Petroleum and Natural Gas Refining Plant Operators</td>
<td>Digital Marketing and Strategy Specialists</td>
<td>Lawyers</td>
</tr>
</tbody>
</table>

*Note: Roles marked with * appear across multiple columns. This reflects the fact that they might be seeing stable or declining demand across one industry but be in demand in another.

These two crucial dimensions are examined further in the following two sub-sections.

**From automation to augmentation**

Some forecasts project that advances in automation will result in the wholesale replacement of the human workforce. Encompassing the near- or medium-term timeframes, our analysis suggests another perspective: that work currently performed by humans is being augmented by machine and algorithmic labour. Responses from employers surveyed for this report can be interpreted as evidence for the increasing viability of what a number of experts have called an ‘augmentation strategy’. Namely, it has been suggested that businesses can look to utilize the automation of some job tasks to complement and enhance the human workforces’ comparative strengths and ultimately to enable and empower employees to extend to their full potential and competitive advantage.

Rather than narrowly focusing on automation-based labour cost savings, an augmentation strategy takes into account the broader horizon of value creating activities that can be accomplished by human workers, often in complement to technology, when they are freed of the need to perform routinized, repetitive tasks and better able to use their distinctively human talents.

Importantly, most automation occurs at the level of specific work tasks, not at the level of whole jobs. For example, according to one recent study, whereas nearly two-thirds of today’s job roles entail at least 30% of tasks that could be automated based on currently available technology, only about one-quarter of today’s job roles can be said to have more than 70% of tasks that are automatable. A similar recent analysis finds that workforce automation is likely to play out in three waves between today and the mid-2030s, increasing the share of fully automatable manual tasks in the most affected current job roles from less than 5% today to nearly 40% by the mid-2030s, and the share of automatable tasks involving social skills from less than 5% today to about 15% in the same time horizon. The most relevant question to businesses, governments and individuals is not to what extent automation will affect current employment numbers, but how and under what conditions the global labour market can be supported in reaching a new equilibrium in the division of labour between human workers, robots and algorithms. Workforce planning and investment decisions taken today will play a crucial role in shaping this process.

Waves of automation have reshaped the global economy throughout history. Since the first and second industrial revolutions, organizations have bundled specific work tasks into discrete job roles, giving rise to distinct occupational profiles and optimizing the process of economic value creation based on the most efficient division of labour between humans and machines technologically available at the time. As technological change and progress have increased workforce productivity by ‘re-bundling’ work tasks into new kinds of jobs, so they have seen the decline of obsolete job profiles and the dynamic rise of wholly new ones, historically leaving the balance of net job and economic value creation firmly on the positive side.

While the Fourth Industrial Revolution’s wave of technological advancement will reduce the number of workers required to perform certain work tasks, responses by the employers surveyed for this report indicate that it will create increased demand for the performance of others, leading to new job creation. Moreover, while the

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**Figure 4: Projected (2022) effects on the workforce of current growth strategy, by proportion of companies**

<table>
<thead>
<tr>
<th>Effect</th>
<th>Proportion of Companies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modified composition of value chain</td>
<td>59%</td>
</tr>
<tr>
<td>Reduced current workforce due to automation</td>
<td>50%</td>
</tr>
<tr>
<td>Modified the locations of operation</td>
<td>48%</td>
</tr>
<tr>
<td>Expanded use of contractors doing task-specialized work</td>
<td>48%</td>
</tr>
<tr>
<td>Expanded current workforce</td>
<td>38%</td>
</tr>
<tr>
<td>Brought new financing on-board to manage transition</td>
<td>36%</td>
</tr>
<tr>
<td>Expanded current workforce due to automation</td>
<td>28%</td>
</tr>
</tbody>
</table>

current popular discourse is often fixated on technology that substitutes for humans, technology will also create new tasks—from app development to piloting drones to remotely monitoring patient health—opening up opportunities for work never previously done by human workers, highlighting that different types of new technology may bring about very different outcomes for workers.

The rise of workplace automation in its many forms has the potential to vastly improve productivity and augment the work of human employees. Automation technology can help remove the burden of repetitive administrative work and enable employees to focus on solving more complex issues while reducing the risk of error, allowing them to focus on value-added tasks. Examples of now well-established and almost unremarkable automation-based augmentation technology that hardly existed 25 years ago range from computer-aided design and modelling software used by architects, engineers and designers, to robotic medical tools used by doctors and surgeons, through to search engine technology that allows researchers to find more relevant information. In theory, these technologies take away tasks from workers, but in practice their overall effect is to vastly amplify and augment their abilities.

The estimates of companies surveyed for this report provide a nuanced view of how human-machine collaboration might evolve in the time horizon up to 2022 (Figure 5). In today’s enterprise, machines and algorithms most often complement human skills in information and data processing. They also support the performance of complex and technical tasks, as well as supplementing more physical and manual work activities. However, some work tasks have thus far remained overwhelmingly human: Communicating and interacting; Coordinating, developing, managing and advising; as well as Reasoning and decision-making. Notably, in terms of total working hours, in the aggregate no work task was yet estimated to be predominantly performed by a machine or an algorithm.

By 2022, this picture is projected to change somewhat. Employers surveyed for this report expect a deepening across the board of these existing trends, with machines and algorithms on average increasing their contribution to specific tasks by 57%. Relative to their starting point today, the expansion of machines’ share of work task performance is particularly marked in Reasoning and decision-making; Administering; and Looking for and receiving job-related information. The majority of an organization’s information and data processing and information search and transmission tasks will be performed by automation technology (Figure 5).

Based on one recent estimate, the next wave of labour-augmenting automation technology could lead to an average labour productivity increase across sectors of about 30% compared to 2015, with some significant variation by industry. For employers, optimally integrating humans and automation technology will require an analytical ability to deconstruct the work performed in their organizations today into discrete elements—that is, seeing the work tasks of today’s job roles as independent and fungible components—and then reconfiguring these components to reveal human-machine collaboration.

**Figure 5: Ratio of human-machine working hours, 2018 vs. 2022 (projected)**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Reasoning and decision-making</td>
<td>19%</td>
<td>28%</td>
<td>19%</td>
<td>28%</td>
</tr>
<tr>
<td>Coordinating, developing, managing and advising</td>
<td>19%</td>
<td>29%</td>
<td>23%</td>
<td>31%</td>
</tr>
<tr>
<td>Communicating and interacting</td>
<td>23%</td>
<td>31%</td>
<td>28%</td>
<td>44%</td>
</tr>
<tr>
<td>Administering</td>
<td>28%</td>
<td>44%</td>
<td>31%</td>
<td>44%</td>
</tr>
<tr>
<td>Performing physical and manual work activities</td>
<td>31%</td>
<td>44%</td>
<td>34%</td>
<td>46%</td>
</tr>
<tr>
<td>Identifying and evaluating job-relevant information</td>
<td>29%</td>
<td>46%</td>
<td>36%</td>
<td>55%</td>
</tr>
<tr>
<td>Performing complex and technical activities</td>
<td>34%</td>
<td>46%</td>
<td>36%</td>
<td>55%</td>
</tr>
<tr>
<td>Looking for and receiving job-related information</td>
<td>36%</td>
<td>55%</td>
<td>47%</td>
<td>62%</td>
</tr>
<tr>
<td>Information and data processing</td>
<td>47%</td>
<td>62%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Source:** Future of Jobs Survey 2018, World Economic Forum.
opportunities that are more efficient, effective and impactful. Among other things, success in this domain will require a strategic repositioning of the corporate human resource function and expanded organizational capabilities in data analysis and workforce analytics.

For workers, improved productivity may allow them to re-focus their work on high-value activities that play to the distinctive strengths of being human. However, to unlock this positive vision, workers will need to have the appropriate skills that will enable them to thrive in the workplace of the future. And as discussed in detail in the next section, even for those who currently have these skills, the pace at which tasks are being augmented and skills are changing continues to accelerate.

The reskilling imperative
Current shifts underway in the workforce will displace some workers while at the same time create new opportunities for others. However, maximizing the gains and minimizing the losses requires attention not just from policy-makers, but also coherent responses from companies to find win-win solutions for workers and for their bottom line. Leading research documents the potentially divergent impact of the introduction of automation technology, demonstrating how both job design (how tasks are organized into jobs) and employee’s possession (or lack thereof) of skills complementing newly introduced technologies contribute to eventual outcomes for companies and workers. Workers with in-demand skills ready for augmentation may see their wages and job quality increase considerably. Conversely, even if automation only affects a subset of the tasks within their job role, workers lacking appropriate skills to adapt to new technologies and move on to higher value tasks may see their wages and job quality suppressed by technology steadily eroding the value of their job, as it encroaches on the tasks required to perform it. Therefore, central to the success of any workforce augmentation strategy is the buy-in of a motivated and agile workforce, equipped with futureproof skills to take advantage of new opportunities through continuous retraining and upskilling. Given the wave of new technologies and trends disrupting business models and the changing division of labour between workers and machines transforming current job profiles, the vast majority of employers surveyed for this report expect that, by 2022, the skills required to perform most jobs will have shifted significantly. While these skill shifts are likely to play out differently across different industries and regions, globally, our respondents expect average skills stability—the proportion of core skills required to perform a job that will remain the same—to be about 58%, meaning an average shift of 42% in required workforce skills over the 2018–2022 period.

Key skills demand trends identified by our analysis include, on the one hand, a continued fall in demand for manual skills and physical abilities and, on the other hand, a decrease in demand for skills related to the management of financial and other resources as well as basic technology installation and maintenance skills (Table 4). Skills continuing to grow in prominence by 2022 include Analytical thinking and innovation as well as Active learning and learning strategies. The sharply increased importance of skills such as Technology design and programming highlights the growing demand for various forms of technology competency identified by employers surveyed for this report. Proficiency in new technologies is only one part of the 2022 skills equation, however, as ‘human’ skills such as creativity, originality and initiative, critical thinking, persuasion, and negotiation will likewise retain or increase their value, as will attention to detail, resilience, flexibility and complex problem-solving. Emotional intelligence, leadership and social influence as well as service orientation also see an outsized increase in demand relative to their current prominence.

Companies will need to pursue a range of organizational strategies in order to stay competitive in the face of rapidly changing workforce skills requirements. To do this, the skills of executive leadership and the human resources function will also need to evolve to successfully lead the transformation. With regard to likely approaches towards workers facing shifting skills demand, companies surveyed for this report specifically highlight three future strategies: hiring wholly new permanent staff already

### Table 4: Comparing skills demand, 2018 vs. 2022, top ten

<table>
<thead>
<tr>
<th>Today, 2018</th>
<th>Trending, 2022</th>
<th>Declining, 2022</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analytical thinking and innovation</td>
<td>Analytical thinking and innovation</td>
<td>Manual dexterity, endurance and precision</td>
</tr>
<tr>
<td>Complex problem-solving</td>
<td>Active learning and learning strategies</td>
<td>Memory, verbal, auditory and spatial abilities</td>
</tr>
<tr>
<td>Critical thinking and analysis</td>
<td>Creativity, originality and initiative</td>
<td>Management of financial, material resources</td>
</tr>
<tr>
<td>Active learning and learning strategies</td>
<td>Technology design and programming</td>
<td>Technology installation and maintenance</td>
</tr>
<tr>
<td>Creativity, originality and initiative</td>
<td>Critical thinking and analysis</td>
<td>Reading, writing, math and active listening</td>
</tr>
<tr>
<td>Attention to detail, trustworthiness</td>
<td>Complex problem-solving</td>
<td>Management of personnel</td>
</tr>
<tr>
<td>Emotional intelligence</td>
<td>Leadership and social influence</td>
<td>Quality control and safety awareness</td>
</tr>
<tr>
<td>Reasoning, problem-solving and ideation</td>
<td>Emotional intelligence</td>
<td>Coordination and time management</td>
</tr>
<tr>
<td>Leadership and social influence</td>
<td>Reasoning, problem-solving and ideation</td>
<td>Visual, auditory and speech abilities</td>
</tr>
<tr>
<td>Coordination and time management</td>
<td>Systems analysis and evaluation</td>
<td>Technology use, monitoring and control</td>
</tr>
</tbody>
</table>

possessing skills relevant to new technologies; seeking to completely automate the work tasks concerned; and retraining existing employees (Figure 6). The likelihood of hiring new permanent staff with relevant skills is nearly twice the likelihood of strategic redundancies of staff lagging behind in new skills adoption. However nearly one-quarter of companies are undecided or unlikely to pursue the retraining of existing employees. Two-thirds expect workers to adapt and pick up skills in the course of their changing jobs. Between one-half and two-thirds are likely to turn to external contractors, temporary staff and freelancers to address their skills gaps.

Employers surveyed for this report estimate that, by 2022, no less than 54% of all employees will require significant reskilling and upskilling (Figure 7). Of these, about 35% are expected to require additional training of up to six months, 9% will require reskilling lasting six to 12 months, while 10% will require additional skills training of more than a year.

Respondents to our survey further indicate that they are set to prioritize and focus their reskilling and upskilling efforts on employees currently performing high value roles as a way of strengthening their enterprise’s strategic capacity, with 54% and 53% of companies, respectively, stating they intend to target employees in key roles and in frontline roles which will be using relevant new technologies. In addition, 41% of employers are set to focus their reskilling provision on high-performing employees while a much smaller proportion of 33% stated that they would prioritize at-risk employees in roles expected to be most affected by technological disruption.

In other words, those most in need of reskilling and upskilling are least likely to receive such training.

Our findings corroborate a range of recent research indicating that, currently, only about 30% of employees in today’s job roles with the highest probability of technological disruption have received any kind of professional training over the past 12 months. In addition, they are on average more than three times less likely than

![Figure 6: Projected (2022) strategies to address shifting skills needs, by proportion of companies (%)](source)

- Hire new permanent staff with skills relevant to new technologies: 84% likely, 12% unlikely.
- Look to automate the work: 81% likely, 14% unlikely.
- Retrain existing employees: 72% likely, 23% unlikely.
- Expect existing employees to pick up skills on the job: 65% likely, 22% unlikely.
- Outsource some business functions to external contractors: 64% likely, 26% unlikely.
- Hire new temporary staff with skills relevant to new technologies: 61% likely, 21% unlikely.
- Hire freelancers with skills relevant to new technologies: 54% likely, 29% unlikely.
- Strategic redundancies of staff who lack the skills to use new technologies: 46% likely, 31% unlikely.


Note: The bars represent the proportion of responses by companies that stated that specific strategies were likely, equally likely or unlikely. Some companies abstained from answering the question. In such cases part of the bar remains blank (typically, 0–1% in the graph above).

![Figure 7: Expected average reskilling needs across companies, by share of employees, 2018–2022](source)

- No reskilling needed: 46%.
- Reskilling needs of less than 1 month: 13%.
- Reskilling needs of 1–3 months: 12%.
- Reskilling needs of 3–6 months: 10%.
- Reskilling needs of 6–12 months: 9%.
- Reskilling needs of over 1 year: 11%.

employees in less exposed roles to have participated in any on-the-job training or distance learning and about twice less likely to have participated in any formal education.\textsuperscript{33}

Other recent research similarly finds that, currently, reskilling and upskilling efforts are largely focused on already highly-skilled and highly-valued employees.\textsuperscript{34}

These findings are a cause for concern, given that making an inclusive culture of lifelong learning a reality is increasingly imperative for organizations and for workers whose growth strategies and job roles are being affected by technological change. In particular, they highlight that the bottom-line impact and business case for reskilling and upskilling investments remain somewhat unclear and require much greater attention. Time requirements, costs, success cases and appropriate delivery models for reskilling and upskilling are likely to look very different for different categories of job roles and workers.

To provide a preliminary picture, companies surveyed for this report highlight that, overwhelmingly, their key success metric for reskilling and upskilling initiatives is increased workforce productivity—chosen by 90% of respondent employers—followed by retention of high-skilled workers, enabling workers in frontline roles to make the best use of new technologies and increased employee satisfaction. Significantly smaller proportions of companies regard reskilling as a means of lowering recruitment costs, redeploying employees in disrupted job roles or as a way to increase the skills base of their medium- and lower-skilled workforce. In short, to date reskilling has been regarded by employers as a narrow strategy focused on specific subsets of employees, not as a comprehensive strategy to drive workforce transformation.

Finally, while companies themselves will need to take the lead in creating capacity within their organizations to support their transition towards the workforce of the future, the economic and societal nature of these challenges means that they will also increasingly need to learn to partner with other stakeholders for managing the large-scale retraining and upskilling challenges ahead. Tangible collaboration opportunities include partnering with educators to reshape school and college curricula, intra- and inter-industry collaboration on building talent pipelines, and partnerships with labour unions to enhance cross-industry talent mobility. Governments may likewise become key partners in creating incentives for lifelong learning, ensuring shared standards for retraining and strengthening safeguards for workers in transition.\textsuperscript{35}

However, more guidance and good practice learning opportunities will be needed. Currently, respondents to our survey expect to continue to primarily look to specialized internal departments to meet their retraining needs for the period up to 2022, with some supplementary support from professional services firms, industry associations and academic experts (Figure 8). Less than half of companies actively consider partnering with government programmes and slightly more than a fifth see labour unions as preferred partners.

Companies surveyed for this report anticipate that, over the 2018–2022 period, on average, around half of all retraining will be delivered through internal departments, about one quarter through private training providers and about one-fifth through public education institutions. About 34% of the retraining to be delivered directly by employers is expected to result in an accreditation recognized outside of the company in question. Expanding such systems for certifiable skills recognition could significantly promote the marketplace for corporate reskilling and upskilling in the near future and improve outcomes for workers. These findings highlight both the future role of companies as learning organizations and the range of possible reskilling and upskilling multistakeholder collaboration arrangements.
The Future of Jobs Across Industries

The future of jobs is not singular. It will diverge by industry and sector, influenced by initial starting conditions around the distribution of tasks, different investments in technology adoption, and the skills availability and adaptability of the workforce. As a consequence, different industries experience variation in the composition of emerging roles and in the nature of roles that are set to have declining demand.

Among the trends driving growth across industries over the 2018–2022 period, advances in mobile internet are likely to have a distinct impact in the Aviation, Travel & Tourism industry, the Financial Services & Investors industries, and in the Consumer industry. The rapid adoption of new technologies by consumers as well as advancements in cloud technology are set to drive growth in the Information & Communication Technologies industry, while the availability of big data is expected to have an even broader impact on the Financial Service & Investors and the Energy Utilities & Technologies industries. New energy supplies and technologies, in tandem with advances in computing power, are set to drive gains in the Energy Utilities & Technologies sector. Among non-technological drivers of business growth, increasing affluence in developing economies is poised to drive growth in the Aviation, Travel & Tourism; Global Health & Healthcare; and Chemistry, Advanced Materials & Biotechnology industries.

Table 5 on page 16 demonstrates the range of demand for the adoption of specific technologies. Robotic technology is set to be adopted by 37% to 23% of the companies surveyed for this report, depending on industry. Companies across all sectors are most likely to adopt the use of stationary robots, in contrast to humanoid, aerial, or underwater robots. However, leaders in the Oil & Gas industry report the same level of demand for stationary and aerial and underwater robots, while employers in the Financial Services & Investors industry are most likely to signal the planned adoption of humanoid robots in the period up to 2022. Distributed ledger technologies are set to have a particular impact in the Financial Services industry, which promises to be an early adopter of the technology. In fact, 73% of respondents expect their enterprise to adopt its use. Another industry set to scale its adoption of distributed ledger technologies will be the Global Health & Healthcare industry. Machine learning is expected to be adopted across a range of industries, including banking and insurance, where it may disrupt risk prediction; in the medical field, where it may be used for advanced diagnosis; across the energy sector, where it may lead to predictive maintenance; and in the consumer sector, where it may enhance the industry’s ability to model demand.

While technologies have the capacity to automate and potentially augment a variety of tasks across enterprises, this will vary by industry-specific capital investment, the risks associated with automating sensitive tasks, the unknown knock-on-effects of how machines and algorithms will perform the task, the presence of a longer-term workforce strategy, and the managerial challenges of re-orienting the operations of different enterprises. Additionally, many sectors face disruption and shifts in demand through non-technological factors, such as the effect of ageing in the Global Health & Healthcare industry. Efficiencies in healthcare technologies will thus become necessary innovations to meet the demographic changes afoot, freeing time spent in administration and record keeping for caregiving activities.

The growth potential of new technological expansion is buffered by multi-dimensional skills gaps across local and global labour markets, and among the leadership of enterprises. Skills gaps among the local labour market are among the most cited barriers to appropriate technology adoption for a number of industries, but they are particularly strong concerns for business leaders in the Aviation Travel & Tourism, Information & Communication Technologies, Financial Services & Investors, and Mining & Metals industries. Companies in Global Health & Healthcare as well as Infrastructure industries are most likely to cite leadership skills gaps as significant barriers, while the Chemistry, Advanced Materials & Biotechnology and Information & Communication Technologies sectors report broad global labour market skills shortages.

There is a distinctive footprint of tasks performed across each industry. For example, on average, workers in the Mining & Metals industry spend the majority of their time in physical and manual tasks, while those in the Professional Services industry spend the majority of their time on tasks related to communicating and interacting. In the Oil & Gas, Infrastructure, and Chemistry, Advanced Materials & Biotechnology industries, the tasks that occupy today’s workers for the largest proportion of their time focus on the performance of complex and technical activities. Administrative activities are particularly prominent in the Infrastructure industry as well in the Mining & Metals and Financial Services & Investors industries.

As industries make investments in new technologies, the impact on each industry as a whole is determined by the task composition of each sector and the desirability of automating or augmenting specific tasks. Existing research has highlighted that some industries remain labour-intensive in the production of goods and services, leading to low productivity growth. If managed well, the augmentation of a range of tasks today can create the opportunity for new, higher productivity growth. For example, administering and physical tasks are often low value and low productivity tasks. In the current projections of companies surveyed for this report, administrative tasks in the Financial Services & Investors sector are set to be significantly replaced by machine labour. While today machines and algorithms perform 36% of the collective hours spent on this task, by 2022 this share will rise to 61%, with knock-on effects on the demand for Data Entry Clerks, Secretarial staff and Accounting staff. In the Energy and Consumer sectors, physical and manual
Table 5: Technology adoption by industry and share of companies surveyed, 2018–2022 (%)

<table>
<thead>
<tr>
<th>Technology Type</th>
<th>Automotive, Aerospace, Supply Chain &amp; Transport</th>
<th>Aviation, Travel &amp; Tourism</th>
<th>Consumer</th>
<th>Energy Utilities &amp; Technologies</th>
<th>Financial Services &amp; Investors</th>
<th>Global Health &amp; Healthcare</th>
<th>Information &amp; Communication Technologies</th>
<th>Infrastructure</th>
<th>Mining &amp; Metals</th>
<th>Oil &amp; Gas</th>
<th>Professional Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>User and entity big data analytics</td>
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<td>84</td>
<td>89</td>
<td>79</td>
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<td>85</td>
<td>86</td>
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<td>62</td>
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<tr>
<td>App- and web-enabled markets</td>
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<td>76</td>
<td>95</td>
<td>71</td>
<td>88</td>
<td>65</td>
<td>89</td>
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<td>58</td>
<td>73</td>
<td>85</td>
<td>65</td>
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<td>86</td>
<td>76</td>
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<td>Machine learning</td>
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<td>87</td>
<td>79</td>
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<td>82</td>
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<td>73</td>
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<td>Cloud computing</td>
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<td>65</td>
<td>73</td>
<td>91</td>
<td>71</td>
<td>62</td>
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<td>68</td>
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<td>70</td>
<td>53</td>
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<td>Augmented and virtual reality</td>
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<td>71</td>
<td>68</td>
<td>50</td>
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<td>65</td>
<td>59</td>
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<td>72</td>
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<td>Encryption</td>
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<td>New materials</td>
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<td>Wearable electronics</td>
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<td>53</td>
<td>46</td>
<td>46</td>
<td>42</td>
<td>49</td>
<td>73</td>
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<td>Distributed ledger (blockchain)</td>
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<td>37</td>
<td>29</td>
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<td>58</td>
<td>54</td>
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<td>16</td>
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<td>44</td>
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<td>Stationary robots</td>
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<td>37</td>
<td>50</td>
<td>42</td>
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<td>Quantum computing</td>
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<td>32</td>
<td>25</td>
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<td>46</td>
<td>43</td>
<td>33</td>
<td>44</td>
<td>24</td>
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<tr>
<td>Non-humanoid land robots</td>
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<td>42</td>
<td>26</td>
<td>21</td>
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<td>27</td>
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<td>11</td>
<td>87</td>
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<td>12</td>
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<td>Humanoid robots</td>
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<td>26</td>
<td>17</td>
<td>18</td>
<td>8</td>
<td>35</td>
<td>13</td>
<td>33</td>
<td>12</td>
<td>25</td>
</tr>
<tr>
<td>Aerial and underwater robots</td>
<td>19</td>
<td>18</td>
<td>16</td>
<td>17</td>
<td>12</td>
<td>35</td>
<td>5</td>
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<td>19</td>
<td>29</td>
<td>25</td>
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Table 6: Projected (2022) effects on the workforce by industry and proportion of companies (%)

<table>
<thead>
<tr>
<th>Effect</th>
<th>Automotive, Aerospace, Supply Chain &amp; Transport</th>
<th>Aviation, Travel &amp; Tourism</th>
<th>Consumer</th>
<th>Energy Utilities &amp; Technologies</th>
<th>Financial Services &amp; Investors</th>
<th>Global Health &amp; Healthcare</th>
<th>Information &amp; Communication Technologies</th>
<th>Infrastructure</th>
<th>Mining &amp; Metals</th>
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<th>Professional Services</th>
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<tbody>
<tr>
<td>Modify value chain</td>
<td>59</td>
<td>82</td>
<td>44</td>
<td>71</td>
<td>83</td>
<td>78</td>
<td>56</td>
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<tr>
<td>Reduce workforce due to automation</td>
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<td>56</td>
<td>56</td>
<td>47</td>
<td>55</td>
<td>53</td>
<td>72</td>
</tr>
<tr>
<td>Expand task-specialized contractors</td>
<td>48</td>
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<td>50</td>
<td>42</td>
<td>51</td>
<td>52</td>
<td>44</td>
<td>33</td>
<td>57</td>
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<tr>
<td>Modify locations of operation</td>
<td>48</td>
<td>42</td>
<td>50</td>
<td>58</td>
<td>54</td>
<td>52</td>
<td>67</td>
<td>73</td>
<td>55</td>
<td>28</td>
<td>44</td>
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<tr>
<td>Expand the workforce</td>
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<td>50</td>
<td>39</td>
<td>38</td>
<td>34</td>
<td>19</td>
<td>31</td>
<td>27</td>
<td>41</td>
<td>28</td>
<td>22</td>
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<tr>
<td>Bring financing on-board for transition</td>
<td>36</td>
<td>38</td>
<td>33</td>
<td>29</td>
<td>40</td>
<td>37</td>
<td>31</td>
<td>20</td>
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<td>22</td>
</tr>
<tr>
<td>Expand workforce due to automation</td>
<td>28</td>
<td>20</td>
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<td>29</td>
<td>23</td>
<td>19</td>
<td>25</td>
<td>20</td>
<td>52</td>
<td>22</td>
<td>33</td>
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</tbody>
</table>

work activities will also be replaced. Today, respectively 38% and 30% of such tasks in these two sectors are performed by machines and algorithms. By 2022, those rates are expected to be 56% and 50% respectively, with knock-on effects on demand for Assembly and Factory Workers, Cashiers, and Stock-Keeping Clerks. Distinctively, the Aviation Travel & Tourism and Information & Communication Technologies sectors are those most likely to venture into automating some complex and technical activities. For example, today 25% of labour in the Information & Communications Technology industry is performed by machines and algorithms, while 46% is projected for 2022.

All industries expect sizable skills gaps, stating that at least 50% of their workforce will require reskilling of some duration. According to respondents to the Future of Jobs Survey, more than 55% of workers across the Aviation, Travel & Tourism; Financial Services & Investors; Chemistry, Advanced Materials & Biotechnology; and Global Health & Healthcare sectors will need some reskilling. The Aviation, Travel & Tourism industry outlines the largest demand for reskilling, projecting that 68% of its workforce will require some reskilling. Further, companies in that industry project that 18% of the workforce will require reskilling lasting more than one year.

While most industry respondents expect to observe declining demand for a set of, often labour-intensive roles dominated by manual and routinized work, that decline is often counter-balanced by growth across other specializations. A critical concern that will affect all industries will be the imperative to reskill workers currently in roles that have declining prospects into ones with expanding prospects.

Many of the companies surveyed for this report project that, by 2022, they will both expand and contract parts of their current workforce, with expansion likely to offset the contraction. However, this balance looks different across different industry sectors. Mining & Metals industry respondents, alongside those from the Consumer and Information & Communication Technologies industries, expect to see a reduction in their workforce due to automation, while Professional Services industry respondents expect that the changes afoot are more likely to lead to an expansion of their workforce.

Projected adaptations specific to the skillling needs associated with these changes include the potential to buy, build, borrow or automate talent. In particular, many of the Future of Jobs Survey respondents highlighted that they are likely to hire new permanent staff with skills that are relevant to the adopted technologies. The broad mobility sector is most likely to look to automation as a way to solve its projected talent challenges, and is least likely to look to reskill current employees. In contrast, companies in the Global Health & Healthcare industry—in addition to the Chemistry, Advanced Materials & Biotechnology industry—are most likely to look to retrain existing workers.

The trusted partners with the potential to support industries in their transformation vary across three key groups: specialized departments within the companies in question, professional services firms and industry associations. A series of other potential stakeholders—education institutions, government programmes and labour unions—received less emphasis as possible partners in these transitions. The Oil & Gas, Mining & Metals, and Energy Utilities & Technology industries are more likely to look to industry associations to support their workforce transition.

Companies in the Global Health & Healthcare sector name professional services firms as their primary support mechanism, but also name academic experts as their third-most important support pillar. Finally, Aviation, Travel & Tourism firms are most likely to name local education institutions as their third-most important support structure. Part 2 of this report contains distinct Industry Profiles that offer a deeper look at technology, jobs, tasks and skills trends within different sectors.

The Future of Jobs Across Regions

As the Fourth Industrial Revolution unfolds across the globe, the future of jobs can be expected to develop with both common and differentiated characteristics across different countries and regions of the world. In the near term, our data shows that the mix of prevalent industries in different countries will result in different national combinations of the effects described in the previous section, The Future of Jobs across Industries. Additionally, as global companies choose to differentiate and locate specific job roles and economic activities in certain countries over others due to a range of strategic considerations, there will be a secondary effect on the future of jobs in a range of developed and emerging markets, highlighting the ongoing importance of global supply chains and multinational companies in shaping the structure of the global economy.

With regard to the factors determining job location decisions, companies surveyed for this report overwhelmingly cite availability of skilled local talent as their foremost consideration, with 74% of respondents providing this factor as their key consideration. In contrast, 64% of companies cite labour costs as their main concern (Table 7). Notably, while we find some evidence of pure labour cost considerations being more important in emerging economies—with, for example, 74% of companies operating in South Africa and a similar share of companies operating in the Philippines highlighting this rationale, compared to 57% in the United Kingdom—skilled local talent availability remains the single most important factor behind job location decisions in these economies as well. A range of additional relevant factors—such as the flexibility of local labour laws, industry agglomeration effects or proximity of raw materials—were considered of lower importance relative to skilled local talent availability and labour cost considerations.
Furthermore, our analysis finds some industry-specific variation with regard to overall labour cost sensitivity relative to skilled local talent availability considerations. For example, across countries and regions, Consumer, Energy Utilities & Technologies, Financial Services & Investors, Infrastructure, and Mining & Metals are industries that tend to emphasize labour cost over skilled local talent availability. In contrast, the Automotive, Aerospace, Supply Chain & Transport; Chemistry, Advanced Materials & Biotechnology; Global Health & Healthcare; and Information & Communication Technologies industries tend to place a larger priority on skilled local talent availability (Table 7).

While a detailed discussion of the potential impact of automation on manufacturing in different countries and regions—and the potential for ‘re-shoring’—is beyond the scope of this report, it is worth noting the link between labour costs, skills and investment in automation technologies in advanced and emerging economies. For example, according to one recent study, in 1997, manufacturing value-added per dollar of labour cost was twice as high in Mexico than in the United States. By 2013, this gap had shrunk to less than 15%. Provided simultaneous investment in automation technology and labour augmentation in advanced economies continues apace over the 2018–2022 period, it is not inconceivable that shifting comparative advantage in labour costs will affect the industrial structure of economies such as Vietnam through re-shoring of work tasks in sectors such as textiles, apparel, footwear or electronics assembly. Indeed, more than half of companies surveyed for this report expected that by 2022 they would be considering adjusting the composition of their value chains in response to the adoption of new technologies, and just under half expected targeting new talent by modifying the location of their operations.

At least two key factors suggest that the grounds for optimism may outweigh concerns. Firstly, even if factory automation and labour augmentation in advanced industrial economies might lead to some re-shoring over the 2018–2022 period, many emerging economies are increasingly shifting toward a domestic consumption driven growth model, with rising local middles classes generating increased demand for goods and services traditionally intended for export. Secondly, as discussed in the section From Automation to Augmentation, new technologies give rise to new job roles, occupations and industries, with wholly new types of jobs emerging to perform new work tasks related to new technologies. Comparing occupational structures across advanced and emerging economies suggests that there is considerable scope for job growth in many sectors in the latter. For example, healthcare and education jobs provide 15% of total employment in the United States, and business services such as finance and real estate provide 19%, whereas, in emerging economies in East Asia and the Pacific, the respective shares are 3.5%–6.0% and 1.5%–6.0%, suggesting considerable scope for job growth.

However, in order to result in a positive outcome for workers and businesses alike in the midst of these geographically differentiated shifts, lifelong learning and national reskilling and upskilling plans for countries at every stage of economic development are paramount. Part 2 of this report offers a deeper look at technology, jobs, tasks and skills trends within different regions and countries through distinct Country and Regional Profiles. They are intended as a practical guide to exploring these issues in greater granularity and identifying opportunities for countries to build up their future talent pool in a targeted manner. The information provided might also prove useful to evaluate
shifting comparative advantage due to new technologies that might affect future company and industry location decisions in relation to various countries in question.

Some of the most frequently cited job roles expected to experience an increase in demand across the geographies covered by the report over the 2018–2022 period—as highlighted by surveyed employers with operations in the respective country or region—including Software and Applications Developers, Data Analysts and Scientists, as well as Human Resources Specialists, Sales and Marketing Professionals and specialized Sales Representatives in virtually all world regions. Region-specific roles expected to be in demand include Financial and Investment Advisers in East Asia and the Pacific and Western Europe; Information Security Analysts in Eastern Europe; Assembly and Factory Workers in Latin America and the Caribbean, Middle East and North Africa, South Asia and Sub-Saharan Africa; and Electrotechnology Engineers in North America.

Crucial to taking advantage of these emerging job creation opportunities across countries and regions will be the existence of a well-skilled local workforce and of national reskilling and upskilling ecosystems equipped to support local workers to keep abreast of technological change and shifting skills needs. As discussed in the section The Reskilling Imperative (see Figure 7 on page 13), across all countries and regions, employers surveyed for this report expect that significant reskilling will be needed by a large share of the global workforce over the 2018–2022 period. The expected average timeframe required to retrain or upskill affected workers—either in order to equip the country’s workforce with the skills needed to seize new opportunities created by the trends and disruptions experienced by businesses operating in the country in question, or in order to avoid losing competitiveness due to the obsolescence of the workforce’s existing skillsets—ranges from 83 days for companies located in Switzerland to 105 days for companies located in France (Figure 11).

A Look to the Recent Past (in Collaboration with LinkedIn)

While the Future of Jobs Survey is designed to look to the near-term future based on the views of the leaders shaping the decisions affecting the future of work, it is equally important to develop a clear sense of recent trends and consider their projections into the future. The World Economic Forum’s data collaboration with LinkedIn helps trace trends in hiring for a range of roles across the period 2013–2017. This data reveals the recent past and the adaptation that has already occurred across roles, impacting the lives and livelihoods of a variety of professionals.

An average rate of change was calculated to reveal the share of hiring for each role from LinkedIn’s 653 codified occupations. LinkedIn analysts expressed the monthly hires of any one job as a proportion of all hires across jobs in each relevant industry within any one calendar month. A linear regression line was fitted to aggregate the generalized trend and to reveal multi-year trends that point to the prioritization of hiring across industries. The resulting lists of roles and scale of change are featured in Figures 9 and 10 (on pages 20 and 21) and reveal, across industries and geographies, the roles that in the aggregate experienced the greatest upward or downward trend in demand from 2013–2017. The trends highlight business prioritization of new hires, namely the roles which employers believed to be the most appropriate investments to prepare their enterprises for success over the relevant period.

The data reveals that the Basics and Infrastructure industry has experienced a boom in real estate brokerage hires, but a decreasing relative demand for engineering roles and for technicians of various kinds. In the Consumer industry, the demand for Sales Managers was outpaced by demand for Marketing Managers and Software Engineers, while the inverse was true for the Energy industry cluster, where the demand for Managerial and Sales personnel has outpaced demand for Technicians and Engineers. A similar trend can be observed in the Information and Communication Technology industry. Here, relative demand for Systems Administrators has been outpaced by an increase in hires specializing in Experience Design and Marketing. In the Healthcare sector, more specialized roles in nutrition and mental health have experienced rising demand in contrast to generalist roles such as Nursing staff or Medical Officers. A slowdown in hiring trends within the Professional Services sector appears to have distinctively impacted creative, editorial and journalistic roles, all reflecting recent disruptions to the publishing industry. A downward trend among the hiring profile of journalistic professions has seen a matching increase in new hires across broader content writing roles.

Across all regions, digital, marketing and talent-related professions dominate the list of roles that have experienced upward hiring trends alongside marketing specialists, and professionals specializing in software engineering, Data Analysts, User Experience Designers and Human Resources Specialists.

The East Asia and the Pacific region has experienced falling demand for more traditional technical professions such as Engineering, and that trend is mirrored in the Middle East and North Africa region. In a similar fashion, historic hiring trends reveal a decline in hires of technical professions, such as Database Administrators and Electrical Engineers in South Asia. The Latin America and Caribbean and Sub-Saharan Africa regions saw a decline in new hires into roles focused on accounting, administrative activities and in supply chain specialization. Finally, Western Europe has experienced a slowdown in the relative hiring of creative professionals, reflecting recent disruptions in the publishing industry.

(Continued on next page)
Figure 9: Top ten most emerging and declining roles between 2013–2017 as observed in hiring trends, by industry (rate of change)

**Basics and Infrastructure**
- Real Estate Agent
- Real Estate Consultant
- Real Estate Broker
- Marketing Specialist
- Software Engineer
- Human Resources Specialist
- Cell Engineer
- Account Manager
- Sales Executive
- Marketing Manager
- Construction Worker
- Electrical Engineer
- Manager of Construction
- Civil Engineering Technician
- Manager of Engineering
- Accountant
- Environmental Health Safety Manager
- Mechanical Technician
- Electrical Technician
- Administrative Assistant

**Healthcare**
- Software Engineer
- Rehabilitation Therapist
- Healthcare Assistant
- Mental Health Practitioner
- Human Resources Specialist
- Marketing Specialist
- Pharmacist
- Nursing Student
- Mental Health Technician
- Data Analyst
- Medical Officer
- Lifeguard
- Sports Instructor
- Administrative Office Manager
- Alternative Medicine Practitioner
- Nurse
- Food and Beverage Server
- Medical Doctor
- Salesperson
- Supervisor
- Administrative Assistant

**Consumer**
- Marketing Specialist
- Software Engineer
- Marketing Manager
- Marketing Representative
- Human Resources Specialist
- Food and Beverage Server
- Sales Consultant
- Manager of Marketing
- Account Manager
- Drive
- Manager of Customer Service
- Accountant
- Artist
- Sales Manager
- Customer Service Specialist
- Merchant
- Manager of Retail
- Customer Service Representatives
- Administrative Assistant
- Salesperson

**Information and Communication Technology**
- Software Engineer
- Marketing Specialist
- Recruit
- Human Resources Specialist
- Data Analyst
- Drive
- User Experience Designer
- Customer Experience Manager
- Account Executive
- Marketing Manager
- Information Technology Manager
- Information Technology Specialist
- Sales Manager
- Customer Service Representative
- Technical Support Specialist
- Information Technology Analyst
- Information Technology Consultant
- System Administrator
- Administrative Assistant
- Project Manager

**Energy**
- Software Engineer
- Business Development Manager
- Sales Manager
- Energy Manager
- Project Manager
- Marketing Specialist
- Manager of Sales
- Account Manager
- Business Development Specialist
- Electrical Engineer
- Accountant
- Chemical Engineer
- Driller
- Electrical Technician
- Mechanical Technician
- Administrative Assistant
- Geologist
- Mechanical Engineer
- Petroleum Engineer

**Mobility**
- Software Engineer
- Drive
- Marketing Specialist
- Human Resources Specialist
- Supply Chain Associate
- Mechanical Engineer
- Marketing Manager
- Recruiter
- Sales Consultant
- Sales Executive
- Chef
- Supply Chain Manager
- Food and Beverage Specialist
- Accountant
- Lifeguard
- Manager of Food Services
- Mechanical Technician
- Customer Service Representative
- Food and Beverage Server
- Administrative Assistant

**Financial Services**
- Software Engineer
- Finance Analyst
- Financial Advisor
- Finance Specialist
- Data Analyst
- Manager of Product Management
- Finance Officer
- Human Resources Specialist
- Marketing Specialist
- Food and Beverage Server
- Accounting Assistant
- Accountant
- Project Manager
- Financial Services Associate
- Manager of Finance
- Banker
- Salesperson
- Customer Service Representative
- Administrative Assistant

**Professional Services**
- Marketing Specialist
- Recruiter
- Human Resources Consultant
- Human Resources Specialist
- Marketing Manager
- Accounting Associate
- Software Engineer
- Account Manager
- Data Analyst
- Financial Analyst
- Customer Service Representative
- Legal Clerk
- Manager of Creative Services
- Editor
- Food and Beverage Server
- Accountant
- Journalist
- Salesperson
- Architect
- Administrative Assistant

Source: LinkedIn.
A Look to the Recent Past (in Collaboration with LinkedIn) (cont’d.)

Figure 10: Top ten most emerging and declining roles between 2013–2017 as observed in hiring trends, by region (rate of change)

East Asia and the Pacific
- Marketing Specialist
- Software Engineer
- Human Resources Specialist
- Human Resources Consultant
- Account Manager
- Nurse
- Data Analyst
- Writer
- User Experience Designer
- Finance Specialist
- Electrical Engineer
- Mechanical Engineer
- Customer Service Representative
- Accountant
- Journalist
- Sales Manager
- Mechanical Engineer
- Project Manager
- Administrative Assistant

North America
- Real Estate Agent
- Software Engineer
- Marketing Specialist
- Recruiter
- Marketing Manager
- Writer
- Data Analyst
- Account Executive
- Finance Analyst
- Human Resources Specialist
- Chef
- Food and Beverage Server
- Sports Instructor
- Editor
- Manager of Retail
- Administrative Office Manager
- Lifeguard
- Customer Service Representative
- Salesperson
- Administrative Assistant

Eastern Europe and Central Asia
- Software Engineer
- Human Resources Specialist
- Recruiter
- Marketing Manager
- Business Strategy Analyst
- Data Analyst
- User Experience Designer
- Manager of Product Management
- Accounting Specialist
- Human Resources Consultant
- Food and Beverage Server
- System Administrator
- Translator
- Sports Instructor
- Manager of Sales
- Journalist
- Salesperson
- Administrative Assistant
- Sales Manager

South Asia
- Marketing Specialist
- Recruiter
- Marketing Manager
- Manager of Business Development
- Human Resources Specialist
- Data Analyst
- Software Engineer
- Graphic Designer
- Business Development Manager
- Manager of Retail
- Economist
- Database Administrator
- Manager of Sales
- Administrative Assistant
- Electrical Engineer
- Accountant
- Information Technology Consultant
- System Administrator
- Project Manager

Latin America and the Caribbean
- Software Engineer
- Marketing Specialist
- Salesperson
- Sales Consultant
- Strategic Advisor
- Lawyer
- Sales Executive
- Real Estate Agent
- Manager of Marketing
- Data Analyst
- Mechanical Technician
- Supply Chain Assistant
- Environmental Health Safety Manager
- Journalist
- Administrative Assistant Specialist
- Information Technology Analyst
- Technical Support Analyst
- Accounting Assistant
- Accountant
- Administrative Assistant

Sub-Saharan Africa
- Software Engineer
- Marketing Manager
- Salesperson
- Strategic Advisor
- Lawyer
- Human Resources Specialist
- Salesperson
- Business Development Manager
- Lawyer
- Civil Engineering Technician
- Electrical Engineer
- Financial Officer
- Supply Chain Manager
- Technical Support Technician
- Electrical Technician
- Journalist
- Mechanical Technician
- Administrative Assistant
- Accountant

Middle East and North Africa
- Software Engineer
- Marketing Specialist
- Marketing Manager
- Human Resources Specialist
- Real Estate Consultant
- Writer
- Lawyer
- Civil Engineer
- Nutritionist
- Mechanical Engineer
- Journalist
- Civil Engineering Technician
- Nurse
- Sales Executive
- Customer Service Representative
- Electrician
- Project Manager
- Administrative Assistant
- Accountant

Western Europe
- Software Engineer
- Marketing Manager
- Human Resources Specialist
- Marketing Specialist
- Recruiter
- Human Resources Consultant
- Business Development Specialist
- Manager of Product Management
- Nutritionist
- Data Analyst
- User Experience Designer
- Architect
- Entertainer
- Marketing Assistant
- Photographer
- Graphic Designer
- Editor
- Food and Beverage Server
- Administrative Assistant
- Salesperson

Source: LinkedIn.

The Future of Jobs Report 2018
For governments and businesses alike, there is a significant opportunity in strengthening cross-sectoral multistakeholder collaboration to promote corporate reskilling and upskilling among employers in affected countries and regions. Responses by the companies surveyed for this report indicate that, currently, employers expect to primarily seek out the support of their own internal departments as well as private training providers to deliver required retraining and upskilling programmes over the 2018–2022 period. In contrast, across many regions, the least sought-after partners are local education institutions, government programmes and labour unions. This somewhat narrow field of envisaged collaboration partners highlights both an opportunity and a clear need for expanding the range of creative and innovative multistakeholder solutions.

**Conclusions**

The new labour market taking shape in the wake of the Fourth Industrial Revolution holds both challenges and opportunities. As companies begin to formulate business transformation and workforce strategies over the course of the 2018–2022 period, they have a genuine window of opportunity to leverage new technologies, including automation, to enhance economic value creation through new activities, improve job quality in traditional and newly emerging occupations, and augment their employees’ skills to reach their full potential to perform new high value-added work tasks, some of which will have never before been performed by human workers. The business case for such an ‘augmentation strategy’ is becoming increasingly clear—and, we expect, will receive progressively more attention over the coming years, including through upcoming work by the World Economic Forum’s Centre for the New Economy and Society.

At the same time, technological change and shifts in job roles and occupational structures are transforming the demand for skills at a faster pace than ever before. Therefore, imperative for achieving such a positive vision of the future of jobs will be an economic and societal move by governments, businesses and individuals towards agile lifelong learning, as well as inclusive strategies and programmes for skills retraining and upgrading across the entire occupational spectrum. Technology-related and non-cognitive soft skills are becoming increasingly more important in tandem, and there are significant opportunities for innovative and creative multistakeholder partnerships of governments, industry employers, education providers and others to experiment and invest in new types of education and training provision that will be most useful to individuals in this new labour market context.

As this new labour market takes shape over the 2018–2022 period, governments, businesses and individuals will also find themselves confronted with a range of wholly new questions. For example, as employment relationships increasingly shift towards temporary and freelancing arrangements, how can we ensure that individuals receive the support and guidance they need to acquire the right skills throughout their working lives? As employers are deconstructing traditional job roles and re-bundling work tasks in response to new technologies, how can they minimize the risks and best leverage new partnerships with resources such as online freelancers and talent platforms? And how can they best ensure such task re-bundling does not inadvertently lead to new forms of job polarization through ‘task segregation’, whereby specific groups of workers are disproportionately allocated the most or least rewarding work tasks?

While it is beyond the scope of this report to attempt to provide comprehensive answers to all of the above questions, a range of immediate implications and priorities stand out for different stakeholders. For governments, firstly, there is an urgent need to address the impact of new technologies on labour markets through upgraded education policies aimed at rapidly raising education and skills levels of individuals of all ages,
particularly with regard to both STEM (science, technology, engineering and mathematics) and non-cognitive soft skills, enabling people to leverage their uniquely human capabilities. Relevant intervention points include school curricula, teacher training and a reinvention of vocational training for the age of the Fourth Industrial Revolution, broadening its appeal beyond traditional low- and medium-skilled occupations. Secondly, improvements in education and skills provision must be balanced with efforts on the demand side. Governments can help stimulate job creation through additional public investment as well as by leveraging private investments through blended finance or government guarantees. The exact nature of desirable investments will vary from country to country. However, over the coming years, there is enormous scope and a clear unmet need in creating the hard and soft infrastructure to power the Fourth Industrial Revolution—from digital communication networks to renewable and smart energy grids to smart schools and hospitals to improved care homes and childcare facilities. Thirdly, to the extent that new technologies and labour augmentation will boost productivity, incomes and wealth, governments may find that increased tax revenues provide scope to enhance social safety nets to better support those who may need support to adjust to the new labour market. This could be achieved through reforming and extending existing social protection schemes, or through moving to a wholly new model such as the idea of basic income and basic services. Learning from pilot schemes of this kind—in addition to those currently underway in places such as the Netherlands, various American and Canadian states, Kenya, India and Brazil—will be critical for all governments over the course of the 2018–2022 period.

For industries, firstly, it will pay to realize that—as competition for scarce skilled talent equipped to seize the opportunities of the Fourth Industrial Revolution intensifies and becomes more costly over the coming years—there is an opportunity to support the upskilling of their current workforce toward new (and technologically reorganized) higher-skilled roles to ensure that their workforce achieves its full potential. Our findings indicate that, to date, many companies intend to mostly limit their skills training provision over the 2018–2022 period to employees performing today’s in-demand job roles, rather than thinking more long-term and creatively. Clearly, a more inclusive and proactive approach will be needed—to both increase the availability of future skills and address impending skills scarcity, and to enable a wider range of workers to share in the gains from new technologies and work more effectively with them through skills augmentation. Secondly, the need to ensure a sufficient pool of appropriately skilled talent creates an opportunity for businesses to truly reposition themselves as learning organizations and to receive support for their reskilling and upskilling efforts from a wide range of stakeholders. One promising model involves new forms of professional skills certification similar to existing schemes delivered by a range of companies in the information technology sector. By establishing objective and marketable credentials for a large variety of emerging job roles, such schemes could help improve the focus of corporate training programmes, increase labour market flexibility, and create clear skills and performance measures to help employers screen candidates and certified workers to command skills premiums. Thirdly, with the increasing importance of talent platforms and online workers, conventional industries, too, should be thinking strategically how these action items could be applied to the growing ‘gig’ and platform workforces as well.

For workers, there is an unquestionable need to take personal responsibility for one’s own lifelong learning and career development. It is also equally clear that many individuals will need to be supported through periods of job transition and phases of retraining and upskilling by governments and employers. For example, lifelong learning is becoming a rich area of experimentation, with several governments and industries looking for the right formula to encourage individuals to voluntarily undergo periodic skills upgrading. Similarly, while a fully-fledged universal basic income may remain politically and economically unfeasible or undesirable over the 2018–2022 period, some variants or aspects of the idea—such as providing a ‘universal lifelong learning fund’ for individuals to draw on as needed—might receive increasing attention over the coming years. Solutions are likely to vary by country and to depend on local political, economic and social circumstances.

Ultimately, the core objective for governments, industries and workers alike should be to ensure that tomorrow’s jobs are fairly remunerated, entail treatment with respect and decency and provide realistic scope for personal growth, development and fulfilment. It is our hope that this new edition of the World Economic Forum’s Future of Jobs Report provides both a call to action and a useful tool for proactively shaping the future of jobs to realize this vision.

Notes


2 African Development Bank (AFDB), Asian Development Bank (ADB), European Bank for Reconstruction and Development (EBRD), and Inter-American Development Bank (IDB), The Future of Work: Regional Perspectives, 2018.

3 According to the International Labour Organization’s literature review, existing research on the future of work covers a wide range of topics, with a particular focus on technological innovations and inequality. Aspects that would merit additional analysis include the impact of demographics and environmental changes and, [with] regard to the future of job creation and destruction, projections on the impact of automation on agriculture would be essential … particularly for developing countries; Ballester, and Elsheikh, The Future of Work: A Literature Review.

5 According to an estimate by Bain & Company, based primarily on the rapidly declining cost of robotic dexterity for service applications, humanoid robots are likely to reach commercialization in the early 2020s, specifically creating ‘a strong business case for the automation of many tasks in restaurant kitchens and bars’; see: Bain & Company, Labor 2030: The Collision of Demographics, Automation and Inequality.

6 For example, ‘cobots’—robotic helper units installed alongside human workers to enhance their productivity and often costing less than one-quarter the price of traditional robots—are set to have a large commercial and workforce impact over the coming years, being well-placed for deployment in many parts of the service sector as yet largely untouched by workplace automation; see: Bain & Company, Labor 2030: The Collision of Demographics, Automation and Inequality.


8 As noted by a recent Bain & Company study, while public reaction to new technologies is likely to vary substantially from one country to the next, thereby accelerating or decelerating their adoption, differences in public policies toward new technologies such as automation may be harder to sustain if their applications are tradeable. For example, if London were to deregulate the application of fully autonomous machine learning algorithms in financial markets, competitive forces are likely to put greater pressure on technology regulators in New York to follow suit. By contrast, if London were to permit coffee shops more generous labour automation leeway than New York, differences are more likely to remain localized; see: Bain & Company, Labor 2030: The Collision of Demographics, Automation and Inequality.

9 These extrapolated figures are based on employers’ current projections for the set of roles with increasing, declining and stable demand in the period up to 2022, which were estimated by employers as a share of each enterprise’s total workforce. The figures were then applied to the International Labour Organization’s estimates and projections of global non-agricultural employment in both 2018 and 2022, adjusted for the estimated share of total employment represented by this report’s respondent data, i.e. large businesses. The figures used for estimating the global share of large business employment are based on established estimates by the World Bank, US Bureau of Labor Statistics and Eurostat, holding the distribution of firm size constant between 2018 and 2022.

10 Barclays, Robots at the gate: Humans and technology at work, 2018.

11 Ibid.


17 PwC, Will robots really steal our jobs? An international analysis of the potential long term impact of automation; the three waves of workforce automation identified by the report consist of an algorithmic wave (to early 2020s; involving ‘automation of simple computational tasks and analysis of structured data, affecting data-driven sectors such as financial services’); an augmentation wave (to late 2020s; involving ‘dynamic interaction with technology for clerical support and decision making … including robotic tasks in semi-controlled environments such as moving objects in warehouses); and an autonomous wave (to mid-2030s; involving ‘automation of physical labour and manual dexterty, and problem-solving in dynamic real-world situations that require responsive actions, such as in transport and construction’).


21 Deloitte, Benedict, “Why automation is more than just a job killer”, RSA Blog, 20 July 2018, https://www.thersa.org/discover/publications-and-articles/rsa-blogs/2018/07/the-four-types-of-automation-substitution-augmentation-generation-and-transference. The RSA, a British think tank, accordingly distinguishes four types of automation: (1) substitution (‘technology taking on a task that would otherwise have been’ be undertaken by a worker); (2) augmentation (‘technology expanding’ the capability of workers, allowing them to achieve more and better-quality work in a shorter space of time’); (3) generation (‘technology generating’ tasks that were never done by humans previously … creating work rather than capturing it from others’); (4) transference (‘technology shifting’ responsibility for undertaking a task from workers to consumers. Self-service checkouts, for instance, have not done away with the job of processing items through tills. Instead they’ve merely passed on the responsibility to shoppers. … This form of automation typically relies on … sophisticated UX and UI Design’); ibid.


24 Deloitte, “Why automation is more than just a job killer.”

25 Measured in incremental additional US$ of gross output per worker, i.e. excluding baseline forecasts of labour productivity growth; Bain & Company, Labor 2030: The Collision of Demographics, Automation and Inequality.


References and Further Reading


---, Creating South Africa's Future Workforce, 2018.


Alphabeta, The Automation Advantage: How Australia can seize a $2 trillion opportunity from automation and create millions of safer, more meaningful and more valuable jobs, 2017.


Barclays, Robots at the gate: Humans and technology at work.


Barclays, Robots at the gate: Humans and technology at work, 2018.
Jesuthasan, Ravin and John Boudreau, "You may not be a disrupter, but you might find———,


Organisation for Economic Co-operation and Development (OECD), Basic income as a policy option: Can it add up?, 2017.


Reijnders, Laurie S.M. and Gaaitzen de Vries, Job Polarization in Advanced and Emerging Countries: The Role of Task Relocation and Technological Change within Global Supply Chains, GGDc Research Memorandum 167, University of Groningen-Groningen Growth and Development Centre, 2017.


———, How to Prevent Discriminatory Outcomes in Machine Learning, 2018.

Appendix A: Report Methodology

Changes to jobs and skills are set to have large-scale effects on companies, government and individuals across the global community. What does the future hold? How can you find the right talent to ensure growth? How can you make informed and socially conscious decisions when faced with major disruptions to jobs and skills?

The analysis that forms the basis of this report is the result of an extensive survey of Chief Human Resources and Chief Executive Officers of leading global employers which aims to give specificity to these discussions. The survey aims to capture executives’ current planning and projections related to jobs and skills in the period leading up to 2022.

Survey Design

There are three core concepts that are key to the construction of the Future of Jobs Survey: job roles, tasks and skills. Task are defined as the actions necessary to turn a set of inputs into valuable outputs. As such, tasks can be considered to form the content of jobs. Skills, on the other hand, are defined as the capabilities that are needed to complete a task. In essence, tasks are what needs to be done and skills define the capacity to do them.

The original Future of Jobs Survey employed to produce the first Future of Jobs Report, in 2016, was informed by an extensive literature review on the various dimensions covered by the survey, and by continuous consultation with leading experts from academia, international organizations, business and civil society through the World Economic Forum’s Global Agenda Council on the Future of Jobs and Global Agenda Council on Gender Parity, which served as partners and advisory bodies to the study. This second edition of the survey adjusted that approach on the basis of lessons learned from that first endeavour.

The updated 2018 survey now consists of three interrelated parts. Part I maps the trends that are set to positively and negatively impact business growth, the technologies that are likely to play a part in that expansion, the rationale and barriers related to this technology expansion, employers’ preferred ecosystem for support, and the workforce shifts that will be needed to effect those changes. Part II maps three interlocking pillars of the labour market—occupations, skills and tasks—and provides employers with an opportunity to share the jobs that are set
to experience stable, declining and rising demand. Part II also asks employers to estimate the current and future composition of their workforce, and the division of labour between humans, machines and algorithms. Part III gives survey respondents an opportunity to share their current plans for the period up to 2022 as they pertain to closing key skills gaps in their enterprises. In particular, the survey asks employers to rate the likelihood of employing a variety of strategies aimed at ensuring their businesses have the right talent to grow, to give specificity to the scale of their future reskilling needs, and to share a range of detailed information about their current and future reskilling provision.

Representativeness
The survey collection process was conducted via an online questionnaire, with data collection spanning a nine-month period from November 2017 to July 2018. The survey set out to represent the current strategies, projections and estimates of global business, with a focus on large multinational companies and more localized companies which are of significance due to their employee or revenue size. As such there are two areas of the future of jobs that remain out of scope for this report—namely, the future of jobs as it relates to the activities of small and medium-sized enterprises and as it relates to the informal sectors of, in particular, developing economies.

The Future of Jobs Survey was distributed to relevant companies through extensive collaboration between the World Economic Forum and its constituents, amplified by regional survey partners. The survey is also the result of extensive cross-departmental coordination within the World Economic Forum during which the Forum’s Business Engagement Team, Centre for Global Industries and Centre for Regional and Geopolitical Affairs supported the report team’s efforts to sub-select relevant samples. For key partners in the survey distribution process, please refer to the Survey Partners and Acknowledgements sections.

Detailed sample design specifications were shared with survey partners, requesting that the sample of companies targeted for participation in the survey should be drawn from a cross-section of leading companies that make up a country or region’s economy, and should include—even if not necessarily be limited to—national and multinational companies that are among the country’s top 100 employers (either by number of employees or by revenue size). In cases where we worked with a regional partner organization we requested additional focus on strong representation from key sectors represented in that geography. To ensure that the survey was representative of the relevant population, the report team conducted additional analysis, confirming the number of responses as well as the size of each respondent’s revenue and employee pool.

The final sub-selection of countries with data of sufficient quality to be featured in the report was based on the overall number of responses from companies with a presence in each country—and within that subset, was based on the number of companies headquartered in the relevant location and the diversity of the sample in relation to the companies’ number of locations. In particular, the aim was to arrive at a sample in which more than two-fifths of the companies were large multinational firms, and a reasonable range of companies maintained a focused local or regional presence. The final sub-selection of industries included was based on the overall number of responses by industry, in addition to a qualitative review of the pool of named companies represented in the survey data.

After relevant criteria were applied, the sample was found to be composed of 12 industry clusters and 20 economies. Industry clusters include Aviation, Travel & Tourism; Chemistry, Advanced Materials & Biotechnology; Consumer; Energy; Financial Services & Investors; Global Health & Healthcare; Information & Communication Technologies; Infrastructure; Mining & Metals; Mobility; Oil & Gas; and Professional Services. Economies include Argentina, Australia, Brazil, China, France, Germany, India, Indonesia, Japan, Mexico, Philippines, Russian Federation, Singapore, South Africa, Republic of Korea, Switzerland, Thailand, United Kingdom, United States and Vietnam—collectively representing about 70% of global GDP. In total, the report’s data set contains 313 unique responses by global companies, collectively representing more than 15 million employees (see Table 1 in Part I).

Classification Frameworks for Jobs and Skills
Similar to the initial report, this year’s report employed the Occupational Information Network (O*NET) framework for its categories of analysis for jobs, skills and tasks. O*NET was developed by the US Department of Labor in collaboration with its Bureau of Labor Statistics’ Standard Classification of Occupations (SOC) and remains the most extensive and respected classification of its kind. In its unabridged form, the O*NET-SOC taxonomy includes detailed information on 974 individual occupations in the United States, grouped into approximately 20 broader job families, which are regularly revised and updated for new and emerging occupations to keep up with the changing occupational landscape.

For this edition of the report, the Generalized Work Activities segment of the O*NET methodology was used to form the list of tasks used in the survey. In addition, for the classification of skills, the report team employed an abridged version of the “Worker Characteristics” and Worker Requirement classifications; in particular, bundles 1.A., 1.C., 2.A., and 2.B. Additional details about the composition of the skills list used in this report can be found in Table A1.
<table>
<thead>
<tr>
<th>Competency bundle</th>
<th>Competencies, O*NET</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Active learning and learning strategies</strong></td>
<td>Active Learning</td>
<td>Understanding the implications of new information for both current and future problem-solving and decision-making.</td>
</tr>
<tr>
<td></td>
<td>Learning Strategies</td>
<td>Selecting and using training/instructional methods and procedures appropriate for the situation when learning or teaching new things.</td>
</tr>
<tr>
<td><strong>Reading, writing, math, active listening</strong></td>
<td>Active Listening</td>
<td>Giving full attention to what other people are saying, taking time to understand the points being made, asking questions as appropriate, and not interrupting at inappropriate times.</td>
</tr>
<tr>
<td></td>
<td>Mathematics</td>
<td>Using mathematics to solve problems.</td>
</tr>
<tr>
<td></td>
<td>Reading Comprehension</td>
<td>Understanding written sentences and paragraphs in work related documents.</td>
</tr>
<tr>
<td></td>
<td>Science</td>
<td>Using scientific rules and methods to solve problems.</td>
</tr>
<tr>
<td></td>
<td>Speaking</td>
<td>Talking to others to convey information effectively.</td>
</tr>
<tr>
<td></td>
<td>Writing</td>
<td>Communicating effectively in writing as appropriate for the needs of the audience.</td>
</tr>
<tr>
<td><strong>Analytical thinking and innovation</strong></td>
<td>Analytical Thinking</td>
<td>Job requires analyzing information and using logic to address work-related issues and problems.</td>
</tr>
<tr>
<td></td>
<td>Innovation</td>
<td>Job requires creativity and alternative thinking to develop new ideas for and answers to work-related problems.</td>
</tr>
<tr>
<td><strong>Attention to detail, trustworthiness</strong></td>
<td>Attention to Detail</td>
<td>Job requires being careful about detail and thorough in completing work tasks.</td>
</tr>
<tr>
<td></td>
<td>Dependability</td>
<td>Job requires being reliable, responsible, and dependable, and fulfilling obligations.</td>
</tr>
<tr>
<td></td>
<td>Integrity</td>
<td>Job requires being honest and ethical.</td>
</tr>
<tr>
<td><strong>Complex problem-solving</strong></td>
<td>Complex Problem-Solving</td>
<td>Identifying complex problems and reviewing related information to develop and evaluate options and implement solutions.</td>
</tr>
<tr>
<td><strong>Coordination and time management</strong></td>
<td>Time Management</td>
<td>Managing one’s own time and the time of others.</td>
</tr>
<tr>
<td></td>
<td>Coordination</td>
<td>Adjusting actions in relation to others’ actions.</td>
</tr>
<tr>
<td><strong>Creativity, originality and initiative</strong></td>
<td>Initiative</td>
<td>Job requires a willingness to take on responsibilities and challenges.</td>
</tr>
<tr>
<td></td>
<td>Creativity</td>
<td>Workers on this job try out their own ideas.</td>
</tr>
<tr>
<td></td>
<td>Responsibility</td>
<td>Workers on this job make decisions on their own.</td>
</tr>
<tr>
<td></td>
<td>Autonomy</td>
<td>Workers on this job plan their work with little supervision.</td>
</tr>
<tr>
<td></td>
<td>Originality</td>
<td>The ability to come up with unusual or clever ideas about a given topic or situation, or to develop creative ways to solve a problem.</td>
</tr>
<tr>
<td><strong>Critical thinking and analysis</strong></td>
<td>Critical Thinking</td>
<td>Using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions or approaches to problems.</td>
</tr>
<tr>
<td></td>
<td>Monitoring</td>
<td>Monitoring/assessing performance of yourself, other individuals, or organizations to make improvements or take corrective action.</td>
</tr>
<tr>
<td><strong>Emotional intelligence</strong></td>
<td>Concern for Others</td>
<td>Job requires being sensitive to others’ needs and feelings and being understanding and helpful on the job.</td>
</tr>
<tr>
<td></td>
<td>Cooperation</td>
<td>Job requires being pleasant with others on the job and displaying a good-natured, cooperative attitude.</td>
</tr>
<tr>
<td></td>
<td>Social Orientation</td>
<td>Job requires preferring to work with others rather than alone, and being personally connected with others on the job.</td>
</tr>
<tr>
<td></td>
<td>Social Perceptiveness</td>
<td>Being aware of others’ reactions and understanding why they react as they do.</td>
</tr>
<tr>
<td><strong>Instruction, mentoring and teaching</strong></td>
<td>Instructing</td>
<td>Teaching others how to do something.</td>
</tr>
<tr>
<td></td>
<td>Training and Teaching Others</td>
<td>Identifying the educational needs of others, developing formal educational or training programs or classes, and teaching or instructing others.</td>
</tr>
<tr>
<td><strong>Leadership and social influence</strong></td>
<td>Leadership</td>
<td>Job requires a willingness to lead, take charge, and offer opinions and direction.</td>
</tr>
<tr>
<td></td>
<td>Social Influence</td>
<td>Job requires having an impact on others in the organization, and displaying energy and leadership.</td>
</tr>
<tr>
<td><strong>Management of financial, material resources</strong></td>
<td>Management of Financial Resources</td>
<td>Determining how money will be spent to get the work done, and accounting for these expenditures.</td>
</tr>
<tr>
<td></td>
<td>Management of Material Resources</td>
<td>Obtaining and seeing to the appropriate use of equipment, facilities, and materials needed to do certain work.</td>
</tr>
<tr>
<td><strong>Management of personnel</strong></td>
<td>Management of Personnel Resources</td>
<td>Motivating, developing, and directing people as they work, identifying the best people for the job.</td>
</tr>
<tr>
<td>Competency bundle</td>
<td>Competencies, O*NET</td>
<td>Description</td>
</tr>
<tr>
<td>-------------------------------------------------------</td>
<td>---------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Manual dexterity, endurance and precision</td>
<td>Endurance</td>
<td>The ability to exert oneself physically over long periods without getting out of breath.</td>
</tr>
<tr>
<td></td>
<td>Flexibility, Balance, and Coordination</td>
<td>Abilities related to the control of gross body movements.</td>
</tr>
<tr>
<td></td>
<td>Physical Strength Abilities</td>
<td>Abilities related to the capacity to exert force.</td>
</tr>
<tr>
<td></td>
<td>Control Movement Abilities</td>
<td>Abilities related to the control and manipulation of objects in time and space.</td>
</tr>
<tr>
<td></td>
<td>Fine Manipulative Abilities</td>
<td>Abilities related to the manipulation of objects.</td>
</tr>
<tr>
<td></td>
<td>Reaction Time and Speed Abilities</td>
<td>Abilities related to speed of manipulation of objects.</td>
</tr>
<tr>
<td>Memory, verbal, auditory and spatial abilities</td>
<td>Attentiveness</td>
<td>Abilities related to application of attention.</td>
</tr>
<tr>
<td></td>
<td>Memory</td>
<td>Abilities related to the recall of available information.</td>
</tr>
<tr>
<td></td>
<td>Perceptual Abilities</td>
<td>Abilities related to the acquisition and organization of visual information.</td>
</tr>
<tr>
<td></td>
<td>Spatial Abilities</td>
<td>Abilities related to the manipulation and organization of spatial information.</td>
</tr>
<tr>
<td></td>
<td>Verbal Abilities</td>
<td>Abilities that influence the acquisition and application of verbal information in problem-solving.</td>
</tr>
<tr>
<td>Persuasion and negotiation</td>
<td>Negotiation</td>
<td>Bringing others together and trying to reconcile differences.</td>
</tr>
<tr>
<td></td>
<td>Persuasion</td>
<td>Persuading others to change their minds or behavior.</td>
</tr>
<tr>
<td>Quality control and safety awareness</td>
<td>Quality Control Analysis</td>
<td>Conducting tests and inspections of products, services, or processes to evaluate quality or performance.</td>
</tr>
<tr>
<td>Reasoning, problem solving and ideation</td>
<td>Idea Generation and Reasoning Abilities</td>
<td>Abilities that influence the application and manipulation of information in problem-solving.</td>
</tr>
<tr>
<td></td>
<td>Quantitative Abilities</td>
<td>Abilities that influence the solution of problems involving mathematical relationships.</td>
</tr>
<tr>
<td>Resilience, stress tolerance and flexibility</td>
<td>Adaptability/Flexibility</td>
<td>Job requires being open to change (positive or negative) and to considerable variety in the workplace.</td>
</tr>
<tr>
<td></td>
<td>Self Control</td>
<td>Job requires maintaining composure, keeping emotions in check, controlling anger, and avoiding aggressive behavior, even in very difficult situations.</td>
</tr>
<tr>
<td></td>
<td>Stress Tolerance</td>
<td>Job requires accepting criticism and dealing calmly and effectively with high stress situations.</td>
</tr>
<tr>
<td>Service orientation</td>
<td>Service Orientation</td>
<td>Actively looking for ways to help people.</td>
</tr>
<tr>
<td>Systems analysis and evaluation</td>
<td>Judgment and Decision Making</td>
<td>Considering the relative costs and benefits of potential actions to choose the most appropriate one.</td>
</tr>
<tr>
<td></td>
<td>Systems Analysis</td>
<td>Determining how a system should work and how changes in conditions, operations, and the environment will affect outcomes.</td>
</tr>
<tr>
<td></td>
<td>Systems Evaluation</td>
<td>Identifying measures or indicators of system performance and the actions needed to improve or correct performance, relative to the goals of the system.</td>
</tr>
<tr>
<td>Technology design and programming</td>
<td>Programming</td>
<td>Writing computer programs for various purposes.</td>
</tr>
<tr>
<td></td>
<td>Technology Design</td>
<td>Generating or adapting equipment and technology to serve user needs.</td>
</tr>
<tr>
<td>Technology installation and maintenance</td>
<td>Equipment Maintenance</td>
<td>Performing routine maintenance on equipment and determining when and what kind of maintenance is needed.</td>
</tr>
<tr>
<td></td>
<td>Installation</td>
<td>Installing equipment, machines, wiring, or programs to meet specifications.</td>
</tr>
<tr>
<td></td>
<td>Repairing</td>
<td>Repairing machines or systems using the needed tools.</td>
</tr>
<tr>
<td>Technology selection, monitoring and control</td>
<td>Equipment Selection</td>
<td>Determining the kind of tools and equipment needed to do a job.</td>
</tr>
<tr>
<td></td>
<td>Operation and Control</td>
<td>Controlling operations of equipment or systems.</td>
</tr>
<tr>
<td></td>
<td>Operation Monitoring</td>
<td>Watching gauges, dials, or other indicators to make sure a machine is working properly.</td>
</tr>
<tr>
<td></td>
<td>Operations Analysis</td>
<td>Analyzing needs and product requirements to create a design.</td>
</tr>
<tr>
<td>Troubleshooting and user experience</td>
<td>Troubleshooting</td>
<td>Determining causes of operating errors and deciding what to do about them.</td>
</tr>
<tr>
<td>Visual, auditory and speech abilities</td>
<td>Auditory and Speech Abilities</td>
<td>Abilities related to auditory and oral input.</td>
</tr>
<tr>
<td></td>
<td>Visual Abilities</td>
<td>Abilities related to visual sensory input.</td>
</tr>
</tbody>
</table>
## Appendix B: Industry and Regional Group Classifications

### Table B1: Classification of industries featured in the report

<table>
<thead>
<tr>
<th>Industry Cluster</th>
<th>Industry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automotive, Aerospace, Supply Chain and Transport</td>
<td>Automotive</td>
</tr>
<tr>
<td></td>
<td>Aerospace</td>
</tr>
<tr>
<td></td>
<td>Supply Chain and Transport</td>
</tr>
<tr>
<td>Aviation, Travel and Tourism</td>
<td>Aviation, Travel and Tourism</td>
</tr>
<tr>
<td>Chemistry, Advanced Materials and Biotechnology</td>
<td>Chemistry, Advanced Materials and Biotechnology</td>
</tr>
<tr>
<td>Consumer</td>
<td>Retail, Consumer Goods and Lifestyle</td>
</tr>
<tr>
<td></td>
<td>Agriculture, Food and Beverage</td>
</tr>
<tr>
<td>Energy Utilities and Technologies</td>
<td>Energy Utilities</td>
</tr>
<tr>
<td></td>
<td>Energy Technologies</td>
</tr>
<tr>
<td>Financial Services and Investors</td>
<td>Insurance and Asset Management</td>
</tr>
<tr>
<td></td>
<td>Banking and Capital Markets</td>
</tr>
<tr>
<td></td>
<td>Private Investors</td>
</tr>
<tr>
<td></td>
<td>Institutional Investors</td>
</tr>
<tr>
<td>Global Health and Healthcare</td>
<td>Global Health and Healthcare</td>
</tr>
<tr>
<td>Information and Communication Technologies</td>
<td>Information Technology</td>
</tr>
<tr>
<td></td>
<td>Telecommunications</td>
</tr>
<tr>
<td></td>
<td>Electronics</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>Infrastructure and Urbanisation</td>
</tr>
<tr>
<td>Mining and Metals</td>
<td>Mining and Metals</td>
</tr>
<tr>
<td>Oil and Gas</td>
<td>Oil and Gas</td>
</tr>
<tr>
<td></td>
<td>Oil Field Services and Equipment</td>
</tr>
<tr>
<td>Professional Services</td>
<td>Professional Services</td>
</tr>
<tr>
<td>EAST ASIA AND THE PACIFIC</td>
<td>EASTERN EUROPE AND CENTRAL ASIA</td>
</tr>
<tr>
<td>---------------------------</td>
<td>---------------------------------</td>
</tr>
<tr>
<td>Australia</td>
<td>Albania</td>
</tr>
<tr>
<td>Brunei</td>
<td>Armenia</td>
</tr>
<tr>
<td>Darussalam</td>
<td>Azerbaijan</td>
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<tr>
<td>Cambodia</td>
<td>Belarus</td>
</tr>
<tr>
<td>China</td>
<td>Bosnia and Herzegovina</td>
</tr>
<tr>
<td>Fiji</td>
<td>Bulgaria</td>
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<tr>
<td>Indonesia</td>
<td>Croatia</td>
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<tr>
<td>Japan</td>
<td>Czech Republic</td>
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<tr>
<td>Korea, Rep. Lao PDR</td>
<td>Estonia</td>
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<tr>
<td>Mongolia</td>
<td>Georgia</td>
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<tr>
<td>Myanmar</td>
<td>Hungary</td>
</tr>
<tr>
<td>New Zealand</td>
<td>Kazakhstan</td>
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<tr>
<td>Philippines</td>
<td>Kyrgyz Republic</td>
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<tr>
<td>Singapore</td>
<td>Latvia</td>
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<tr>
<td>Thailand</td>
<td>Lithuania</td>
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<tr>
<td>Timor-Leste</td>
<td>Macedonia</td>
</tr>
<tr>
<td>Vietnam</td>
<td>Moldova</td>
</tr>
<tr>
<td></td>
<td>Montenegro</td>
</tr>
<tr>
<td></td>
<td>Poland</td>
</tr>
<tr>
<td></td>
<td>Romania</td>
</tr>
<tr>
<td></td>
<td>Russian Federation</td>
</tr>
<tr>
<td></td>
<td>Serbia</td>
</tr>
<tr>
<td></td>
<td>Slovak Republic</td>
</tr>
<tr>
<td></td>
<td>Slovenia</td>
</tr>
<tr>
<td></td>
<td>Tajikistan</td>
</tr>
<tr>
<td></td>
<td>Ukraine</td>
</tr>
<tr>
<td></td>
<td>Uzbekistan</td>
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</tr>
</tbody>
</table>
Part 2

Industry and Country/Region Profiles
User’s Guide: How to Read the Industry and Country/Region Profiles

Part 2 of the report presents findings through an industry and country lens, with the aim of providing specific practical information to decision-makers and experts from academia, business, government and civil society. Complementing the cross-industry and cross-country analysis of results in Part 1, it provides deeper granularity for a given industry, country or region through dedicated Industry Profiles and Country/Region Profiles. Profiles are intended to provide interested companies and policymakers with the opportunity to benchmark themselves relative to the range of expectations prevalent in their industry and/or country. This User’s Guide provides an overview of the information contained in the various Industry Profiles and Country/Region Profiles and its appropriate interpretation.

Industry Profiles

1. Trends driving industry growth
   The first section of each Industry Profile provides an overview of the top socio-economic trends and technological disruptions expected to positively affect the growth of the industry over the 2018–2022 period, ranked according to the share of survey respondents from the industry who selected the stated trend as one of the top drivers of growth for their industry. For a more detailed discussion of each trend, please refer to the Strategic Drivers of New Business Models section in Part 1 of the report.

2. Technology adoption in industry
   The bar chart represents the share of survey respondents from the industry who indicated that, by 2022, their company was “likely” or “very likely” (on a 5-point scale) to have adopted the stated technology as part of its growth strategy. For a more detailed discussion of each technology, please refer to the section Strategic Drivers of New Business Models section in Part 1 of the report.

3. Expected impact on workforce
   This bar chart represents the share of survey respondents from the industry who expect their company to have adopted the stated measure(s) over the 2018–2022 period as part of their current growth strategy. For a more detailed discussion of each measure, please refer to the The 2022 Jobs Landscape section in Part 1 of the report.

4. Barriers to adoption of new technologies
   This bar chart represents the five biggest perceived barriers to adopting new technologies across the industry, as measured by the share of survey respondents from the industry who selected the stated obstacle as one of the top
impediments to successful new technology adoption faced by their company. The data featured in the Industry Profile represents additional supplementary information beyond the high-level overview provided in Part 1 of the report.

5 Projected adaptation partners

The bar chart in the first section of the second page of the Industry Profile represents the share of survey respondents from the industry who indicated that their company was “likely” or “very likely” (on a 5-point scale) to collaborate with the stated partner entity over the 2018–2022 period to develop measures and strategies for adaptation to the trends and disruptions expected to affect the industry. For a more detailed discussion of adaptation partner collaboration intentions, please refer to the The Reskilling Imperative section in Part 1 of the report.

6 Augmentation of key job tasks in 2018 and 2022

Bar charts in this section represent the expected evolution of human-machine collaboration over the 2018–2022 period across the industry. The column labels on the left-hand side of the section report the three most common job tasks, in terms of total task hours, performed across the totality of jobs in the industry. The 2018 column reports the total share of task hours contributed to the achievement of the job task by human workers on the one hand, and by machines or algorithms on the other. For example, if the respective shares were 75% and 25%, respectively, for every hour spent on performing the task in the industry, 45 minutes would have been expended by human workers and 15 minutes by machines or algorithms. The 2022 column reports the expected evolution of this human-machine division of labour across the industry by the stated year.

Note that the diagrams measure the relative change in contribution by human workers and machines, not the absolute underlying number of task hours—meaning that there is no “zero-sum” competition between the two. For example, a reduction in the relative share of task hours contributed to a specific task by human workers could be entirely due to increased machine productivity over the 2018–2022 period, rather than a reduction in the absolute number of work hours spent on the task by human workers. For a more detailed discussion of this issue, please refer to the From Automation to Augmentation section in Part 1 of the report.

7 Average reskilling needs

This section highlights the expected reskilling needs over the 2018–2022 period across the industry. The diagram represents the distribution of the industry workforce according to the expected average timeframe required to retrain or upskill affected workers—or in order to equip the industry’s workforce with the skills needed to seize new opportunities created by the trends and disruptions expected to affect the industry, or in order to avoid losing competitiveness due to the obsolescence of the workforce’s existing skillsets. For a more detailed discussion of expected reskilling needs, please refer to the The Reskilling Imperative section in Part 1 of the report.

8 Workforce in 2018 and 2022

This table provides an overview of expected developments in the industry-specific job roles most frequently mentioned by survey respondents from the industry. The blue column highlights emerging job roles for the industry in question and indicates their expected total employment share within the industry workforce in 2018 and 2022. Analogously, the grey column highlights declining job roles for the industry in question and indicates their expected total employment share within the industry workforce in 2018 and 2022. The individual job roles listed underneath each category are for illustrative purposes and report the job roles most frequently cited by survey respondents from the industry. Categorization of job roles is adapted from the O*NET labour market information system (please see Appendix A: Report Methodology for details).
Country/Region Profiles

1 Factors determining job location decisions
The first section of each Country/Region Profile provides an overview of the factors determining job location decisions at a global level for companies operating in the country or region. On the one hand, policy-makers may use the information provided to benchmark the country on the priority factors identified by each industry to determine opportunities for the country to build up its future talent pool in a targeted manner. On the other hand, the information provided might also prove useful to evaluate the potential risk posed by new technologies and shifting comparative advantage that might affect future company and industry location decisions in relation to the country. For a more detailed discussion of this issue, please refer to the The Future of Jobs across Regions section in Part 1 of the report.

2 Technology adoption
This bar chart represents the share of survey respondents from companies operating in the country in question who indicated that, by 2022, their company was “likely” or “very likely” (on a 5-point scale) to have adopted the stated technology as part of its growth strategy. For a more detailed discussion of each technology, please refer to the Strategic Drivers of New Business Models section in Part 1 of the report.

3 Emerging job roles
This table provides an overview of job roles expected to experience an increase in demand across the country over the 2018–2022 period. The individual job roles listed are for illustrative purposes and report the job roles most frequently cited by survey respondents from companies operating in the country. Categorization of job roles is adapted from the O*NET labour market information system (please see Appendix A: Report Methodology for details).

4 Average reskilling needs
The first section of the second page of the Country/Region Profile highlights the expected reskilling needs over the 2018–2022 period across the country. The diagram represents the distribution of the country’s workforce according to the expected average timeframe required to retrain or upskill affected workers—either in order to equip the country’s workforce with the skills needed to seize new opportunities created by the trends and disruptions expected to affect businesses operating in the country in question, or in order to avoid losing competitiveness due to the obsolescence of the workforce’s existing skillsets. For a more detailed discussion of expected reskilling needs, please refer to the The Reskilling Imperative section in Part 1 of the report.

5 Responses to shifting skills needs
This stacked bar chart is a diagrammatic representation of the share of survey respondents from companies operating in the country in question who indicated that, by 2022, their company was either “likely” or “very likely” (on a 5-point scale) to have implemented the stated response measure to shifting skills needs within its industry, that their company was yet “undecided” about introducing the response measure in question, or who questioned the need for introducing the stated response measure and therefore indicated that their company was “unlikely” or “very unlikely” (on a 5-point scale) to adopt it. The stacked bars are ordered by the overall proportion of survey respondents from companies operating in the country who considered introduction of the respective response measures “likely” or “very likely”—providing a sense of the total shifting skills needs response profile across companies operating in the country. Underlying responses have been rounded and may therefore not exactly add up to 100%. For a more detailed discussion of expected
reskilling response strategies, please refer to the The Reskilling Imperative section in Part 1 of the report.

**Emerging skills**

This table provides an outlook on the expected evolution of workforce skills demand over the 2018–2022 period across the country. The individual skills listed are for illustrative purposes and report the skills most frequently cited by survey respondents from companies operating in the country. Categorization of skills is adapted from the O*NET labour market information system. For a detailed description of each skill, please see Table A1 in the Appendix A: Report Methodology section in v of the report.

**Projected use of training providers**

This bar chart represents the share of survey respondents from companies operating in the country who expect their company to make use of the stated education and training provider(s) over the 2018–2022 period to deliver reskilling and upskilling opportunities to their current workforce. For a more detailed discussion of companies’ retraining and upskilling intentions, please refer to The Reskilling Imperative section in Part 1 of the report.
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Industry Profiles
Industry Profile

Automotive, Aerospace, Supply Chain & Transport

Trends driving industry growth

1. Increasing adoption of new technology
2. Advances in artificial intelligence
3. Increasing availability of big data
4. Shifts in national economic growth
5. Advances in new energy supplies and technologies
6. Advances in mobile internet
7. Advances in cloud technology
8. Expansion of affluence in developing economies
9. Advances in computing power
10. Advances in devices bridging the human-machine divide

Technology adoption in industry (share of companies surveyed)

- Machine learning: 87%
- User and entity big data analytics: 84%
- Internet of things: 82%
- Cloud computing: 76%
- App- and web-enabled markets: 76%
- Autonomous transport: 74%
- New materials: 71%
- Augmented and virtual reality: 71%
- Digital trade: 68%
- Wearable electronics: 61%
- 3D printing: 61%
- Encryption: 56%
- Stationary robots: 53%
- Non-humanoid land robots: 42%
- Distributed ledger (blockchain): 32%
- Quantum computing: 29%
- Humanoid robots: 29%
- Biotechnology: 18%
- Aerial and underwater robots: 18%

Expected impact on workforce (share of companies surveyed)

- Modify value chain: 82%
- Expand task-specialized contractors: 52%
- Expand the workforce: 50%
- Reduce workforce due to automation: 48%
- Modify locations of operation: 42%
- Bring financing on-board for transition: 38%
- Expand workforce due to automation: 20%

Barriers to adoption of new technologies (share of companies surveyed)

- Skills gaps, local labour market: 59%
- Don’t understand opportunities: 59%
- Skills gaps, leadership: 41%
- Shortage of investment capital: 36%
- Lack of flexibility, hiring and firing: 28%
Industry Profile

Automotive, Aerospace, Supply Chain & Transport

Projected adaptation partners

- Specialized departments in my firm: 84%
- Professional services firms: 71%
- Industry associations: 66%

Average reskilling needs (share of workforce)

- Less than 1 month: 13%
- 1 to 3 months: 11%
- 6 to 12 months: 11%
- Over 1 year: 12%
- No reskilling needed: 45%

Augmentation of key job tasks in 2018 and 2022 (share of task hours)

1. Communicating and interacting
   - Human: 17%
   - Machine: 25%

2. Performing complex and technical activities
   - Human: 21%
   - Machine: 36%

3. Performing physical and manual work activities
   - Human: 31%
   - Machine: 48%

Workforce in 2018 and 2022

EMERGING: 8% in 2018, 21% in 2022
- Data Analysts and Scientists
- AI and Machine Learning Specialists
- Process Automation Specialists
- Software and Applications Developers and Analysts
- Innovation Professionals
- Sales and Marketing Professionals
- Service and Solutions Designers
- Product Managers
- Industrial and Production Engineers
- Supply Chain and Logistics Specialists

DECLINING: 41% in 2018, 26% in 2022
- Assembly and Factory Workers
- Data Entry Clerks
- Client Information and Customer Service Workers
- Accountants and Auditors
- Accounting, Bookkeeping and Payroll Clerks
- Administrative and Executive Secretaries
- Transportation Attendants and Conductors
- Material-Recording and Stock-Keeping Clerks
- General and Operations Managers
- Business Services and Administration Managers
Industry Profile

Aviation, Travel & Tourism

### Trends driving industry growth

1. Advances in mobile internet
2. Increasing adoption of new technology
3. Expansion of affluence in developing economies
4. Advances in artificial intelligence
5. Expansion of the middle classes
6. Expansion of education
7. Increasing availability of big data
8. Increasing frequency of new working arrangements
9. Shifts in national economic growth
10. Advances in cloud technology

### Technology adoption in industry (share of companies surveyed)

<table>
<thead>
<tr>
<th>Technology</th>
<th>Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internet of things</td>
<td>95%</td>
</tr>
<tr>
<td>App- and web-enabled markets</td>
<td>95%</td>
</tr>
<tr>
<td>User and entity big data analytics</td>
<td>89%</td>
</tr>
<tr>
<td>Machine learning</td>
<td>79%</td>
</tr>
<tr>
<td>Cloud computing</td>
<td>79%</td>
</tr>
<tr>
<td>Digital trade</td>
<td>68%</td>
</tr>
<tr>
<td>Augmented and virtual reality</td>
<td>68%</td>
</tr>
<tr>
<td>Autonomous transport</td>
<td>58%</td>
</tr>
<tr>
<td>Wearable electronics</td>
<td>53%</td>
</tr>
<tr>
<td>Encryption</td>
<td>53%</td>
</tr>
<tr>
<td>Stationary robots</td>
<td>37%</td>
</tr>
<tr>
<td>Distributed ledger (blockchain)</td>
<td>37%</td>
</tr>
<tr>
<td>Quantum computing</td>
<td>32%</td>
</tr>
<tr>
<td>New materials</td>
<td>32%</td>
</tr>
<tr>
<td>Non-humanoid land robots</td>
<td>26%</td>
</tr>
<tr>
<td>Humanoid robots</td>
<td>26%</td>
</tr>
<tr>
<td>3D printing</td>
<td>21%</td>
</tr>
<tr>
<td>Aerial and underwater robots</td>
<td>16%</td>
</tr>
<tr>
<td>Biotechnology</td>
<td>0%</td>
</tr>
</tbody>
</table>

### Expected impact on workforce (share of companies surveyed)

<table>
<thead>
<tr>
<th>Impact</th>
<th>Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduce workforce due to automation</td>
<td>50%</td>
</tr>
<tr>
<td>Modify locations of operation</td>
<td>50%</td>
</tr>
<tr>
<td>Expand workforce due to automation</td>
<td>50%</td>
</tr>
<tr>
<td>Expand task-specialized contractors</td>
<td>50%</td>
</tr>
<tr>
<td>Modify value chain</td>
<td>44%</td>
</tr>
<tr>
<td>Expand the workforce</td>
<td>39%</td>
</tr>
<tr>
<td>Bring financing on-board for transition</td>
<td>33%</td>
</tr>
</tbody>
</table>

### Barriers to adoption of new technologies (share of companies surveyed)

- Skills gaps, local labour market: 89%
- Don't understand opportunities: 50%
- Skills gaps, leadership: 39%
- Shortage of investment capital: 39%
- Skills gaps, global labour market: 33%
Industry Profile

Aviation, Travel & Tourism

Projected adaptation partners

<table>
<thead>
<tr>
<th>Specialized departments in my firm</th>
<th>94%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry associations</td>
<td>71%</td>
</tr>
<tr>
<td>Local educational institutions</td>
<td>65%</td>
</tr>
</tbody>
</table>

Augmentation of key job tasks in 2018 and 2022 (share of task hours)

<table>
<thead>
<tr>
<th>Human</th>
<th>Machine</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td></td>
</tr>
<tr>
<td>1. Communicating and interacting</td>
<td>18%</td>
</tr>
<tr>
<td>2. Coordinating, developing, managing and advising</td>
<td>19%</td>
</tr>
<tr>
<td>3. Performing complex and technical activities</td>
<td>29%</td>
</tr>
<tr>
<td>2022</td>
<td></td>
</tr>
</tbody>
</table>

Average reskilling needs (share of workforce)

<table>
<thead>
<tr>
<th>Less than 1 month</th>
<th>13%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 to 3 months</td>
<td>13%</td>
</tr>
<tr>
<td>3 to 6 months</td>
<td>12%</td>
</tr>
<tr>
<td>Over 1 year</td>
<td>18%</td>
</tr>
<tr>
<td>No reskilling needed</td>
<td>32%</td>
</tr>
</tbody>
</table>

Workforce in 2018 and 2022

EMERGING

8% in 2018 13% in 2022

- General and Operations Managers
- Data Analysts and Scientists
- User Experience and Human-Machine Interaction Designers
- AI and Machine Learning Specialists
- Software and Applications Developers
- Sales and Marketing Professionals
- Product Managers
- Innovation Professionals
- Information Security Analysts
- Brand and Communication Specialists

DECLINING

25% in 2018 14% in 2022

- Accounting, Bookkeeping and Payroll Clerks
- Data Entry Clerks
- Administrative and Executive Secretaries
- Concierges and Hotel Desk Clerks
- Accountants and Auditors
- Sales and Purchasing Agents and Brokers
- Material-Recording and Stock-Keeping Clerks
- Financial Analysts
- Client Information and Customer Service Workers
- Cashiers and Ticket Clerks
Industry Profile

Chemistry, Advanced Materials & Biotechnology

Trends driving industry growth

1. Increasing adoption of new technology
2. Expansion of affluence in developing economies
3. Increasing availability of big data
4. Advances in new energy supplies and technologies
5. Shifts in global macroeconomic growth
6. Shifts in national economic growth
7. Advances in artificial intelligence
8. Advances in computing power
9. Expansion of the middle classes
10. Increasing urbanization

Technology adoption in industry (share of companies surveyed)

<table>
<thead>
<tr>
<th>Technology</th>
<th>Adoption Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>User and entity big data analytics</td>
<td>79%</td>
</tr>
<tr>
<td>New materials</td>
<td>79%</td>
</tr>
<tr>
<td>App- and web-enabled markets</td>
<td>71%</td>
</tr>
<tr>
<td>Cloud computing</td>
<td>67%</td>
</tr>
<tr>
<td>Digital trade</td>
<td>62%</td>
</tr>
<tr>
<td>Machine learning</td>
<td>59%</td>
</tr>
<tr>
<td>Internet of things</td>
<td>58%</td>
</tr>
<tr>
<td>3D printing</td>
<td>58%</td>
</tr>
<tr>
<td>Autonomous transport</td>
<td>54%</td>
</tr>
<tr>
<td>Stationary robots</td>
<td>50%</td>
</tr>
<tr>
<td>Augmented and virtual reality</td>
<td>50%</td>
</tr>
<tr>
<td>Wearable electronics</td>
<td>46%</td>
</tr>
<tr>
<td>Biotechnology</td>
<td>42%</td>
</tr>
<tr>
<td>Distributed ledger (blockchain)</td>
<td>29%</td>
</tr>
<tr>
<td>Quantum computing</td>
<td>25%</td>
</tr>
<tr>
<td>Encryption</td>
<td>25%</td>
</tr>
<tr>
<td>Non-humanoid land robots</td>
<td>21%</td>
</tr>
<tr>
<td>Humanoid robots</td>
<td>17%</td>
</tr>
<tr>
<td>Aerial and underwater robots</td>
<td>17%</td>
</tr>
</tbody>
</table>

Expected impact on workforce (share of companies surveyed)

<table>
<thead>
<tr>
<th>Impact</th>
<th>Impact Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modify value chain</td>
<td>71%</td>
</tr>
<tr>
<td>Modify locations of operation</td>
<td>58%</td>
</tr>
<tr>
<td>Expand task-specialized contractors</td>
<td>42%</td>
</tr>
<tr>
<td>Reduce workforce due to automation</td>
<td>38%</td>
</tr>
<tr>
<td>Expand the workforce</td>
<td>38%</td>
</tr>
<tr>
<td>Expand workforce due to automation</td>
<td>38%</td>
</tr>
<tr>
<td>Bring financing on-board for transition</td>
<td>29%</td>
</tr>
</tbody>
</table>

Barriers to adoption of new technologies (share of companies surveyed)

<table>
<thead>
<tr>
<th>Barrier</th>
<th>Barriers Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Don’t understand opportunities</td>
<td>75%</td>
</tr>
<tr>
<td>Skills gaps, local labour market</td>
<td>71%</td>
</tr>
<tr>
<td>Skills gaps, global labour market</td>
<td>50%</td>
</tr>
<tr>
<td>Skills gaps, leadership</td>
<td>46%</td>
</tr>
<tr>
<td>Lack of flexibility, hiring and firing</td>
<td>29%</td>
</tr>
</tbody>
</table>
Industry Profile

Chemistry, Advanced Materials & Biotechnology

Projected adaptation partners

- Specialized departments in my firm: 86%
- Professional services firms: 83%
- Industry associations: 65%

Average reskilling needs (share of workforce)

1. Coordinating, developing, managing and advising: 29% (2018), 28% (2022)
2. Performing complex and technical activities: 33% (2018), 37% (2022)
3. Performing physical and manual work activities: 29% (2018), 41% (2022)

Augmentation of key job tasks in 2018 and 2022 (share of task hours)

- Human: 2018 - 2022

2018: Human - 29%, Machine - 28%
2022: Human - 29%, Machine - 41%

Workforce in 2018 and 2022

- EMERGING: 10% in 2018, 19% in 2022
- DECLINING: 25% in 2018, 19% in 2022

Roles such as:
- General and Operations Managers
- AI and Machine Learning Specialists
- Sales and Marketing Professionals
- Organisational Development Specialists
- Mechanical Engineers
- Data Analysts and Scientists
- Research and Development Officers
- New Technology Specialists
- Innovation Professionals

Roles such as:
- Data Entry Clerks
- Assembly and Factory Workers
- Accounting, Bookkeeping and Payroll Clerks
- Cashiers and Ticket Clerks
- Administrative and Executive Secretaries
- Building Caretakers and Housekeepers
- Sales and Purchasing Agents and Brokers
- Financial and Investment Advisers
- Special Education Teachers
Industry Profile

Consumer

Trends driving industry growth

1. Advances in mobile internet
2. Advances in artificial intelligence
3. Shifts of mindset among the new generation
4. Increasing adoption of new technology
5. Increasing availability of big data
6. Increasing urbanization
7. Shifts in national economic growth
8. Advances in new energy supplies and technologies
9. Expansion of affluence in developing economies
10. Expansion of the middle classes

Technology adoption in industry (share of companies surveyed)

- App- and web-enabled markets: 88%
- Wearable electronics: 85%
- Machine learning: 82%
- Digital trade: 62%
- New materials: 79%
- Internet of things: 73%
- Cloud computing: 67%
- Biotechnology: 52%
- Augmented and virtual reality: 48%
- Stationary robots: 42%
- Encryption: 42%
- 3D printing: 42%
- Distributed ledger (blockchain): 39%
- Autonomous transport: 39%
- Non-humanoid land robots: 36%
- Quantum computing: 33%
- Humanoid robots: 18%
- Healthcare: 12%

Expected impact on workforce (share of companies surveyed)

- Modify value chain: 83%
- Reduce workforce due to automation: 57%
- Modify locations of operation: 54%
- Expand task-specialized contractors: 51%
- Bring financing on-board for transition: 40%
- Expand the workforce: 34%
- Expand workforce due to automation: 23%

Barriers to adoption of new technologies (share of companies surveyed)

- Don’t understand opportunities: 77%
- Skills gaps, local labour market: 57%
- Skills gaps, leadership: 57%
- Lack of flexibility, hiring and firing: 29%
- Shortage of investment capital: 26%
Industry Profile

Consumer

Projected adaptation partners

<table>
<thead>
<tr>
<th>Category</th>
<th>Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professional services firms</td>
<td>88%</td>
</tr>
<tr>
<td>Specialized departments in my firm</td>
<td>84%</td>
</tr>
<tr>
<td>Academic experts</td>
<td>53%</td>
</tr>
</tbody>
</table>

Augmentation of key job tasks in 2018 and 2022 (share of task hours)

<table>
<thead>
<tr>
<th>Task Description</th>
<th>2018</th>
<th>2022</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Communicating and interacting</td>
<td>29%</td>
<td>40%</td>
</tr>
<tr>
<td>2. Coordinating, developing, managing and advising</td>
<td>24%</td>
<td>40%</td>
</tr>
<tr>
<td>3. Performing physical and manual work activities</td>
<td>30%</td>
<td>50%</td>
</tr>
</tbody>
</table>

Average reskilling needs (share of workforce)

- Less than 1 month: 8%
- 1 to 3 months: 12%
- Over 1 year: 9%
- 3 to 6 months: 10%
- No reskilling needed: 50%

Workforce in 2018 and 2022

- **EMERGING**
  - 28% in 2022
  - Roles such as:
    - Data Analysts and Scientists
    - Sales and Marketing Professionals
    - AI and Machine Learning Specialists
    - Training and Development Specialists
    - General and Operations Managers
    - Ecommerce and Social Media Specialists
    - Organisational Development Specialists
    - New Technology Specialists
    - Information Technology Services
    - User Experience and Human-Machine Interaction Designers

- **DECLINING**
  - 22% in 2022
  - Roles such as:
    - Data Entry Clerks
    - Accounting, Bookkeeping and Payroll Clerks
    - Assembly and Factory Workers
    - Administrative and Executive Secretaries
    - Material-Recording and Stock-Keeping Clerks
    - Cashiers and Ticket Clerks
    - Postal Service Clerks
    - Garment and Related Trades Workers
    - Business Services and Administration Managers
    - Social Media Strategist
Industry Profile

Energy Utilities & Technologies

Trends driving industry growth

1. Advances in new energy supplies and technologies
2. Increasing availability of big data
3. Advances in artificial intelligence
4. Advances in cloud technology
5. Advances in computing power
6. Increasing adoption of new technology
7. Expansion of education
8. Advances in mobile internet
9. Effects of climate change
10. Expansion of affluence in developing economies

Technology adoption in industry (share of companies surveyed)

- User and entity big data analytics: 85%
- Internet of things: 85%
- Machine learning: 77%
- Cloud computing: 73%
- New materials: 65%
- Augmented and virtual reality: 65%
- App- and web-enabled markets: 65%
- Digital trade: 58%
- Distributed ledger (blockchain): 54%
- 3D printing: 54%
- Quantum computing: 46%
- Autonomous transport: 46%
- Wearable electronics: 42%
- Biotechnology: 42%
- Encryption: 38%
- Stationary robots: 35%
- Aerial and underwater robots: 35%
- Non-humanoid land robots: 27%
- Humanoid robots: 8%

Expected impact on workforce (share of companies surveyed)

- Modify value chain: 78%
- Reduce workforce due to automation: 56%
- Modify locations of operation: 52%
- Expand task-specialized contractors: 52%
- Bring financing on-board for transition: 37%
- Expand workforce due to automation: 19%
- Expand the workforce: 19%

Barriers to adoption of new technologies (share of companies surveyed)

- Don’t understand opportunities: 64%
- Skills gaps, local labour market: 60%
- Skills gaps, leadership: 40%
- Lack of flexibility, hiring and firing: 40%
- Shortage of investment capital: 28%
## Industry Profile

### Energy Utilities & Technologies

#### Projected adaptation partners

<table>
<thead>
<tr>
<th>Specialized departments in my firm</th>
<th>80%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry associations</td>
<td>76%</td>
</tr>
<tr>
<td>Professional services firms</td>
<td>62%</td>
</tr>
</tbody>
</table>

#### Average reskilling needs (share of workforce)

- Less than 1 month: 14%
- 1 to 3 months: 8%
- 3 to 6 months: 8%
- 6 to 12 months: 9%
- Over 1 year: 9%
- No reskilling needed: 51%

#### Augmentation of key job tasks in 2018 and 2022 (share of task hours)

<table>
<thead>
<tr>
<th>Human</th>
<th>Machine</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>2022</td>
</tr>
<tr>
<td>1. Coordinating, developing, managing and advising</td>
<td>15%</td>
</tr>
<tr>
<td>2. Performing complex and technical activities</td>
<td>36%</td>
</tr>
<tr>
<td>3. Performing physical and manual work activities</td>
<td>38%</td>
</tr>
</tbody>
</table>

#### Workforce in 2018 and 2022

**EMERGING**
- 16% in 2018
- 31% in 2022

**DECLINING**
- 34% in 2018
- 24% in 2022

**Roles such as:**
- Data Analysts and Scientists
- Organisational Development Specialists
- Renewable Energy Engineers
- Digital Transformation Specialists
- Big Data Specialists
- Software and Applications Developers and Analysts
- Process Automation Specialists
- AI and Machine Learning Specialists
- New Technology Specialists
- Innovation Professionals

**Roles such as:**
- Data Entry Clerks
- Mechanics and Machinery Repairers
- Accounting, Bookkeeping and Payroll Clerks
- Human Resources Specialists
- Administrative and Executive Secretaries
- Power Production Plant Operators
- Petroleum and Natural Gas Refining Plant Operators
- Material-Recording and Stock-Keeping Clerks
- Assembly and Factory Workers
- Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products

**Projected adaptation of key job tasks in 2018 and 2022 (share of task hours)**

<table>
<thead>
<tr>
<th>Human</th>
<th>Machine</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>2022</td>
</tr>
<tr>
<td>1. Coordinating, developing, managing and advising</td>
<td>15%</td>
</tr>
<tr>
<td>2. Performing complex and technical activities</td>
<td>36%</td>
</tr>
<tr>
<td>3. Performing physical and manual work activities</td>
<td>38%</td>
</tr>
</tbody>
</table>
Industry Profile

Financial Services & Investors

Trends driving industry growth

1. Advances in mobile internet
2. Increasing availability of big data
3. Increasing adoption of new technology
4. Advances in artificial intelligence
5. Advances in cloud technology
6. Advances in computing power
7. Expansion of affluence in developing economies
8. Expansion of education
9. Expansion of the middle classes
10. Shifts of mindset among the new generation

Technology adoption in industry (share of companies surveyed)

- App- and web-enabled markets: 89%
- User and entity big data analytics: 86%
- Machine learning: 73%
- Encryption: 73%
- Distributed ledger (blockchain): 73%
- Digital trade: 70%
- Internet of things: 65%
- Cloud computing: 65%
- Augmented and virtual reality: 59%
- Wearable electronics: 49%
- Quantum computing: 43%
- Humanoid robots: 35%
- Non-humanoid land robots: 32%
- Stationary robots: 27%
- New materials: 22%
- 3D printing: 19%
- Autonomous transport: 16%
- Biotechnology: 11%
- Aerial and underwater robots: 5%

Expected impact on workforce (share of companies surveyed)

- Modify locations of operation: 67%
- Reduce workforce due to automation: 56%
- Modify value chain: 56%
- Expand task-specialized contractors: 44%
- Expand the workforce: 31%
- Bring financing on-board for transition: 31%
- Expand workforce due to automation: 25%

Barriers to adoption of new technologies (share of companies surveyed)

- Skills gaps, local labour market: 74%
- Don't understand opportunities: 51%
- Skills gaps, leadership: 43%
- Skills gaps, global labour market: 37%
- Lack of flexibility, hiring and firing: 29%
Industry Profile

Financial Services & Investors

Projected adaptation partners

- Specialized departments in my firm: 79%
- Professional services firms: 76%
- Industry associations: 73%

Average reskilling needs (share of workforce)

Augmentation of key job tasks in 2018 and 2022 (share of task hours)

1. Administering: Human: 36%, Machine: 61%
3. Information and data processing: Human: 51%, Machine: 64%

Workforce in 2018 and 2022

**EMERGING**
- 15% in 2018
- 29% in 2022

Roles such as:
- Data Analysts and Scientists
- AI and Machine Learning Specialists
- User Experience and Human-Machine Interaction Designers
- Digital Transformation Specialists
- Sales and Marketing Professionals
- Client Information and Customer Service Workers
- Innovation Professionals
- Information Technology Services
- Information Security Analysts
- General and Operations Managers

**DECLINING**
- 30% in 2018
- 19% in 2022

Roles such as:
- Data Entry Clerks
- Administrative and Executive Secretaries
- Accounting, Bookkeeping and Payroll Clerks
- Business Services and Administration Managers
- Bank Tellers and Related Clerks
- Management and Organization Analysts
- Financial Analysts
- Postal Service Clerks
- Credit and Loans Officers
- Accountants and Auditors

Average reskilling needs (share of workforce)

Less than 1 month: 13%
1 to 3 months: 9%
3 to 6 months: 10%
No reskilling needed: 44%

1 to 3 months: 9%
3 to 6 months: 10%
No reskilling needed: 44%
Industry Profile

Global Health & Healthcare

Trends driving industry growth

1. Increasingly ageing societies
2. Advances in artificial intelligence
3. Expansion of affluence in developing economies
4. Expansion of the middle classes
5. Increasing adoption of new technology
6. Increasing availability of big data
7. Shifts in global macroeconomic growth
8. Shifts in national economic growth
9. Advances in mobile internet
10. Expansion of education

Technology adoption in industry (share of companies surveyed)

- User and entity big data analytics: 87%
- Biotechnology: 87%
- Machine learning: 80%
- App- and web-enabled markets: 80%
- Wearable electronics: 73%
- Cloud computing: 73%
- Internet of things: 67%
- Encryption: 67%
- Distributed ledger (blockchain): 67%
- Augmented and virtual reality: 67%
- New materials: 60%
- Digital trade: 53%
- 3D printing: 53%
- Stationary robots: 47%
- Non-humanoid land robots: 40%
- Quantum computing: 33%
- Autonomous transport: 20%
- Humanoid robots: 13%
- Aerial and underwater robots: 0%

Expected impact on workforce (share of companies surveyed)

- Modify locations of operation: 73%
- Modify value chain: 67%
- Reduce workforce due to automation: 47%
- Expand task-specialized contractors: 33%
- Expand the workforce: 27%
- Expand workforce due to automation: 20%
- Bring financing on-board for transition: 20%

Barriers to adoption of new technologies (share of companies surveyed)

- Don’t understand opportunities: 80%
- Skills gaps, leadership: 73%
- Skills gaps, local labour market: 60%
- Shortage of investment capital: 40%
- Other (Please specify): 20%
## Industry Profile

### Global Health & Healthcare

**Projected adaptation partners**

<table>
<thead>
<tr>
<th>Role</th>
<th>2018</th>
<th>2022</th>
</tr>
</thead>
<tbody>
<tr>
<td>Professional services firms</td>
<td>93%</td>
<td></td>
</tr>
<tr>
<td>Specialized departments in my firm</td>
<td>93%</td>
<td></td>
</tr>
<tr>
<td>Academic experts</td>
<td>67%</td>
<td></td>
</tr>
</tbody>
</table>

**Average reskilling needs (share of workforce)**

- Less than 1 month: 11% in 2018, 17% in 2022
- 1 to 3 months: 15% in 2018, 33% in 2022
- 3 to 6 months: 12% in 2018, 21% in 2022
- No reskilling needed: 41% in 2018, 21% in 2022

**Augmentation of key job tasks in 2018 and 2022 (share of task hours)**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Communicating and interacting</td>
<td>26%</td>
<td>31%</td>
<td>26%</td>
<td>39%</td>
</tr>
<tr>
<td>2. Coordinating, developing, managing and advising</td>
<td>23%</td>
<td>24%</td>
<td>23%</td>
<td>26%</td>
</tr>
<tr>
<td>3. Performing complex and technical activities</td>
<td>26%</td>
<td>33%</td>
<td>26%</td>
<td>39%</td>
</tr>
</tbody>
</table>

**Workforce in 2018 and 2022**

- **EMERGING**
  - 8% in 2018
  - 17% in 2022
  - Roles such as:
    - Data Analysts and Scientists
    - Biologists and Geneticists
    - AI and Machine Learning Specialists
    - Information Technology Services
    - Environmental and Occupational Health and Hygiene Professionals
    - Big Data Specialists
    - Administrative and Executive Secretaries
    - Supply Chain and Logistics Specialists
    - Specialist Medical Practitioners

- **DECLINING**
  - 33% in 2018
  - 21% in 2022
  - Roles such as:
    - Data Entry Clerks
    - Assembly and Factory Workers
    - Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products
    - Postal Service Clerks
    - Electronics and Telecommunications Installers and Repairers
    - Client Information and Customer Service Workers
    - Business Services and Administration Managers
    - Accounting, Bookkeeping and Payroll Clerks
    - Accountants and Auditors
    - Traditional and Complementary Medicine Professionals
Industry Profile

Information & Communication Technologies

Trends driving industry growth

1. Increasing adoption of new technology
2. Advances in cloud technology
3. Increasing availability of big data
4. Advances in mobile internet
5. Advances in computing power
6. Advances in artificial intelligence
7. Advances in devices bridging the human-machine divide
8. Expansion of affluence in developing economies
9. Expansion of education
10. Advances in new energy supplies and technologies

Technology adoption in industry (share of companies surveyed)

- User and entity big data analytics: 93%
- App- and web-enabled markets: 93%
- Machine learning: 91%
- Cloud computing: 91%
- Internet of things: 86%
- Augmented and virtual reality: 72%
- Digital trade: 70%
- Encryption: 67%
- Distributed ledger (blockchain): 67%
- Wearable electronics: 49%
- Quantum computing: 44%
- Autonomous transport: 44%
- Non-humanoid land robots: 37%
- Stationary robots: 35%
- 3D printing: 35%
- Humanoid robots: 33%
- New materials: 30%
- Biotechnology: 23%
- Aerial and underwater robots: 19%

Expected impact on workforce (share of companies surveyed)

- Expand task-specialized contractors: 57%
- Reduce workforce due to automation: 55%
- Modify value chain: 55%
- Modify locations of operation: 55%
- Expand workforce due to automation: 52%
- Expand the workforce: 41%
- Bring financing on-board for transition: 34%

Barriers to adoption of new technologies (share of companies surveyed)

- Skills gaps, local labour market: 74%
- Don’t understand opportunities: 58%
- Skills gaps, leadership: 49%
- Skills gaps, global labour market: 40%
- Lack of flexibility, hiring and firing: 30%
Industry Profile

Information & Communication Technologies

Projected adaptation partners

- Specialized departments in my firm: 88%
- Professional services firms: 69%
- International educational institutions: 64%

Augmentation of key job tasks in 2018 and 2022 (share of task hours)

1. Administering
   - Human: 57%
   - Machine: 39%
2. Communicating and interacting
   - Human: 52%
   - Machine: 48%
3. Performing complex and technical activities
   - Human: 46%
   - Machine: 25%

Average reskilling needs (share of workforce)

- Less than 1 month: 12%
- 1 to 3 months: 10%
- 3 to 6 months: 10%
- Over 1 year: 12%
- No reskilling needed: 50%

Workforce in 2018 and 2022

EMERGING
- 17% in 2018
- 33% in 2022

Roles such as:
- Data Analysts and Scientists
- AI and Machine Learning Specialists
- Big Data Specialists
- Software and Applications Developers and Analysts
- Innovation Professionals
- Information Security Analysts
- New Technology Specialists
- Blockchain Specialists
- User Experience and Human-Machine Interaction Designers
- Sales and Marketing Professionals

DECLINING
- 34% in 2018
- 24% in 2022

Roles such as:
- Data Entry Clerks
- Administrative and Executive Secretaries
- ICT Operations and User Support Technicians
- Accounting, Bookkeeping and Payroll Clerks
- Client Information and Customer Service Workers
- Business Services and Administration Managers
- Assembly and Factory Workers
- Material-Recording and Stock-Keeping Clerks
- Human Resources Specialists
- Electronics and Telecommunications Installers and Repairers

The Future of Jobs Report 2018
Industry Profile

Infrastructure

Trends driving industry growth

1. Increasing urbanization
2. Increasing availability of big data
3. Advances in new energy supplies and technologies
4. Expansion of the middle classes
5. Shifts in national economic growth
6. Advances in artificial intelligence
7. Expansion of affluence in developing economies
8. Advances in cloud technology
9. Shifts in global macroeconomic growth
10. Advances in devices bridging the human-machine divide

Technology adoption in industry (share of companies surveyed)

- New materials: 82%
- Internet of things: 76%
- Cloud computing: 71%
- User and entity big data analytics: 65%
- Augmented and virtual reality: 59%
- Machine learning: 53%
- App- and web-enabled markets: 53%
- Digital trade: 47%
- Encryption: 41%
- Autonomous transport: 41%
- 3D printing: 41%
- Stationary robots: 35%
- Non-humanoid land robots: 29%
- Aerial and underwater robots: 29%
- Wearable electronics: 24%
- Quantum computing: 24%
- Distributed ledger (blockchain): 18%
- Humanoid robots: 12%
- Biotechnology: 12%

Expected impact on workforce (share of companies surveyed)

- Modify value chain: 78%
- Expand task-specialized contractors: 56%
- Bring financing on-board for transition: 56%
- Reduce workforce due to automation: 33%
- Modify locations of operation: 28%
- Expand the workforce: 28%
- Expand workforce due to automation: 22%

Barriers to adoption of new technologies (share of companies surveyed)

- Skills gaps, local labour market: 59%
- Skills gaps, leadership: 59%
- Don’t understand opportunities: 47%
- Shortage of investment capital: 35%
- No interest among leadership: 29%
Industry Profile

Infrastructure

Projected adaptation partners

<table>
<thead>
<tr>
<th>Specialized departments in my firm</th>
<th>82%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry associations</td>
<td>73%</td>
</tr>
<tr>
<td>Professional services firms</td>
<td>71%</td>
</tr>
</tbody>
</table>

Average reskilling needs (share of workforce)

Augmentation of key job tasks in 2018 and 2022 (share of task hours)

- **1. Administering**
  - 2018: Human 46%, Machine 54%
  - 2022: Human 56%, Machine 44%
- **2. Communicating and interacting**
  - 2018: Human 29%, Machine 71%
  - 2022: Human 39%, Machine 61%
- **3. Performing complex and technical activities**
  - 2018: Human 34%, Machine 66%
  - 2022: Human 39%, Machine 61%

Workforce in 2018 and 2022

**EMERGING**

- **16% in 2018**
  - Roles such as:
    - Robotics Specialists and Engineers
    - Data Analysts and Scientists
    - Software and Applications Developers and Analysts
    - Sales and Marketing Professionals
    - Product Managers
    - Organisational Development Specialists
    - Information Security Analysts
    - Big Data Specialists
    - Process Automation Specialists
    - User Experience and Human-Machine Interaction Designers

- **19% in 2022**

**DECLINING**

- **38% in 2018**
  - Roles such as:
    - Data Entry Clerks
    - Assembly and Factory Workers
    - Administrative and Executive Secretaries
    - Accounting, Bookkeeping and Payroll Clerks
    - Mechanics and Machinery Repairers
    - General and Operations Managers
    - Electronics and Telecommunications Installers and Repairers
    - Credit and Loans Officers
    - Client Information and Customer Service Workers
    - Civil Engineers

- **30% in 2022**
Industry Profile

Mining & Metals

Trends driving industry growth

1. Increasing adoption of new technology
2. Advances in devices bridging the human-machine divide
3. Advances in new energy supplies and technologies
4. Advances in artificial intelligence
5. Shifts in national economic growth
6. Expansion of education
7. Expansion of gender parity
8. Increasing availability of big data
9. Shifts in global macroeconomic growth
10. Advances in cloud technology

Technology adoption in industry (share of companies surveyed)

- Machine learning: 69%
- User and entity big data analytics: 62%
- New materials: 62%
- Cloud computing: 62%
- Augmented and virtual reality: 62%
- Internet of things: 50%
- Digital trade: 50%
- Autonomous transport: 50%
- App- and web-enabled markets: 50%
- 3D printing: 50%
- Biotechnology: 44%
- Stationary robots: 38%
- Distributed ledger (blockchain): 38%
- Wearable electronics: 25%
- Non-humanoid land robots: 25%
- Humanoid robots: 25%
- Encryption: 25%
- Aerial and underwater robots: 25%
- Quantum computing: 19%

Expected impact on workforce (share of companies surveyed)

- Reduce workforce due to automation: 72%
- Expand task-specialized contractors: 56%
- Modify value chain: 44%
- Modify locations of operation: 44%
- Expand workforce due to automation: 33%
- Expand the workforce: 22%
- Bring financing on-board for transition: 22%

Barriers to adoption of new technologies (share of companies surveyed)

- Skills gaps, local labour market: 67%
- Don't understand opportunities: 61%
- Skills gaps, leadership: 56%
- Shortage of investment capital: 39%
- Lack of flexibility, hiring and firing: 39%
Industry Profile

Mining & Metals

Projected adaptation partners

- Specialized departments in my firm: 94%
- Professional services firms: 88%
- Industry associations: 80%

Average reskilling needs (share of workforce)

Augmentation of key job tasks in 2018 and 2022 (share of task hours)

1. Administering
   - Human: 38%
   - Machine: 42%

2. Communicating and interacting
   - Human: 27%
   - Machine: 32%

3. Performing physical and manual work activities
   - Human: 39%
   - Machine: 45%

Workforce in 2018 and 2022

- EMERGING: 15% in 2018, 22% in 2022
  - Roles such as:
    - Sales and Marketing Professionals
    - New Technology Specialists
    - General and Operations Managers
    - Data Analysts and Scientists
    - Process Automation Specialists
    - Organisational Development Specialists
    - Big Data Specialists
    - AI and Machine Learning Specialists
    - Systems Engineers
    - Supply Chain and Logistics Specialists

- DECLINING: 40% in 2018, 32% in 2022
  - Roles such as:
    - Mining and Petroleum Plant Operators
    - Accounting, Bookkeeping and Payroll Clerks
    - Mining and Petroleum Extraction Workers
    - Business Services and Administration Managers
    - Mechanics and Machinery Repairers
    - Management and Organization Analysts
    - Locomotive Engine Drivers and Related Workers
    - Heavy Truck and Bus Drivers
    - Data Analysts and Scientists
    - Assembly and Factory Workers
Industry Profile

Oil & Gas

Trends driving industry growth

1. Advances in cloud technology
2. Advances in computing power
3. Increasing availability of big data
4. Increasing adoption of new technology
5. Advances in artificial intelligence
6. Advances in new energy supplies and technologies
7. Shifts in national economic growth
8. Advances in mobile internet
9. Expansion of education
10. Expansion of gender parity

Technology adoption in industry (share of companies surveyed)

- User and entity big data analytics: 87%
- New materials: 83%
- Internet of things: 83%
- Cloud computing: 78%
- Wearable electronics: 70%
- Machine learning: 70%
- Augmented and virtual reality: 65%
- App- and web-enabled markets: 61%
- Encryption: 57%
- Digital trade: 57%
- 3D printing: 57%
- Stationary robots: 52%
- Aerial and underwater robots: 52%
- Distributed ledger (blockchain): 48%
- Quantum computing: 43%
- Biotechnology: 39%
- Non-humanoid land robots: 30%
- Autonomous transport: 30%
- Humanoid robots: 13%

Expected impact on workforce (share of companies surveyed)

- Modify value chain: 87%
- Modify locations of operation: 57%
- Reduce workforce due to automation: 52%
- Expand task-specialized contractors: 52%
- Expand the workforce: 35%
- Bring financing on-board for transition: 30%
- Expand workforce due to automation: 26%

Barriers to adoption of new technologies (share of companies surveyed)

- Don’t understand opportunities: 61%
- Skills gaps, local labour market: 57%
- Skills gaps, leadership: 52%
- Lack of flexibility, hiring and firing: 43%
- Skills gaps, global labour market: 39%

The Future of Jobs Report 2018
## Industry Profile

### Oil & Gas

#### Projected adaptation partners
- Specialized departments in my firm: 91%
- Industry associations: 87%
- Professional services firms: 74%

#### Average reskilling needs (share of workforce)

#### Augmentation of key job tasks in 2018 and 2022 (share of task hours)

1. Communicating and interacting: 24% human, 23% machine
2. Performing complex and technical activities: 46% human, 38% machine
3. Performing physical and manual work activities: 30% human, 38% machine

#### Workforce in 2018 and 2022

**EMERGING**
- 17% in 2018
- 26% in 2022

**DECLINING**
- 27% in 2018
- 24% in 2022

**Roles such as:**
- Data Analysts and Scientists
- Big Data Specialists
- Robotics Specialists and Engineers
- Renewable Energy Engineers
- Process Automation Specialists
- Organisational Development Specialists
- New Technology Specialists
- Information Technology Services
- Digital Transformation Specialists
- Scrum Masters

**Roles such as:**
- Data Entry Clerks
- Accounting, Bookkeeping and Payroll Clerks
- Petroleum and Natural Gas Refining Plant Operators
- Mechanics and Machinery Repairers
- Material-Recording and Stock-Keeping Clerks
- Administrative and Executive Secretaries
- Power Production Plant Operators
- Mining and Petroleum Plant Operators
- Printing and Related Trades Workers
- ICT Operations and User Support Technicians
Industry Profile

Professional Services

Trends driving industry growth

1. Increasing adoption of new technology
2. Advances in artificial intelligence
3. Increasing availability of big data
4. Advances in cloud technology
5. Advances in mobile internet
6. Expansion of education
7. Shifts in national economic growth
8. Expansion of affluence in developing economies
9. Increasing frequency of new working arrangements
10. Shifts of mindset among the new generation

Technology adoption in industry (share of companies surveyed)

- User and entity big data analytics: 85%
- Cloud computing: 76%
- Machine learning: 74%
- Internet of things: 74%
- App- and web-enabled markets: 74%
- Digital trade: 59%
- Encryption: 53%
- Augmented and virtual reality: 53%
- Distributed ledger (blockchain): 50%
- Quantum computing: 41%
- New materials: 41%
- Autonomous transport: 41%
- Wearable electronics: 35%
- Stationary robots: 29%
- 3D printing: 29%
- Non-humanoid land robots: 24%
- Humanoid robots: 24%
- Biotechnology: 24%
- Aerial and underwater robots: 21%

Expected impact on workforce (share of companies surveyed)

- Expand the workforce: 71%
- Modify value chain: 60%
- Expand workforce due to automation: 57%
- Modify locations of operation: 54%
- Expand task-specialized contractors: 51%
- Reduce workforce due to automation: 37%
- Bring financing on-board for transition: 37%

Barriers to adoption of new technologies (share of companies surveyed)

- Skills gaps, local labour market: 65%
- Don't understand opportunities: 59%
- Skills gaps, leadership: 38%
- Shortage of investment capital: 38%
- Lack of flexibility, hiring and firing: 29%
Industry Profile

Professional Services

Projected adaptation partners

- Specialized departments in my firm: 82%
- Professional services firms: 67%
- Industry associations: 66%

Average reskilling needs (share of workforce)

Augmentation of key job tasks in 2018 and 2022 (share of task hours)

- Communicating and interacting: 2018 - Human: 30%, Machine: 28%  
  2022 - Human: 40%, Machine: 29%
  2022 - Human: 29%, Machine: 38%
- Reasoning and decision-making: 2018 - Human: 26%, Machine: 26%  
  2022 - Human: 29%, Machine: 29%

Workforce in 2018 and 2022

- EMERGING: 17% in 2018, 37% in 2022
  Roles such as:
  - Digital Transformation Specialists
  - Regulatory and Government Associate Professionals
  - Organisational Development Specialists
  - Data Analysts and Scientists
  - Contract-Workforce Managers
  - Training and Development Specialists
  - Process Automation Specialists
  - Innovation Professionals
  - Information Technology Services

- DECLINING: 36% in 2018, 18% in 2022
  Roles such as:
  - Accounting, Bookkeeping and Payroll Clerks
  - Data Entry Clerks
  - Administrative and Executive Secretaries
  - Material-Recording and Stock-Keeping Clerks
  - Client Information and Customer Service Workers
  - Accountants and Auditors
  - Telemarketers
  - Postal Service Clerks
  - Car, Van and Motorcycle Drivers

Average reskilling needs (share of workforce)

- Less than 1 month: 12%
- 1 to 3 months: 10%
- 3 to 6 months: 10%
- 6 to 12 months: 9%
- Over 1 year: 10%
- No reskilling needed: 50%
## Country Profile
### Argentina

### Factors determining job location decisions

<table>
<thead>
<tr>
<th>Industry</th>
<th>Primary</th>
<th>Secondary</th>
<th>Tertiary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automotive, Aerospace, Supply Chain &amp; Transport</td>
<td>Production cost</td>
<td>Labour cost</td>
<td>Talent availability</td>
</tr>
<tr>
<td>Aviation, Travel &amp; Tourism</td>
<td>Talent availability</td>
<td>Ease of importing talent</td>
<td>Organization HQ</td>
</tr>
<tr>
<td>Chemistry, Advanced Materials &amp; Biotechnology</td>
<td>Talent availability</td>
<td>Labour cost</td>
<td>Production cost</td>
</tr>
<tr>
<td>Consumer</td>
<td>Labour cost</td>
<td>Talent availability</td>
<td>Quality of the supply chain</td>
</tr>
<tr>
<td>Energy Utilities &amp; Technologies</td>
<td>Talent availability</td>
<td>Production cost</td>
<td>Organization HQ</td>
</tr>
<tr>
<td>Financial Services &amp; Investors</td>
<td>Talent availability</td>
<td>Organization HQ</td>
<td>Labour cost</td>
</tr>
<tr>
<td>Global Health &amp; Healthcare</td>
<td>Talent availability</td>
<td>Labour cost</td>
<td>Production cost</td>
</tr>
<tr>
<td>Information &amp; Communication Technologies</td>
<td>Talent availability</td>
<td>Labour cost</td>
<td>Geographic concentration</td>
</tr>
<tr>
<td>Oil &amp; Gas</td>
<td>Production cost</td>
<td>Talent availability</td>
<td>Organization HQ</td>
</tr>
<tr>
<td>Professional Services</td>
<td>Talent availability</td>
<td>Labour cost</td>
<td>Strong local education provision</td>
</tr>
</tbody>
</table>

**Range of options:** Flexibility of labour laws, Geographic spread, Quality of the supply chain, Ease of importing talent, Labour cost, Location of raw materials, Organization HQ, Production cost, Strong local education provision, Talent availability.

### Emerging job roles

- Software and Applications Developers and Analysts
- Managing Directors and Chief Executives
- Data Analysts and Scientists
- Sales and Marketing Professionals
- General and Operations Managers
- Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products
- Assembly and Factory Workers
- Financial and Investment Advisers
- Database and Network Professionals
- Human Resources Specialists

### Technology adoption (share of companies surveyed)

<table>
<thead>
<tr>
<th>Industry</th>
<th>User and entity big data analytics</th>
<th>App- and web-enabled markets</th>
<th>Machine learning</th>
<th>Internet of things</th>
<th>Cloud computing</th>
<th>Augmented and virtual reality</th>
<th>Digital trade</th>
<th>New materials</th>
<th>Encryption</th>
<th>Autonomous transport</th>
<th>Wearable electronics</th>
<th>Distributed ledger (blockchain)</th>
<th>3D printing</th>
<th>Stationary robots</th>
<th>Quantum computing</th>
<th>Non-humanoid land robots</th>
<th>Biotechnology</th>
<th>Aerial and underwater robots</th>
<th>Humanoid robots</th>
</tr>
</thead>
</table>
Country Profile
Argentina

Average reskilling needs (share of workforce)

- Less than 1 month ..........13%
- 1 to 3 months ..............13%
- 3 to 6 months ..............10%
- 6 to 12 months ............ 9%
- Over 1 year ................. 9%
- No reskilling needed .......47%

Responses to shifting skills needs (share of companies surveyed)

- Hire new permanent staff with skills relevant to new technologies
- Look to automate the work
- Hire new temporary staff with skills relevant to new technologies
- Retrain existing employees
- Expect existing employees to pick up skills on the job
- Hire freelancers with skills relevant to new technologies
- Outsource some business functions to external contractors
- Strategic redundancies of staff who lack the skills to use new technologies

Emerging skills
- Analytical thinking and innovation
- Creativity, originality and initiative
- Active learning and learning strategies
- Technology design and programming
- Reasoning, problem-solving and ideation
- Leadership and social influence

Critical thinking and analysis
Complex problem-solving
Resilience, stress tolerance and flexibility
Emotional intelligence

Projected use of training providers (share of training)

- Internal department 47%
- Private training providers 32%
- Private educational institutions 23%
- Public training provider 14%
- Public educational institutions 14%
### Country Profile

#### Australia

**Factors determining job location decisions**

<table>
<thead>
<tr>
<th>Industry</th>
<th>Primary</th>
<th>Secondary</th>
<th>Tertiary</th>
</tr>
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<tbody>
<tr>
<td>Automotive, Aerospace, Supply Chain &amp; Transport</td>
<td>Talent availability</td>
<td>Quality of the supply chain</td>
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</tr>
<tr>
<td>Aviation, Travel &amp; Tourism</td>
<td>Talent availability</td>
<td>Organization HQ</td>
<td>Ease of importing talent</td>
</tr>
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<td>Talent availability</td>
<td>Labour cost</td>
<td>Geographic concentration</td>
</tr>
<tr>
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<td>Talent availability</td>
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<td>Geographic concen.</td>
<td>Production cost</td>
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<td>Organization HQ</td>
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</tr>
<tr>
<td>Information &amp; Communication Technologies</td>
<td>Talent availability</td>
<td>Labour cost</td>
<td>Geographic concentration</td>
</tr>
<tr>
<td>Oil &amp; Gas</td>
<td>Production cost</td>
<td>Geographic concentration</td>
<td>Talent availability</td>
</tr>
<tr>
<td>Professional Services</td>
<td>Talent availability</td>
<td>Strong local ed. provision</td>
<td>Labour cost</td>
</tr>
</tbody>
</table>

**Range of options:** Flexibility of labour laws, Geographic spread, Quality of the supply chain, Ease of importing talent, Labour cost, Location of raw materials, Organization HQ, Production cost, Strong local education provision, Talent availability.

### Emerging job roles

- Software and Applications Developers and Analysts
- Sales and Marketing Professionals
- Managing Directors and Chief Executives
- Data Analysts and Scientists
- General and Operations Managers
- Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products
- Human Resources Specialists
- Assembly and Factory Workers
- Financial and Investment Advisers
- Business Services and Administration Managers
- Encryption
- Autonomous transport
- Distributed ledger (blockchain)
- Stationary robots
- 3D printing
- Quantum computing
- Non-humanoid land robots
- Biotechnology
- Humanoid robots
- Aerial and underwater robots
- Wearable electronics
- New materials
- Digital trade
- Oil & Gas

**Technology adoption (share of companies surveyed)**

- User and entity big data analytics: 90%
- Internet of things: 83%
- Machine learning: 82%
- App- and web-enabled markets: 81%
- Cloud computing: 72%
- Augmented and virtual reality: 71%
- Digital trade: 64%
- Wearable electronics: 59%
- New materials: 58%
- Encryption: 55%
- Autonomous transport: 54%
- Distributed ledger (blockchain): 52%
- Stationary robots: 48%
- 3D printing: 46%
- Quantum computing: 45%
- Non-humanoid land robots: 43%
- Biotechnology: 31%
- Humanoid robots: 28%
- Aerial and underwater robots: 23%
Country Profile

Australia

Average reskilling needs (share of workforce)

Emerging skills

- Creativity, originality and initiative
- Analytical thinking and innovation
- Active learning and learning strategies
- Technology design and programming
- Complex problem-solving
- Critical thinking and analysis
- Leadership and social influence
- Emotional intelligence
- Reasoning, problem-solving and ideation
- Resilience, stress tolerance and flexibility

Responses to shifting skills needs (share of companies surveyed)

- Look to automate the work: 87%
- Hire new permanent staff with skills relevant to new technologies: 84%
- Retrain existing employees: 74%
- Hire new temporary staff with skills relevant to new technologies: 73%
- Expect existing employees to pick up skills on the job: 71%
- Hire freelancers with skills relevant to new technologies: 67%
- Outsource some business functions to external contractors: 61%
- Strategic redundancies of staff who lack the skills to use new technologies: 55%

Projected use of training providers (share of training)

- Internal department: 50%
- Private training providers: 29%
- Private educational institutions: 21%
- Public educational institutions: 18%
- Public training provider: 16%

The Future of Jobs Report 2018
Country Profile
Brazil

Factors determining job location decisions

<table>
<thead>
<tr>
<th>Industry</th>
<th>Primary</th>
<th>Secondary</th>
<th>Tertiary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automotive, Aerospace, Supply Chain &amp; Transport</td>
<td>Talent availability</td>
<td>Production cost</td>
<td>Labour cost</td>
</tr>
<tr>
<td>Aviation, Travel &amp; Tourism</td>
<td>Talent availability</td>
<td>Organization HQ</td>
<td>Ease of importing talent</td>
</tr>
<tr>
<td>Chemistry, Advanced Materials &amp; Biotechnology</td>
<td>Talent availability</td>
<td>Labour cost</td>
<td>Production cost</td>
</tr>
<tr>
<td>Consumer</td>
<td>Labour cost</td>
<td>Talent availability</td>
<td>Quality of the supply chain</td>
</tr>
<tr>
<td>Energy Utilities &amp; Technologies</td>
<td>Production cost</td>
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</tr>
<tr>
<td>Financial Services &amp; Investors</td>
<td>Talent availability</td>
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<td>Organization HQ</td>
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<tr>
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<td>Talent availability</td>
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<td>Organization HQ</td>
</tr>
<tr>
<td>Oil &amp; Gas</td>
<td>Production cost</td>
<td>Talent availability</td>
<td>Organization HQ</td>
</tr>
<tr>
<td>Professional Services</td>
<td>Talent availability</td>
<td>Strong local ed. provision</td>
<td>Labour cost</td>
</tr>
</tbody>
</table>

Range of options: Flexibility of labour laws, Geographic spread, Quality of the supply chain, Ease of importing talent, Labour cost, Location of raw materials, Organization HQ, Production cost, Strong local education provision, Talent availability.

Emerging job roles

- Software and Applications Developers and Analysts
- Managing Directors and Chief Executives
- Data Analysts and Scientists
- Sales and Marketing Professionals
- General and Operations Managers
- Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products
- Human Resources Specialists
- Financial Analysts
- Database and Network Professionals
- Financial and Investment Advisers

Technology adoption (share of companies surveyed)

<table>
<thead>
<tr>
<th>Technology</th>
<th>Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>User and entity big data analytics</td>
<td>92%</td>
</tr>
<tr>
<td>App- and web-enabled markets</td>
<td>82%</td>
</tr>
<tr>
<td>Machine learning</td>
<td>79%</td>
</tr>
<tr>
<td>Internet of things</td>
<td>79%</td>
</tr>
<tr>
<td>Augmented and virtual reality</td>
<td>70%</td>
</tr>
<tr>
<td>Cloud computing</td>
<td>69%</td>
</tr>
<tr>
<td>Digital trade</td>
<td>64%</td>
</tr>
<tr>
<td>New materials</td>
<td>61%</td>
</tr>
<tr>
<td>Encryption</td>
<td>61%</td>
</tr>
<tr>
<td>Wearable electronics</td>
<td>59%</td>
</tr>
<tr>
<td>Distributed ledger (blockchain)</td>
<td>55%</td>
</tr>
<tr>
<td>Autonomous transport</td>
<td>54%</td>
</tr>
<tr>
<td>3D printing</td>
<td>49%</td>
</tr>
<tr>
<td>Stationary robots</td>
<td>44%</td>
</tr>
<tr>
<td>Non-humanoid land robots</td>
<td>42%</td>
</tr>
<tr>
<td>Quantum computing</td>
<td>41%</td>
</tr>
<tr>
<td>Biotechnology</td>
<td>32%</td>
</tr>
<tr>
<td>Aerial and underwater robots</td>
<td>27%</td>
</tr>
<tr>
<td>Humanoid robots</td>
<td>25%</td>
</tr>
</tbody>
</table>
Country Profile

Brazil

Average reskilling needs (share of workforce)

- Less than 1 month ......... 12%
- 1 to 3 months .............. 14%
- 3 to 6 months ............. 10%
- 6 to 12 months ............ 9%
- Over 1 year ................ 9%
- No reskilling needed ...... 47%

Emerging skills

- Analytical thinking and innovation
- Creativity, originality and initiative
- Active learning and learning strategies
- Technology design and programming
- Reasoning, problem-solving and ideation
- Leadership and social influence
- Critical thinking and analysis
- Complex problem-solving
- Resilience, stress tolerance and flexibility
- Emotional intelligence

Responses to shifting skills needs (share of companies surveyed)

- Hire new permanent staff with skills relevant to new technologies 88%
- Look to automate the work 86%
- Retrain existing employees 79%
- Hire new temporary staff with skills relevant to new technologies 74%
- Expect existing employees to pick up skills on the job 68%
- Hire freelancers with skills relevant to new technologies 62%
- Outsource some business functions to external contractors 61%
- Strategic redundancies of staff who lack the skills to use new technologies 54%

Projected use of training providers (share of training)

- Internal department 48%
- Private training providers 28%
- Private educational institutions 18%
- Public educational institutions 16%
- Public training provider 12%

The Future of Jobs Report 2018
## Country Profile

### China

#### Technology adoption (share of companies surveyed)

<table>
<thead>
<tr>
<th>Technology</th>
<th>Share of Companies Surveyed</th>
</tr>
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<tbody>
<tr>
<td>User and entity big data analytics</td>
<td>89%</td>
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<tr>
<td>App- and web-enabled markets</td>
<td>78%</td>
</tr>
<tr>
<td>Internet of things</td>
<td>78%</td>
</tr>
<tr>
<td>Machine learning</td>
<td>75%</td>
</tr>
<tr>
<td>Cloud computing</td>
<td>69%</td>
</tr>
<tr>
<td>Digital trade</td>
<td>60%</td>
</tr>
<tr>
<td>Augmented and virtual reality</td>
<td>60%</td>
</tr>
<tr>
<td>Encryption</td>
<td>59%</td>
</tr>
<tr>
<td>New materials</td>
<td>56%</td>
</tr>
<tr>
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<td>54%</td>
</tr>
<tr>
<td>Distributed ledger (blockchain)</td>
<td>51%</td>
</tr>
<tr>
<td>Autonomous transport</td>
<td>50%</td>
</tr>
<tr>
<td>3D printing</td>
<td>49%</td>
</tr>
<tr>
<td>Stationary robots</td>
<td>45%</td>
</tr>
<tr>
<td>Non-humanoid land robots</td>
<td>43%</td>
</tr>
<tr>
<td>Quantum computing</td>
<td>38%</td>
</tr>
<tr>
<td>Biotechnology</td>
<td>31%</td>
</tr>
<tr>
<td>Humanoid robots</td>
<td>24%</td>
</tr>
<tr>
<td>Aerial and underwater robots</td>
<td>18%</td>
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#### Emerging job roles

- **Software and Applications Developers and Analysts**
  - Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products
  - Human Resources Specialists
  - Assembly and Factory Workers
  - Financial and Investment Advisers
  - Database and Network Professionals
- **Sales and Marketing Professionals**
- **Managing Directors and Chief Executives**
- **Data Analysts and Scientists**
- **General and Operations Managers**

#### Factors determining job location decisions

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**Range of options:** Flexibility of labour laws, Geographic spread, Quality of the supply chain, Ease of importing talent, Labour cost, Location of raw materials, Organization HQ, Production cost, Strong local education provision, Talent availability.
Country Profile

China

Average reskilling needs (share of workforce)

- Less than 1 month: 12%
- 1 to 3 months: 13%
- 3 to 6 months: 9%
- 6 to 12 months: 9%
- Over 1 year: 9%
- No reskilling needed: 48%

Responses to shifting skills needs (share of companies surveyed)

- Lock to automate the work: 86%
- Hire new permanent staff with skills relevant to new technologies: 86%
- Retrain existing employees: 79%
- Hire new temporary staff with skills relevant to new technologies: 68%
- Outsource some business functions to external contractors: 65%
- Expect existing employees to pick up skills on the job: 64%
- Hire freelancers with skills relevant to new technologies: 58%
- Strategic redundancies of staff who lack the skills to use new technologies: 47%

Emerging skills

- Creativity, originality and initiative
- Analytical thinking and innovation
- Active learning and learning strategies
- Technology design and programming
- Complex problem-solving
- Critical thinking and analysis
- Emotional intelligence
- Leadership and social influence
- Systems analysis and evaluation
- Reasoning, problem-solving and ideation

Projected use of training providers (share of training)

- Internal department: 52%
- Private training providers: 28%
- Private educational institutions: 21%
- Public educational institutions: 18%
- Public training provider: 14%
Country Profile
France

Factors determining job location decisions

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Range of options: Flexibility of labour laws, Geographic spread, Quality of the supply chain, Ease of importing talent, Labour cost, Location of raw materials, Organization HQ, Production cost, Strong local education provision, Talent availability.

Emerging job roles

Managing Directors and Chief Executives
Software and Applications Developers and Analysts
Sales and Marketing Professionals
General and Operations Managers
Data Analysts and Scientists
Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products
Assembly and Factory Workers
Human Resources Specialists
Financial and Investment Advisers
Financial Analysts

Technology adoption (share of companies surveyed)

- User and entity big data analytics: 89%
- App- and web-enabled markets: 84%
- Machine learning: 79%
- Internet of things: 79%
- Cloud computing: 72%
- Augmented and virtual reality: 70%
- Digital trade: 69%
- New materials: 58%
- Encryption: 56%
- Wearable electronics: 54%
- Autonomous transport: 52%
- 3D printing: 52%
- Distributed ledger (blockchain): 49%
- Stationary robots: 44%
- Non-humanoid land robots: 41%
- Quantum computing: 39%
- Biotechnology: 32%
- Humanoid robots: 28%
- Aerial and underwater robots: 24%
Country Profile
France

Average reskilling needs (share of workforce)

- Less than 1 month ........ 11%
- 1 to 3 months .......... 12%
- 3 to 6 months .......... 9%
- 6 to 12 months .......... 9%
- Over 1 year .......... 11%
- No reskilling needed .... 48%

Responses to shifting skills needs (share of companies surveyed)

- Look to automate the work
- Hire new permanent staff with skills relevant to new technologies
- Retrain existing employees
- Hire new temporary staff with skills relevant to new technologies
- Expect existing employees to pick up skills on the job
- Hire freelancers with skills relevant to new technologies
- Outsource some business functions to external contractors
- Strategic redundancies of staff who lack the skills to use new technologies

Emerging skills

- Creativity, originality and initiative
- Analytical thinking and innovation
- Active learning and learning strategies
- Technology design and programming
- Complex problem-solving
- Critical thinking and analysis

- Leadership and social influence
- Emotional intelligence
- Reasoning, problem-solving and ideation
- Resilience, stress tolerance and flexibility

Projected use of training providers (share of training)

- Internal department .... 50%
- Private training providers .... 31%
- Private educational institutions .... 21%
- Public educational institutions .... 17%
- Public training provider .... 16%

The Future of Jobs Report 2018
Country Profile

Germany

Factors determining job location decisions

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Range of options: Flexibility of labour laws, Geographic spread, Quality of the supply chain, Ease of importing talent, Labour cost, Location of raw materials, Organization HQ, Production cost, Strong local education provision, Talent availability.

Emerging job roles

Software and Applications Developers and Analysts
Managing Directors and Chief Executives
Sales and Marketing Professionals
General and Operations Managers
Data Analysts and Scientists

Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products
Assembly and Factory Workers
Human Resources Specialists
Financial and Investment Advisers
Financial Analysts

Technology adoption (share of companies surveyed)

- User and entity big data analytics: 91%
- App- and web-enabled markets: 84%
- Machine learning: 79%
- Internet of things: 79%
- Cloud computing: 71%
- Digital trade: 69%
- Augmented and virtual reality: 68%
- New materials: 62%
- Wearable electronics: 58%
- Encryption: 56%
- 3D printing: 55%
- Distributed ledger (blockchain): 54%
- Autonomous transport: 52%
- Stationary robots: 45%
- Non-humanoid land robots: 44%
- Quantum computing: 40%
- Biotechnology: 30%
- Humanoid robots: 28%
- Aerial and underwater robots: 22%

The Future of Jobs Report 2018

Range of options: Flexibility of labour laws, Geographic spread, Quality of the supply chain, Ease of importing talent, Labour cost, Location of raw materials, Organization HQ, Production cost, Strong local education provision, Talent availability.
Country Profile

Germany

Average reskilling needs (share of workforce)

- Less than 1 month: 13%
- 1 to 3 months: 13%
- 3 to 6 months: 9%
- 6 to 12 months: 9%
- Over 1 year: 10%
- No reskilling needed: 46%

Responses to shifting skills needs (share of companies surveyed)

- Look to automate the work: 85%
- Hire new permanent staff with skills relevant to new technologies: 83%
- Retrain existing employees: 73%
- Hire new temporary staff with skills relevant to new technologies: 70%
- Expect existing employees to pick up skills on the job: 70%
- Hire freelancers with skills relevant to new technologies: 63%
- Outsource some business functions to external contractors: 60%
- Strategic redundancies of staff who lack the skills to use new technologies: 54%

Emerging skills

- Analytical thinking and innovation
- Creativity, originality and initiative
- Active learning and learning strategies
- Technology design and programming
- Critical thinking and analysis
- Complex problem-solving
- Leadership and social influence
- Emotional intelligence
- Resilience, stress tolerance and flexibility
- Systems analysis and evaluation

Projected use of training providers (share of training)

- Internal department: 47%
- Private training providers: 27%
- Private educational institutions: 19%
- Public educational institutions: 15%
- Public training provider: 13%

The Future of Jobs Report 2018
### Country Profile

#### India

**Factors determining job location decisions**

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<td>Production cost</td>
<td>Other (please specify)</td>
</tr>
<tr>
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</tr>
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**Range of options:** Flexibility of labour laws, Geographic spread, Quality of the supply chain, Ease of importing talent, Labour cost, Location of raw materials, Organization HQ, Production cost, Strong local education provision, Talent availability.

**Emerging job roles**

- Managing Directors and Chief Executives
- Sales and Marketing Professionals
- Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products
- Software and Applications Developers and Analysts
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- Data Analysts and Scientists
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- Human Resources Specialists
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### Technology adoption (share of companies surveyed)

- **User and entity big data analytics:** 89%
- **Internet of things:** 77%
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- **Augmented and virtual reality:** 63%
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- **Encryption:** 57%
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- **3D printing:** 52%
- **Autonomous transport:** 50%
- **Distributed ledger (blockchain):** 48%
- **Stationary robots:** 44%
- **Quantum computing:** 41%
- **Non-humanoid land robots:** 40%
- **Biotechnology:** 31%
- **Humanoid robots:** 27%
- **Aerial and underwater robots:** 21%
Country Profile

India

Average reskilling needs (share of workforce)

- Less than 1 month ........13%
- 1 to 3 months.............13%
- 3 to 6 months.............9%
- 6 to 12 months..........9%
- Over 1 year...............10%
- No reskilling needed......46%

Responses to shifting skills needs (share of companies surveyed)

- Look to automate the work 83%
- Retrain existing employees 79%
- Hire new permanent staff with skills relevant to new technologies 78%
- Expect existing employees to pick up skills on the job 70%
- Outsource some business functions to external contractors 67%
- Hire new temporary staff with skills relevant to new technologies 62%
- Hire freelancers with skills relevant to new technologies 56%
- Strategic redundancies of staff who lack the skills to use new technologies 51%

Emerging skills

- Analytical thinking and innovation
- Active learning and learning strategies
- Creativity, originality and initiative
- Technology design and programming
- Critical thinking and analysis
- Complex problem-solving
- Leadership and social influence
- Reasoning, problem-solving and ideation
- Emotional intelligence
- Systems analysis and evaluation

Projected use of training providers (share of training)

- Internal department 51%
- Private training providers 29%
- Private educational institutions 20%
- Public educational institutions 18%
- Public training provider 14%
Country Profile
Indonesia

Factors determining job location decisions

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<td>Ease of importing talent</td>
<td>Organization HQ</td>
</tr>
<tr>
<td>Chemistry, Advanced Materials &amp; Biotechnology</td>
<td>Talent availability</td>
<td>Labour cost</td>
<td>Geographic concentration</td>
</tr>
<tr>
<td>Consumer</td>
<td>Talent availability</td>
<td>Labour cost</td>
<td>Production cost</td>
</tr>
<tr>
<td>Energy Utilities &amp; Technologies</td>
<td>Production cost</td>
<td>Talent availability</td>
<td>Quality of the supply chain</td>
</tr>
<tr>
<td>Financial Services &amp; Investors</td>
<td>Talent availability</td>
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<td>Organization HQ</td>
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<td>Information &amp; Communication Technologies</td>
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<td>Geographic concentration</td>
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<tr>
<td>Oil &amp; Gas</td>
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<tr>
<td>Professional Services</td>
<td>Talent availability</td>
<td>Strong local ed. provision</td>
<td>Labour cost</td>
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</tbody>
</table>

Range of options: Flexibility of labour laws, Geographic spread, Quality of the supply chain, Ease of importing talent, Labour cost, Location of raw materials, Organization HQ, Production cost, Strong local education provision, Talent availability.

Emerging job roles

- Software and Applications Developers and Analysts
- Sales and Marketing Professionals
- Data Analysts and Scientists
- Managing Directors and Chief Executives
- General and Operations Managers
- Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products
- Human Resources Specialists
- Financial and Investment Advisers
- Financial Analysts
- Robotics Specialists and Engineers
- User and entity big data analytics: 92%
- Internet of things: 86%
- App- and web-enabled markets: 83%
- Machine learning: 82%
- Cloud computing: 77%
- Augmented and virtual reality: 65%
- Encryption: 61%
- Digital trade: 61%
- Wearable electronics: 58%
- Distributed ledger (blockchain): 55%
- New materials: 53%
- Quantum computing: 45%
- Autonomous transport: 45%
- 3D printing: 45%
- Stationary robots: 39%
- Non-humanoid land robots: 36%
- Biotechnology: 30%
- Humanoid robots: 27%
- Aerial and underwater robots: 20%
Country Profile

Indonesia

Average reskilling needs (share of workforce)

- Less than 1 month .......... 12%
- 1 to 3 months ............... 12%
- 3 to 6 months ............... 9%
- 6 to 12 months .............. 9%
- Over 1 year .................. 9%
- No reskilling needed ....... 50%

Responses to shifting skills needs (share of companies surveyed)

- Lock to automate the work 88%
- Hire new permanent staff with skills relevant to new technologies 87%
- Retrain existing employees 83%
- Expect existing employees to pick up skills on the job 70%
- Outsource some business functions to external contractors 65%
- Hire new temporary staff with skills relevant to new technologies 65%
- Hire freelancers with skills relevant to new technologies 60%
- Strategic redundancies of staff who lack the skills to use new technologies 52%

Emerging skills

- Creativity, originality and initiative
- Analytical thinking and innovation
- Active learning and learning strategies
- Technology design and programming
- Complex problem-solving
- Leadership and social influence
- Emotional intelligence
- Critical thinking and analysis
- Reasoning, problem-solving and ideation
- Systems analysis and evaluation

Projected use of training providers (share of training)

- Internal department 48%
- Private training providers 25%
- Private educational institutions 20%
- Public educational institutions 20%
- Public training provider 14%

The Future of Jobs Report 2018
Country Profile
Japan

Factors determining job location decisions

<table>
<thead>
<tr>
<th>Industry</th>
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</tr>
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<tbody>
<tr>
<td>Automotive, Aerospace, Supply Chain &amp; Transport</td>
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Range of options: Flexibility of labour laws, Geographic spread, Quality of the supply chain, Ease of importing talent, Labour cost, Location of raw materials, Organization HQ, Production cost, Strong local education provision, Talent availability.

Emerging job roles

Software and Applications Developers and Analysts
Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products
Managing Directors and Chief Executives
Human Resources Specialists
Data Analysts and Scientists
Financial and Investment Advisers
General and Operations Managers
Assembly and Factory Workers
Financial Analysts

Technology adoption (share of companies surveyed)

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<th>Technology</th>
<th>Share</th>
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<tbody>
<tr>
<td>User and entity big data analytics</td>
<td>87%</td>
</tr>
<tr>
<td>Internet of things</td>
<td>80%</td>
</tr>
<tr>
<td>Machine learning</td>
<td>76%</td>
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<tr>
<td>App- and web-enabled markets</td>
<td>75%</td>
</tr>
<tr>
<td>Cloud computing</td>
<td>69%</td>
</tr>
<tr>
<td>Augmented and virtual reality</td>
<td>63%</td>
</tr>
<tr>
<td>Digital trade</td>
<td>60%</td>
</tr>
<tr>
<td>Wearable electronics</td>
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<td>Humanoid robots</td>
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<tr>
<td>Aerial and underwater robots</td>
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Country Profile

Japan

Average reskilling needs (share of workforce)

- Less than 1 month: 12%
- 1 to 3 months: 13%
- 3 to 6 months: 9%
- 6 to 12 months: 9%
- Over 1 year: 10%
- No reskilling needed: 48%

Emerging skills

- Creativity, originality and initiative
- Analytical thinking and innovation
- Active learning and learning strategies
- Technology design and programming
- Critical thinking and analysis
- Complex problem-solving
- Emotional intelligence
- Leadership and social influence
- Reasoning, problem-solving and ideation
- Systems analysis and evaluation

Responses to shifting skills needs (share of companies surveyed)

- Look to automate the work: 85%
- Hire new permanent staff with skills relevant to new technologies: 83%
- Retrain existing employees: 75%
- Expect existing employees to pick up skills on the job: 67%
- Hire new temporary staff with skills relevant to new technologies: 64%
- Outsource some business functions to external contractors: 61%
- Hire freelancers with skills relevant to new technologies: 58%
- Strategic redundancies of staff who lack the skills to use new technologies: 51%

Projected use of training providers (share of training)

- Internal department: 52%
- Private training providers: 27%
- Private educational institutions: 22%
- Public educational institutions: 18%
- Public training provider: 15%
Country Profile
Korea, Rep.

Factors determining job location decisions

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Range of options: Flexibility of labour laws, Geographic spread, Quality of the supply chain, Ease of importing talent, Labour cost, Location of raw materials, Organization HQ, Production cost, Strong local education provision, Talent availability.

Emerging job roles

Sales and Marketing Professionals
Software and Applications Developers and Analysts
Data Analysts and Scientists
Managing Directors and Chief Executives
Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products
General and Operations Managers
Human Resources Specialists
Assembly and Factory Workers
Risk Management Specialists
Financial Analysts

Technology adoption (share of companies surveyed)

- User and entity big data analytics: 87%
- Internet of things: 76%
- App- and web-enabled markets: 73%
- Machine learning: 68%
- Cloud computing: 64%
- Augmented and virtual reality: 56%
- New materials: 55%
- Encryption: 52%
- 3D printing: 51%
- Wearable electronics: 50%
- Digital trade: 48%
- Distributed ledger (blockchain): 46%
- Autonomous transport: 44%
- Stationary robots: 43%
- Non-humanoid land robots: 41%
- Quantum computing: 39%
- Biotechnology: 28%
- Humanoid robots: 26%
- Aerial and underwater robots: 17%
Country Profile
Korea, Rep.

Average reskilling needs (share of workforce)

- Less than 1 month ............ 13%
- 1 to 3 months ............... 13%
- 3 to 6 months ............... 10%
- 6 to 12 months .............. 8%
- Over 1 year ................. 9%
- No reskilling needed ........ 46%

Responses to shifting skills needs (share of companies surveyed)

- Look to automate the work       89% (Likely)
- Hire new permanent staff with skills relevant to new technologies 87% (Likely)
- Retrain existing employees    82% (Likely)
- Outsource some business functions to external contractors 65% (Likely)
- Hire new temporary staff with skills relevant to new technologies 63% (Likely)
- Expect existing employees to pick up skills on the job 61% (Likely)
- Hire freelancers with skills relevant to new technologies 52% (Likely)
- Strategic redundancies of staff who lack the skills to use new technologies 44% (Likely)

Emerging skills

- Analytical thinking and innovation
- Creativity, originality and initiative
- Active learning and learning strategies
- Critical thinking and analysis
- Technology design and programming
- Complex problem-solving

Leadership and social influence
Reasoning, problem-solving and ideation
Systems analysis and evaluation
Emotional intelligence

Projected use of training providers (share of training)

- Internal department .......... 50%
- Private training providers 23%
- Private educational institutions 19%
- Public educational institutions 18%
- Public training provider ...... 10%

The Future of Jobs Report 2018
Country Profile
Mexico

Factors determining job location decisions

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Range of options: Flexibility of labour laws, Geographic spread, Quality of the supply chain, Ease of importing talent, Labour cost, Location of raw materials, Organization HQ, Production cost, Strong local education provision, Talent availability.

Emerging job roles

Managing Directors and Chief Executives
Software and Applications Developers and Analysts
Data Analysts and Scientists
Sales and Marketing Professionals
General and Operations Managers

Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products
Human Resources Specialists
Financial and Investment Advisers
Assembly and Factory Workers
Financial Analysts

Technology adoption (share of companies surveyed)

- User and entity big data analytics: 87%
- App- and web-enabled markets: 80%
- Internet of things: 78%
- Machine learning: 76%
- Cloud computing: 76%
- Augmented and virtual reality: 72%
- Digital trade: 65%
- New materials: 63%
- Wearable electronics: 60%
- Encryption: 59%
- Distributed ledger (blockchain): 54%
- 3D printing: 54%
- Autonomous transport: 51%
- Stationary robots: 43%
- Quantum computing: 41%
- Non-humanoid land robots: 35%
- Biotechnology: 32%
- Aerial and underwater robots: 24%
- Humanoid robots: 22%
Country Profile
Mexico

Average reskilling needs (share of workforce)

- Less than 1 month: 12%
- 1 to 3 months: 11%
- 3 to 6 months: 10%
- 6 to 12 months: 9%
- Over 1 year: 8%
- No reskilling needed: 48%

Emerging skills
- Analytical thinking and innovation
- Creativity, originality and initiative
- Active learning and learning strategies
- Technology design and programming
- Reasoning, problem-solving and ideation
- Complex problem-solving
- Leadership and social influence
- Critical thinking and analysis
- Resilience, stress tolerance and flexibility
- Emotional intelligence

Responses to shifting skills needs (share of companies surveyed)

- Look to automate the work: 84%
- Hire new permanent staff with skills relevant to new technologies: 84%
- Retrain existing employees: 78%
- Hire new temporary staff with skills relevant to new technologies: 74%
- Expect existing employees to pick up skills on the job: 70%
- Hire freelancers with skills relevant to new technologies: 62%
- Outsource some business functions to external contractors: 61%
- Strategic redundancies of staff who lack the skills to use new technologies: 54%

Projected use of training providers (share of training)

- Internal department: 49%
- Private training providers: 33%
- Private educational institutions: 24%
- Public training provider: 16%
- Public educational institutions: 16%
Country Profile
Philippines

Factors determining job location decisions

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Factors determining job location decisions

Emerging job roles

Software and Applications Developers and Analysts
Sales and Marketing Professionals
Managing Directors and Chief Executives
Data Analysts and Scientists
Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products
General and Operations Managers
Human Resources Specialists
Financial and Investment Advisers
Assembly and Factory Workers
Database and Network Professionals

Technology adoption (share of companies surveyed)

<table>
<thead>
<tr>
<th>Technology</th>
<th>Share of Companies Surveyed</th>
</tr>
</thead>
<tbody>
<tr>
<td>User and entity big data analytics</td>
<td>92%</td>
</tr>
<tr>
<td>Internet of things</td>
<td>83%</td>
</tr>
<tr>
<td>App- and web-enabled markets</td>
<td>81%</td>
</tr>
<tr>
<td>Machine learning</td>
<td>77%</td>
</tr>
<tr>
<td>Cloud computing</td>
<td>72%</td>
</tr>
<tr>
<td>Augmented and virtual reality</td>
<td>70%</td>
</tr>
<tr>
<td>Digital trade</td>
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<td>Encryption</td>
<td>61%</td>
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<td>New materials</td>
<td>57%</td>
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<td>Distributed ledger (blockchain)</td>
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Range of options: Flexibility of labour laws, Geographic spread, Quality of the supply chain, Ease of importing talent, Labour cost, Location of raw materials, Organization HQ, Production cost, Strong local education provision, Talent availability.
Country Profile
Philippines

Average reskilling needs (share of workforce)

- Less than 1 month: 10%
- 1 to 3 months: 12%
- 3 to 6 months: 9%
- 6 to 12 months: 10%
- Over 1 year: 10%
- No reskilling needed: 49%

Responses to shifting skills needs (share of companies surveyed)

- Log to automate the work: 86%
- Hire new permanent staff with skills relevant to new technologies: 84%
- Retrain existing employees: 80%
- Expect existing employees to pick up skills on the job: 74%
- Outsource some business functions to external contractors: 65%
- Hire new temporary staff with skills relevant to new technologies: 64%
- Hire freelancers with skills relevant to new technologies: 61%
- Strategic redundancies of staff who lack the skills to use new technologies: 54%

Emerging skills

- Analytical thinking and innovation
- Active learning and learning strategies
- Creativity, originality and initiative
- Technology design and programming
- Critical thinking and analysis
- Complex problem-solving

Leadership and social influence
- Emotional intelligence
- Reasoning, problem-solving and ideation
- Resilience, stress tolerance and flexibility

Projected use of training providers (share of training)

- Internal department: 49%
- Private training providers: 27%
- Private educational institutions: 20%
- Public educational institutions: 19%
- Public training provider: 15%
Country Profile

Russian Federation

Factors determining job location decisions

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</table>

Range of options: Flexibility of labour laws, Geographic spread, Quality of the supply chain, Ease of importing talent, Labour cost, Location of raw materials, Organization HQ, Production cost, Strong local education provision, Talent availability.

Emerging job roles

Managing Directors and Chief Executives
Software and Applications Developers and Analysts
Sales and Marketing Professionals
General and Operations Managers
Sales Representatives, Wholesale and Manufacturing,
Technical and Scientific Products
Data Analysts and Scientists
Human Resources Specialists
Assembly and Factory Workers
Financial and Investment Advisers
Risk Management Specialists

Technology adoption (share of companies surveyed)

- User and entity big data analytics: 93%
- App- and web-enabled markets: 81%
- Machine learning: 80%
- Internet of things: 72%
- Cloud computing: 72%
- Augmented and virtual reality: 64%
- New materials: 63%
- Digital trade: 62%
- Wearable electronics: 55%
- 3D printing: 54%
- Encryption: 52%
- Stationary robots: 51%
- Distributed ledger (blockchain): 51%
- Autonomous transport: 51%
- Quantum computing: 45%
- Non-humanoid land robots: 44%
- Biotechnology: 34%
- Humanoid robots: 26%
- Aerial and underwater robots: 19%
Country Profile

Russian Federation

Average reskilling needs (share of workforce)

- Less than 1 month: 12%
- 1 to 3 months: 15%
- 3 to 6 months: 10%
- 6 to 12 months: 7%
- Over 1 year: 10%
- No reskilling needed: 46%

Emerging skills

- Creativity, originality and initiative
- Analytical thinking and innovation
- Active learning and learning strategies
- Technology design and programming
- Critical thinking and analysis
- Emotional intelligence
- Complex problem-solving
- Leadership and social influence
- Reasoning, problem-solving and ideation
- Systems analysis and evaluation

Responses to shifting skills needs (share of companies surveyed)

- Hire new permanent staff with skills relevant to new technologies: 86%
- Look to automate the work: 84%
- Hire new temporary staff with skills relevant to new technologies: 74%
- Expect existing employees to pick up skills on the job: 71%
- Retrain existing employees: 68%
- Outsource some business functions to external contractors: 62%
- Hire freelancers with skills relevant to new technologies: 59%
- Strategic redundancies of staff who lack the skills to use new technologies: 54%

Projected use of training providers (share of training)

- Internal department: 47%
- Private training providers: 26%
- Private educational institutions: 19%
- Public educational institutions: 19%
- Public training provider: 16%
Country Profile
Singapore

Factors determining job location decisions

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<thead>
<tr>
<th>Industry</th>
<th>Primary</th>
<th>Secondary</th>
<th>Tertiary</th>
</tr>
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<tbody>
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<td>Talent availability</td>
<td>Labour cost</td>
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<td>Ease of importing talent</td>
</tr>
<tr>
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<td>Labour cost</td>
<td>Quality of the supply chain</td>
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<tr>
<td>Consumer</td>
<td>Labour cost</td>
<td>Talent availability</td>
<td>Quality of the supply chain</td>
</tr>
<tr>
<td>Energy Utilities &amp; Technologies</td>
<td>Production cost</td>
<td>Talent availability</td>
<td>Labour cost</td>
</tr>
<tr>
<td>Financial Services &amp; Investors</td>
<td>Talent availability</td>
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<td>Talent availability</td>
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<td>Geographic concentration</td>
</tr>
<tr>
<td>Oil &amp; Gas</td>
<td>Talent availability</td>
<td>Production cost</td>
<td>Geographic concentration</td>
</tr>
<tr>
<td>Professional Services</td>
<td>Talent availability</td>
<td>Strong local ed. provision</td>
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Range of options: Flexibility of labour laws, Geographic spread, Quality of the supply chain, Ease of importing talent, Labour cost, Location of raw materials, Organization HQ, Production cost, Strong local education provision, Talent availability.

Emerging job roles

- Software and Applications Developers and Analysts
- Sales and Marketing Professionals
- Data Analysts and Scientists
- Managing Directors and Chief Executives
- Human Resources Specialists
- General and Operations Managers
- Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products
- Financial and Investment Advisers
- Financial Analysts
- Database and Network Professionals

Technology adoption (share of companies surveyed)

- User and entity big data analytics: 92%
- Internet of things: 82%
- App- and web-enabled markets: 81%
- Machine learning: 78%
- Cloud computing: 73%
- Digital trade: 63%
- Augmented and virtual reality: 62%
- Encryption: 62%
- Wearable electronics: 58%
- Distributed ledger (blockchain): 54%
- New materials: 52%
- 3D printing: 47%
- Autonomous transport: 46%
- Stationary robots: 43%
- Quantum computing: 41%
- Non-humanoid land robots: 39%
- Biotechnology: 27%
- Humanoid robots: 24%
- Aerial and underwater robots: 21%
Country Profile

Singapore

Average reskilling needs (share of workforce)

- Less than 1 month: 11%
- 1 to 3 months: 13%
- 3 to 6 months: 9%
- 6 to 12 months: 9%
- Over 1 year: 10%
- No reskilling needed: 47%

Emerging skills

- Analytical thinking and innovation
- Active learning and learning strategies
- Creativity, originality and initiative
- Technology design and programming
- Critical thinking and analysis
- Complex problem-solving
- Leadership and social influence
- Emotional intelligence
- Reasoning, problem-solving and ideation
- Systems analysis and evaluation

Responses to shifting skills needs (share of companies surveyed)

- Look to automate the work: 86%
- Hire new permanent staff with skills relevant to new technologies: 85%
- Retrain existing employees: 77%
- Expect existing employees to pick up skills on the job: 71%
- Hire new temporary staff with skills relevant to new technologies: 69%
- Outsource some business functions to external contractors: 62%
- Hire freelancers with skills relevant to new technologies: 57%
- Strategic redundancies of staff who lack the skills to use new technologies: 53%

Projected use of training providers (share of training)

- Internal department: 49%
- Private training providers: 27%
- Private educational institutions: 21%
- Public educational institutions: 19%
- Public training provider: 17%
Country Profile
South Africa

Factors determining job location decisions

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<th>Primary</th>
<th>Secondary</th>
<th>Tertiary</th>
</tr>
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<tbody>
<tr>
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<td>Production cost</td>
<td>Talent availability</td>
<td>Quality of the supply chain</td>
</tr>
<tr>
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<td>Talent availability</td>
<td>Organization HQ</td>
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</tr>
<tr>
<td>Chemistry, Advanced Materials &amp; Biotechnology</td>
<td>Talent availability</td>
<td>Labour cost</td>
<td>Geographic concentration</td>
</tr>
<tr>
<td>Consumer</td>
<td>Talent availability</td>
<td>Quality of the supply chain</td>
<td>Production cost</td>
</tr>
<tr>
<td>Energy Utilities &amp; Technologies</td>
<td>Labour cost</td>
<td>Geographic concentration</td>
<td>Talent availability</td>
</tr>
<tr>
<td>Financial Services &amp; Investors</td>
<td>Talent availability</td>
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</tr>
<tr>
<td>Oil &amp; Gas</td>
<td>Production cost</td>
<td>Geographic concentration</td>
<td>Talent availability</td>
</tr>
<tr>
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</table>

Range of options: Flexibility of labour laws, Geographic spread, Quality of the supply chain, Ease of importing talent, Labour cost, Location of raw materials, Organization HQ, Production cost, Strong local education provision, Talent availability.

Emerging job roles

- Software and Applications Developers and Analysts
- Sales and Marketing Professionals
- Managing Directors and Chief Executives
- General and Operations Managers
- Data Analysts and Scientists
- Financial and Investment Advisers
- Truck Drivers and Mechanics
- Industry Sales Representatives
- Customer Relationship Managers
- Investment Bankers
- Financial Analysts and Consultants

Technology adoption (share of companies surveyed)

<table>
<thead>
<tr>
<th>Industry</th>
<th>Adoption Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>User and entity big data analytics</td>
<td>96%</td>
</tr>
<tr>
<td>Machine learning</td>
<td>90%</td>
</tr>
<tr>
<td>App- and web-enabled markets</td>
<td>88%</td>
</tr>
<tr>
<td>Cloud computing</td>
<td>81%</td>
</tr>
<tr>
<td>Internet of things</td>
<td>78%</td>
</tr>
<tr>
<td>Augmented and virtual reality</td>
<td>76%</td>
</tr>
<tr>
<td>Digital trade</td>
<td>68%</td>
</tr>
<tr>
<td>Encryption</td>
<td>64%</td>
</tr>
<tr>
<td>New materials</td>
<td>61%</td>
</tr>
<tr>
<td>Wearable electronics</td>
<td>60%</td>
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<tr>
<td>3D printing</td>
<td>57%</td>
</tr>
<tr>
<td>Stationary robots</td>
<td>54%</td>
</tr>
<tr>
<td>Distributed ledger (blockchain)</td>
<td>54%</td>
</tr>
<tr>
<td>Autonomous transport</td>
<td>54%</td>
</tr>
<tr>
<td>Quantum computing</td>
<td>51%</td>
</tr>
<tr>
<td>Non-humanoid land robots</td>
<td>49%</td>
</tr>
<tr>
<td>Biotechnology</td>
<td>38%</td>
</tr>
<tr>
<td>Humanoid robots</td>
<td>32%</td>
</tr>
<tr>
<td>Aerial and underwater robots</td>
<td>24%</td>
</tr>
</tbody>
</table>
Country Profile

South Africa

Average reskilling needs (share of workforce)

- Less than 1 month: 12%
- 1 to 3 months: 11%
- 3 to 6 months: 10%
- 6 to 12 months: 10%
- Over 1 year: 9%
- No reskilling needed: 47%

Responses to shifting skills needs (share of companies surveyed)

- Hire new permanent staff with skills relevant to new technologies: 88%
- Look to automate the work: 83%
- Hire new temporary staff with skills relevant to new technologies: 75%
- Expect existing employees to pick up skills on the job: 72%
- Retrain existing employees: 67%
- Outsource some business functions to external contractors: 62%
- Hire freelancers with skills relevant to new technologies: 62%
- Strategic redundancies of staff who lack the skills to use new technologies: 56%

Emerging skills

- Analytical thinking and innovation
- Creativity, originality and initiative
- Active learning and learning strategies
- Technology design and programming
- Complex problem-solving
- Leadership and social influence
- Reasoning, problem-solving and ideation
- Critical thinking and analysis
- Resilience, stress tolerance and flexibility
- Emotional intelligence

Projected use of training providers (share of training)

- Internal department: 48%
- Private training providers: 31%
- Private educational institutions: 20%
- Public training provider: 15%
- Public educational institutions: 14%
## Country Profile

### Switzerland

### Factors determining job location decisions

<table>
<thead>
<tr>
<th>Industry</th>
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**Range of options:** Flexibility of labour laws, Geographic spread, Quality of the supply chain, Ease of importing talent, Labour cost, Location of raw materials, Organization HQ, Production cost, Strong local education provision, Talent availability.

### Emerging job roles

- Managing Directors and Chief Executives
- Data Analysts and Scientists
- Sales and Marketing Professionals
- Human Resources Specialists
- Software and Applications Developers and Analysts
- Assembly and Factory Workers
- Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products
- Database and Network Professionals
- General and Operations Managers
- Information Security Analysts
- Aerial and underwater robots
- Non-humanoid land robots
- Quantum computing
- Biotechnology
- Humanoid robots
- Autonomous transport
- 3D printing
- Distributed ledger (blockchain)
- Encryption
- Wearable electronics
- New materials
- Digital trade

### Technology adoption (share of companies surveyed)

- User and entity big data analytics 93%
- App- and web-enabled markets 83%
- Machine learning 81%
- Internet of things 81%
- Cloud computing 79%
- Augmented and virtual reality 72%
- Digital trade 71%
- Wearable electronics 61%
- New materials 60%
- Encryption 57%
- Autonomous transport 54%
- 3D printing 54%
- Distributed ledger (blockchain) 50%
- Stationary robots 47%
- Non-humanoid land robots 46%
- Quantum computing 39%
- Biotechnology 31%
- Humanoid robots 24%
- Aerial and underwater robots 19%
Country Profile
Switzerland

Average reskilling needs (share of workforce)

Responses to shifting skills needs (share of companies surveyed)

Lock to automate the work
Hire new permanent staff with skills relevant to new technologies
Retrain existing employees
Hire new temporary staff with skills relevant to new technologies
Expect existing employees to pick up skills on the job
Hire freelancers with skills relevant to new technologies
Strategic redundancies of staff who lack the skills to use new technologies
Outsource some business functions to external contractors

Emerging skills
Analytical thinking and innovation
Creativity, originality and initiative
Active learning and learning strategies
Technology design and programming
Leadership and social influence
Emotional intelligence

Projected use of training providers (share of training)

Internal department
Private training providers
Private educational institutions
Public educational institutions
Public training provider
Country Profile

Thailand

Factors determining job location decisions

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Emerging job roles

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Managing Directors and Chief Executives
Sales and Marketing Professionals
Data Analysts and Scientists
Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products

General and Operations Managers
Human Resources Specialists
Financial and Investment Advisers
Assembly and Factory Workers
Financial Analysts

Technology adoption (share of companies surveyed)

User and entity big data analytics 92%
Internet of things 81%
App- and web-enabled markets 81%
Machine learning 75%
Cloud computing 71%
Augmented and virtual reality 63%
Digital trade 62%
Encryption 57%
Wearable electronics 55%
New materials 55%
Distributed ledger (blockchain) 51%
Autonomous transport 51%
3D printing 47%
Stationary robots 42%
Quantum computing 38%
Non-humanoid land robots 34%
Biotechnology 27%
Humanoid robots 25%
Aerial and underwater robots 20%
Country Profile

Thailand

Average reskilling needs (share of workforce)

- Less than 1 month .......... 11%
- 1 to 3 months ............... 12%
- 3 to 6 months ................ 9%
- 6 to 12 months .............. 9%
- Over 1 year .................. 10%
- No reskilling needed ......... 49%

Responses to shifting skills needs (share of companies surveyed)

- Lock to automate the work ........ 90%
- Hire new permanent staff with skills relevant to new technologies .... 85%
- Retrain existing employees .... 79%
- Expect existing employees to pick up skills on the job ....... 76%
- Hire new temporary staff with skills relevant to new technologies ... 70%
- Outsource some business functions to external contractors ........ 63%
- Strategic redundancies of staff who lack the skills to use new technologies ... 56%
- Hire freelancers with skills relevant to new technologies ....... 55%
- Average reskilling needs (share of workforce) .... 6%
- Likely ..... 13%
- Equally likely .... 18%
- Unlikely ....... 13%

Emerging skills

- Analytical thinking and innovation
- Creativity, originality and initiative
- Active learning and learning strategies
- Technology design and programming
- Complex problem-solving
- Leadership and social influence

Critical thinking and analysis
- Systems analysis and evaluation
- Reasoning, problem-solving and ideation
- Emotional intelligence

Projected use of training providers (share of training)

- Internal department ........ 49%
- Private training providers .... 29%
- Private educational institutions ... 23%
- Public educational institutions .... 21%
- Public training provider ....... 20%
Country Profile

United Kingdom

Factors determining job location decisions

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Emerging job roles

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Data Analysts and Scientists
General and Operations Managers
Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products
Assembly and Factory Workers
Human Resources Specialists
Financial and Investment Advisers
Financial Analysts

Technology adoption (share of companies surveyed)

- User and entity big data analytics: 91%
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- Non-humanoid land robots: 43%
- Quantum computing: 43%
- Biotechnology: 28%
- Humanoid robots: 26%
- Aerial and underwater robots: 23%

The Future of Jobs Report 2018
Country Profile

United Kingdom

Average reskilling needs (share of workforce)

- Less than 1 month ...........13%
- 1 to 3 months ...............13%
- 3 to 6 months ...............10%
- 6 to 12 months .............8%
- Over 1 year ..................9%
- No reskilling needed .......47%

Responses to shifting skills needs (share of companies surveyed)

<table>
<thead>
<tr>
<th>Activity</th>
<th>Likely</th>
<th>Equally likely</th>
<th>Unlikely</th>
</tr>
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<tbody>
<tr>
<td>Hire new permanent staff with skills relevant to new technologies</td>
<td>86%</td>
<td>11%</td>
<td>11%</td>
</tr>
<tr>
<td>Look to automate the work</td>
<td>84%</td>
<td>12%</td>
<td>12%</td>
</tr>
<tr>
<td>Retrain existing employees</td>
<td>75%</td>
<td>20%</td>
<td>20%</td>
</tr>
<tr>
<td>Hire new temporary staff with skills relevant to new technologies</td>
<td>71%</td>
<td>21%</td>
<td>21%</td>
</tr>
<tr>
<td>Expect existing employees to pick up skills on the job</td>
<td>71%</td>
<td>21%</td>
<td>21%</td>
</tr>
<tr>
<td>Outsource some business functions to external contractors</td>
<td>61%</td>
<td>30%</td>
<td>30%</td>
</tr>
<tr>
<td>Hire freelancers with skills relevant to new technologies</td>
<td>60%</td>
<td>25%</td>
<td>25%</td>
</tr>
<tr>
<td>Strategic redundancies of staff who lack the skills to use new technologies</td>
<td>50%</td>
<td>30%</td>
<td>30%</td>
</tr>
</tbody>
</table>

Emerging skills

- Analytical thinking and innovation
- Creativity, originality and initiative
- Active learning and learning strategies
- Technology design and programming
- Complex problem-solving
- Critical thinking and analysis

Leadership and social influence
- Systems analysis and evaluation
- Reasoning, problem-solving and ideation
- Emotional intelligence

Projected use of training providers (share of training)

<table>
<thead>
<tr>
<th>Training Provider</th>
<th>Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal department</td>
<td>49%</td>
</tr>
<tr>
<td>Private training providers</td>
<td>28%</td>
</tr>
<tr>
<td>Private educational institutions</td>
<td>20%</td>
</tr>
<tr>
<td>Public educational institutions</td>
<td>17%</td>
</tr>
<tr>
<td>Public training provider</td>
<td>15%</td>
</tr>
</tbody>
</table>
Country Profile

United States

Factors determining job location decisions

<table>
<thead>
<tr>
<th>Industry</th>
<th>Primary</th>
<th>Secondary</th>
<th>Tertiary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automotive, Aerospace, Supply Chain &amp; Transport</td>
<td>Talent availability</td>
<td>Quality of the supply chain</td>
<td>Labour cost</td>
</tr>
<tr>
<td>Aviation, Travel &amp; Tourism</td>
<td>Talent availability</td>
<td>Organization HQ</td>
<td>Ease of importing talent</td>
</tr>
<tr>
<td>Chemistry, Advanced Materials &amp; Biotechnology</td>
<td>Talent availability</td>
<td>Labour cost</td>
<td>Production cost</td>
</tr>
<tr>
<td>Consumer</td>
<td>Talent availability</td>
<td>Labour cost</td>
<td>Quality of the supply chain</td>
</tr>
<tr>
<td>Energy Utilities &amp; Technologies</td>
<td>Labour cost</td>
<td>Talent availability</td>
<td>Production cost</td>
</tr>
<tr>
<td>Financial Services &amp; Investors</td>
<td>Talent availability</td>
<td>Organization HQ</td>
<td>Labour cost</td>
</tr>
<tr>
<td>Global Health &amp; Healthcare</td>
<td>Talent availability</td>
<td>Labour cost</td>
<td>Production cost</td>
</tr>
<tr>
<td>Information &amp; Communication Technologies</td>
<td>Talent availability</td>
<td>Labour cost</td>
<td>Organization HQ</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>Talent availability</td>
<td>Labour cost</td>
<td>Production cost</td>
</tr>
<tr>
<td>Oil &amp; Gas</td>
<td>Talent availability</td>
<td>Labour cost</td>
<td>Production cost</td>
</tr>
<tr>
<td>Professional Services</td>
<td>Talent availability</td>
<td>Labour cost</td>
<td>Strong local ed. provision</td>
</tr>
</tbody>
</table>

Factors determining job location decisions

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<tr>
<td>Consumer</td>
<td>Talent availability</td>
<td>Labour cost</td>
<td>Quality of the supply chain</td>
</tr>
<tr>
<td>Energy Utilities &amp; Technologies</td>
<td>Labour cost</td>
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</tr>
</tbody>
</table>

Range of options: Flexibility of labour laws, Geographic spread, Quality of the supply chain, Ease of importing talent, Labour cost, Location of raw materials, Organization HQ, Production cost, Strong local education provision, Talent availability.

Emerging job roles

Software and Applications Developers and Analysts
Data Analysts and Scientists
Managing Directors and Chief Executives
General and Operations Managers
Sales and Marketing Professionals

Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products
Human Resources Specialists
Financial Analysts
Financial and Investment Advisers
Database and Network Professionals

Technology adoption (share of companies surveyed)

<table>
<thead>
<tr>
<th>Technology</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>User and entity big data analytics</td>
<td>89%</td>
</tr>
<tr>
<td>Internet of things</td>
<td>80%</td>
</tr>
<tr>
<td>App- and web-enabled markets</td>
<td>76%</td>
</tr>
<tr>
<td>Machine learning</td>
<td>75%</td>
</tr>
<tr>
<td>Cloud computing</td>
<td>71%</td>
</tr>
<tr>
<td>Augmented and virtual reality</td>
<td>66%</td>
</tr>
<tr>
<td>Encryption</td>
<td>60%</td>
</tr>
<tr>
<td>Digital trade</td>
<td>57%</td>
</tr>
<tr>
<td>Wearable electronics</td>
<td>56%</td>
</tr>
<tr>
<td>New materials</td>
<td>55%</td>
</tr>
<tr>
<td>Distributed ledger (blockchain)</td>
<td>52%</td>
</tr>
<tr>
<td>3D printing</td>
<td>47%</td>
</tr>
<tr>
<td>Stationary robots</td>
<td>44%</td>
</tr>
<tr>
<td>Autonomous transport</td>
<td>43%</td>
</tr>
<tr>
<td>Quantum computing</td>
<td>41%</td>
</tr>
<tr>
<td>Non-humanoid land robots</td>
<td>38%</td>
</tr>
<tr>
<td>Humanoid robots</td>
<td>25%</td>
</tr>
<tr>
<td>Biotechnology</td>
<td>25%</td>
</tr>
<tr>
<td>Aerial and underwater robots</td>
<td>22%</td>
</tr>
</tbody>
</table>
Country Profile
United States

Average reskilling needs (share of workforce)

- Less than 1 month ........... 13%
- 1 to 3 months ............... 14%
- 3 to 6 months ............... 10%
- 6 to 12 months .............. 8%
- Over 1 year .................. 9%
- No reskilling needed ......... 46%

Responses to shifting skills needs (share of companies surveyed)

- Look to automate the work 84%
- Hire new permanent staff with skills relevant to new technologies 84%
- Retrain existing employees 81%
- Hire new temporary staff with skills relevant to new technologies 68%
- Outsource some business functions to external contractors 65%
- Expect existing employees to pick up skills on the job 65%
- Hire freelancers with skills relevant to new technologies 58%
- Strategic redundancies of staff who lack the skills to use new technologies 46%

- Leadership and social influence
- Reasoning, problem-solving and ideation
- Emotional intelligence
- Systems analysis and evaluation

Projected use of training providers (share of training)

- Internal department 52%
- Private training providers 27%
- Private educational institutions 21%
- Public educational institutions 17%
- Public training provider 14%
Country Profile

Vietnam

Factors determining job location decisions

<table>
<thead>
<tr>
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<th>Tertiary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automotive, Aerospace, Supply Chain &amp; Transport</td>
<td>Production cost</td>
<td>Talent availability</td>
<td>Labour cost</td>
</tr>
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<tr>
<td>Chemistry, Advanced Materials &amp; Biotechnology</td>
<td>Labour cost</td>
<td>Talent availability</td>
<td>Quality of the supply chain</td>
</tr>
<tr>
<td>Consumer</td>
<td>Labour cost</td>
<td>Talent availability</td>
<td>Quality of the supply chain</td>
</tr>
<tr>
<td>Energy Utilities &amp; Technologies</td>
<td>Labour cost</td>
<td>Geographic concentration</td>
<td>Talent availability</td>
</tr>
<tr>
<td>Financial Services &amp; Investors</td>
<td>Talent availability</td>
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<tr>
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</table>

Range of options: Flexibility of labour laws, Geographic spread, Quality of the supply chain, Ease of importing talent, Labour cost, Location of raw materials, Organization HQ, Production cost, Strong local education provision, Talent availability.

Emerging job roles


Technology adoption (share of companies surveyed)

- User and entity big data analytics: 87%
- Internet of things: 81%
- App- and web-enabled markets: 81%
- Machine learning: 76%
- Cloud computing: 68%
- Digital trade: 61%
- Encryption: 59%
- Augmented and virtual reality: 58%
- New materials: 56%
- Distributed ledger (blockchain): 53%
- Wearable electronics: 49%
- 3D printing: 48%
- Autonomous transport: 47%
- Stationary robots: 45%
- Quantum computing: 43%
- Non-humanoid land robots: 34%
- Biotechnology: 33%
- Humanoid robots: 28%
- Aerial and underwater robots: 19%

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Country Profile

Vietnam

Average reskilling needs (share of workforce)

- Less than 1 month: 11%
- 1 to 3 months: 14%
- 3 to 6 months: 10%
- 6 to 12 months: 9%
- Over 1 year: 9%
- No reskilling needed: 47%

Responses to shifting skills needs (share of companies surveyed)

- Look to automate the work: 87%
- Hire new permanent staff with skills relevant to new technologies: 87%
- Retrain existing employees: 82%
- Outsource some business functions to external contractors: 69%
- Expect existing employees to pick up skills on the job: 68%
- Hire new temporary staff with skills relevant to new technologies: 64%
- Hire freelancers with skills relevant to new technologies: 61%
- Strategic redundancies of staff who lack the skills to use new technologies: 58%

Emerging skills

- Analytical thinking and innovation
- Creativity, originality and initiative
- Active learning and learning strategies
- Critical thinking and analysis
- Leadership and social influence
- Complex problem-solving
- Technology design and programming
- Emotional intelligence
- Reasoning, problem-solving and ideation
- Systems analysis and evaluation

Projected use of training providers (share of training)

- Internal department: 47%
- Private training providers: 24%
- Private educational institutions: 21%
- Public educational institutions: 17%
- Public training provider: 16%
### Regional Profile

**Central Asia**

#### Factors determining job location decisions

<table>
<thead>
<tr>
<th>Industry</th>
<th>Primary</th>
<th>Secondary</th>
<th>Tertiary</th>
</tr>
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<tbody>
<tr>
<td>Automotive, Aerospace, Supply Chain &amp; Transport</td>
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<td>Production cost</td>
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</tr>
<tr>
<td>Consumer</td>
<td>Labour cost</td>
<td>Geographic concentration</td>
<td>Talent availability</td>
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<tr>
<td>Energy Utilities &amp; Technologies</td>
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</tr>
<tr>
<td>Oil &amp; Gas</td>
<td>Production cost</td>
<td>Talent availability</td>
<td>Location of raw materials</td>
</tr>
<tr>
<td>Professional Services</td>
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<td>Geographic concentration</td>
<td>Labour cost</td>
</tr>
</tbody>
</table>

**Range of options:** Flexibility of labour laws, Geographic spread, Quality of the supply chain, Ease of importing talent, Labour cost, Location of raw materials, Organization HQ, Production cost, Strong local education provision, Talent availability.

#### Technology adoption (share of companies surveyed)

<table>
<thead>
<tr>
<th>Technology</th>
<th>Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>User and entity big data analytics</td>
<td>91%</td>
</tr>
<tr>
<td>App- and web-enabled markets</td>
<td>83%</td>
</tr>
<tr>
<td>Machine learning</td>
<td>77%</td>
</tr>
<tr>
<td>Internet of things</td>
<td>77%</td>
</tr>
<tr>
<td>Cloud computing</td>
<td>76%</td>
</tr>
<tr>
<td>Augmented and virtual reality</td>
<td>67%</td>
</tr>
<tr>
<td>New materials</td>
<td>61%</td>
</tr>
<tr>
<td>Digital trade</td>
<td>61%</td>
</tr>
<tr>
<td>Wearable electronics</td>
<td>59%</td>
</tr>
<tr>
<td>Encryption</td>
<td>56%</td>
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<td>Stationary robots</td>
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<td>28%</td>
</tr>
<tr>
<td>Aerial and underwater robots</td>
<td>18%</td>
</tr>
</tbody>
</table>

#### Emerging job roles

- **Managing Directors and Chief Executives**
- **Software and Applications Developers and Analysts**
- **Sales and Marketing Professionals**
- **Data Analysts and Scientists**
- **General and Operations Managers**
- **Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products**
- **Human Resources Specialists**
- **Financial and Investment Advisers**
- **Assembly and Factory Workers**
- **Financial Analysts**
Regional Profile
Central Asia

Average reskilling needs (share of workforce)

- Less than 1 month .......... 11%
- 1 to 3 months ............. 13%
- 3 to 6 months ............. 10%
- 6 to 12 months ............ 9%
- Over 1 year ................ 9%
- No reskilling needed ...... 49%

Emerging skills

- Analytical thinking and innovation
- Creativity, originality and initiative
- Active learning and learning strategies
- Technology design and programming
- Critical thinking and analysis
- Emotional intelligence

Complex problem-solving
- Leadership and social influence
- Reasoning, problem-solving and ideation
- Resilience, stress tolerance and flexibility

Responses to shifting skills needs (share of companies surveyed)

- Look to automate the work 84%
- Hire new permanent staff with skills relevant to new technologies 83%
- Expect existing employees to pick up skills on the job 76%
- Hire new temporary staff with skills relevant to new technologies 74%
- Retrain existing employees 73%
- Hire freelancers with skills relevant to new technologies 59%
- Outsource some business functions to external contractors 56%
- Strategic redundancies of staff who lack the skills to use new technologies 53%

Projected use of training providers (share of training)

- Internal department 44%
- Private training providers 29%
- Private educational institutions 21%
- Public educational institutions 20%
- Public training provider 15%
Regional Profile

East Asia and the Pacific

Factors determining job location decisions

<table>
<thead>
<tr>
<th>Industry</th>
<th>Primary</th>
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<tbody>
<tr>
<td>Automotive, Aerospace, Supply Chain &amp; Transport</td>
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<tr>
<td>Aviation, Travel &amp; Tourism</td>
<td>Talent availability</td>
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<tr>
<td>Chemistry, Advanced Materials &amp; Biotechnology</td>
<td>Talent availability</td>
<td>Labour cost</td>
<td>Quality of the supply chain</td>
</tr>
<tr>
<td>Consumer</td>
<td>Talent availability</td>
<td>Labour cost</td>
<td>Production cost</td>
</tr>
<tr>
<td>Energy Utilities &amp; Technologies</td>
<td>Labour cost</td>
<td>Geographic concentration</td>
<td>Talent availability</td>
</tr>
<tr>
<td>Financial Services &amp; Investors</td>
<td>Talent availability</td>
<td>Organization HQ</td>
<td>Geographic concentration</td>
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<td>Production cost</td>
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<tr>
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<td>Geographic concentration</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>Labour cost</td>
<td>Talent availability</td>
<td>Organization HQ</td>
</tr>
<tr>
<td>Mining &amp; Metals</td>
<td>Production cost</td>
<td>Labour cost</td>
<td>Quality of the supply chain</td>
</tr>
<tr>
<td>Oil &amp; Gas</td>
<td>Talent availability</td>
<td>Production cost</td>
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<tr>
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Range of options: Flexibility of labour laws, Geographic spread, Quality of the supply chain, Ease of importing talent, Labour cost, Location of raw materials, Organization HQ, Production cost, Strong local education provision, Talent availability.

Emerging job roles

- Software and Applications Developers and Analysts
- Managing Directors and Chief Executives
- Data Analysts and Scientists
- Sales and Marketing Professionals
- General and Operations Managers
- Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products
- Human Resources Specialists
- Financial Analysts
- Financial and Investment Advisers
- Database and Network Professionals
- Emerging job roles include:
  - User and entity big data analytics: 85%
  - App- and web-enabled markets: 77%
  - Internet of things: 77%
  - Machine learning: 70%
  - Cloud computing: 67%
  - Encryption: 67%
  - Augmented and virtual reality: 67%
  - Digital trade: 51%
  - New materials: 51%
  - Wearable electronics: 49%
  - Distributed ledger (blockchain): 44%
  - Autonomous transport: 42%
  - 3D printing: 42%
  - Quantum computing: 38%
  - Stationary robots: 37%
  - Non-humanoid land robots: 35%
  - Biotechnology: 29%
  - Humanoid robots: 24%
  - Aerial and underwater robots: 18%
Regional Profile
East Asia and the Pacific

Average reskilling needs (share of workforce)

Emerging skills
- Analytical thinking and innovation
- Active learning and learning strategies
- Creativity, originality and initiative
- Technology design and programming
- Critical thinking and analysis
- Complex problem-solving
- Systems analysis and evaluation
- Leadership and social influence
- Emotional intelligence
- Reasoning, problem-solving and ideation

Responses to shifting skills needs (share of companies surveyed)

- Look to automate the work: 83%
- Hire new permanent staff with skills relevant to new technologies: 83%
- Retrain existing employees: 73%
- Outsource some business functions to external contractors: 63%
- Hire new temporary staff with skills relevant to new technologies: 63%
- Expect existing employees to pick up skills on the job: 63%
- Hire freelancers with skills relevant to new technologies: 50%
- Strategic redundancies of staff who lack the skills to use new technologies: 46%

Projected use of training providers (share of training)
- Internal department: 49%
- Private training providers: 26%
- Private educational institutions: 21%
- Public educational institutions: 20%
- Public training provider: 17%
Regional Profile

Eastern Europe

Factors determining job location decisions

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Range of options: Flexibility of labour laws, Geographic spread, Quality of the supply chain, Ease of importing talent, Labour cost, Location of raw materials, Organization HQ, Production cost, Strong local education provision, Talent availability.

Emerging job roles

- Software and Applications Developers and Analysts
- Managing Directors and Chief Executives
- Sales and Marketing Professionals
- Data Analysts and Scientists
- General and Operations Managers
- Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products
- Human Resources Specialists
- Financial Analysts
- Assembly and Factory Workers
- Information Security Analysts
- User and entity big data analytics: 93%
- App- and web-enabled markets: 79%
- Machine learning: 77%
- Internet of things: 73%
- Cloud computing: 72%
- Augmented and virtual reality: 66%
- Digital trade: 61%
- New materials: 60%
- Wearable electronics: 57%
- Encryption: 51%
- Autonomous transport: 50%
- 3D printing: 50%
- Distributed ledger (blockchain): 49%
- Stationary robots: 47%
- Non-humanoid land robots: 43%
- Quantum computing: 41%
- Biotechnology: 31%
- Humanoid robots: 25%
- Aerial and underwater robots: 21%
Regional Profile
Eastern Europe

Average reskilling needs (share of workforce)

- Less than 1 month .......... 11%
- 1 to 3 months .............. 14%
- 3 to 6 months ............ 9%
- 6 to 12 months ........... 8%
- Over 1 year ............... 9%
- No reskilling needed ...... 48%

Responses to shifting skills needs (share of companies surveyed)

- Hire new permanent staff with skills relevant to new technologies: 86%
- Look to automate the work: 85%
- Retrain existing employees: 72%
- Hire new temporary staff with skills relevant to new technologies: 72%
- Expect existing employees to pick up skills on the job: 70%
- Outsource some business functions to external contractors: 62%
- Hire freelancers with skills relevant to new technologies: 60%
- Strategic redundancies of staff who lack the skills to use new technologies: 53%

Emerging skills

- Creativity, originality and initiative
- Analytical thinking and innovation
- Active learning and learning strategies
- Technology design and programming
- Emotional intelligence
- Critical thinking and analysis

Leadership and social influence
- Complex problem-solving
- Systems analysis and evaluation
- Reasoning, problem-solving and ideation

Projected use of training providers (share of training)

- Internal department: 48%
- Private training providers: 24%
- Public educational institutions: 18%
- Private educational institutions: 17%
- Public training provider: 14%
Regional Profile
Latin America and the Caribbean

Factors determining job location decisions

<table>
<thead>
<tr>
<th>Industry</th>
<th>Primary</th>
<th>Secondary</th>
<th>Tertiary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automotive, Aerospace, Supply Chain &amp; Transport</td>
<td>Talent availability</td>
<td>Labour cost</td>
<td>Geographic concentration</td>
</tr>
<tr>
<td>Aviation, Travel &amp; Tourism</td>
<td>Talent availability</td>
<td>Organization HQ</td>
<td>Ease of importing talent</td>
</tr>
<tr>
<td>Chemistry, Advanced Materials &amp; Biotechnology</td>
<td>Talent availability</td>
<td>Labour cost</td>
<td>Quality of the supply chain</td>
</tr>
<tr>
<td>Consumer</td>
<td>Labour cost</td>
<td>Talent availability</td>
<td>Quality of the supply chain</td>
</tr>
<tr>
<td>Energy Utilities &amp; Technologies</td>
<td>Production cost</td>
<td>Labour cost</td>
<td>Talent availability</td>
</tr>
<tr>
<td>Financial Services &amp; Investors</td>
<td>Talent availability</td>
<td>Labour cost</td>
<td>Geographic concentration</td>
</tr>
<tr>
<td>Global Health &amp; Healthcare</td>
<td>Talent availability</td>
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<td>Production cost</td>
</tr>
<tr>
<td>Information &amp; Communication Technologies</td>
<td>Talent availability</td>
<td>Labour cost</td>
<td>Ease of importing talent</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>Talent availability</td>
<td>Organization HQ</td>
<td>Labour cost</td>
</tr>
<tr>
<td>Mining &amp; Metals</td>
<td>Production cost</td>
<td>Location of raw materials</td>
<td>Labour cost</td>
</tr>
<tr>
<td>Oil &amp; Gas</td>
<td>Talent availability</td>
<td>Production cost</td>
<td>Organization HQ</td>
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<tr>
<td>Professional Services</td>
<td>Talent availability</td>
<td>Labour cost</td>
<td>Geographic concentration</td>
</tr>
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</table>

Range of options: Flexibility of labour laws, Geographic spread, Quality of the supply chain, Ease of importing talent, Labour cost, Location of raw materials, Organization HQ, Production cost, Strong local education provision, Talent availability.

Emerging job roles

Software and Applications Developers and Analysts
Managing Directors and Chief Executives
Data Analysts and Scientists
General and Operations Managers
Sales and Marketing Professionals
Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products
Financial and Investment Advisers
Financial Analysts
Human Resources Specialists
Assembly and Factory Workers

Technology adoption (share of companies surveyed)

<table>
<thead>
<tr>
<th>Technology</th>
<th>Share of Companies Surveyed</th>
</tr>
</thead>
<tbody>
<tr>
<td>User and entity big data analytics</td>
<td>89%</td>
</tr>
<tr>
<td>App- and web-enabled markets</td>
<td>79%</td>
</tr>
<tr>
<td>Machine learning</td>
<td>78%</td>
</tr>
<tr>
<td>Internet of things</td>
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</tr>
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<td>Non-humanoid land robots</td>
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<tr>
<td>Biotechnology</td>
<td>29%</td>
</tr>
<tr>
<td>Humanoid robots</td>
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</tr>
<tr>
<td>Aerial and underwater robots</td>
<td>23%</td>
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</tbody>
</table>
Regional Profile
Latin America and the Caribbean

Average reskilling needs (share of workforce)

- Less than 1 month ........12%
- 1 to 3 months..............13%
- 3 to 6 months..............10%
- 6 to 12 months..............9%
- Over 1 year..................9%
- No reskilling needed.......48%

Responses to shifting skills needs (share of companies surveyed)

- Hire new permanent staff with skills relevant to new technologies 85%
- Look to automate the work 83%
- Retrain existing employees 76%
- Hire new temporary staff with skills relevant to new technologies 66%
- Expect existing employees to pick up skills on the job 65%
- Outsource some business functions to external contractors 61%
- Hire freelancers with skills relevant to new technologies 59%
- Strategic redundancies of staff who lack the skills to use new technologies 52%

Emerging skills

- Analytical thinking and innovation
- Creativity, originality and initiative
- Active learning and learning strategies
- Technology design and programming
- Reasoning, problem-solving and ideation
- Critical thinking and analysis
- Leadership and social influence
- Complex problem-solving
- Emotional intelligence
- Resilience, stress tolerance and flexibility

Projected use of training providers (share of training)

- Internal department 50%
- Private training providers 30%
- Private educational institutions 21%
- Public educational institutions 16%
- Public training provider 13%
Regional Profile

Middle East and North Africa

Factors determining job location decisions

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<tr>
<th>Industry</th>
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<td>Automotive, Aerospace, Supply Chain &amp; Transport</td>
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<td>Labour cost</td>
<td>Quality of the supply chain</td>
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<tr>
<td>Consumer</td>
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<td>Talent availability</td>
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<tr>
<td>Energy Utilities &amp; Technologies</td>
<td>Labour cost</td>
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<td>Production cost</td>
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<tr>
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<td>Talent availability</td>
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<tr>
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<td>Production cost</td>
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<tr>
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<td>Geographic concentration</td>
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<tr>
<td>Oil &amp; Gas</td>
<td>Talent availability</td>
<td>Production cost</td>
<td>Location of raw materials</td>
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<td>Professional Services</td>
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Range of options: Flexibility of labour laws, Geographic spread, Quality of the supply chain, Ease of importing talent, Labour cost, Location of raw materials, Organization HQ, Production cost, Strong local education provision, Talent availability.

Emerging job roles

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- Financial and Investment Advisers

Technology adoption (share of companies surveyed)

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- Autonomous transport: 54%
- 3D printing: 52%
- Distributed ledger (blockchain): 50%
- Stationary robots: 48%
- Non-humanoid land robots: 42%
- Quantum computing: 41%
- Biotechnology: 28%
- Humanoid robots: 27%
- Aerial and underwater robots: 26%
Regional Profile
Middle East and North Africa

Average reskilling needs (share of workforce)

- Less than 1 month ........12%
- 1 to 3 months ...........13%
- 3 to 6 months ............9%
- 6 to 12 months ..........9%
- Over 1 year .............9%
- No reskilling needed ....47%

Responses to shifting skills needs (share of companies surveyed)

- Lock to automate the work 89%
- Hire new permanent staff with skills relevant to new technologies 84%
- Retrain existing employees 76%
- Expect existing employees to pick up skills on the job 73%
- Hire new temporary staff with skills relevant to new technologies 72%
- Outsource some business functions to external contractors 69%
- Hire freelancers with skills relevant to new technologies 56%
- Strategic redundancies of staff who lack the skills to use new technologies 53%

Emerging skills

- Analytical thinking and innovation
- Active learning and learning strategies
- Creativity, originality and initiative
- Technology design and programming
- Complex problem-solving
- Leadership and social influence

Critical thinking and analysis
- Reasoning, problem-solving and ideation
- Emotional intelligence
- Systems analysis and evaluation

Projected use of training providers (share of training)

- Internal department 50%
- Private training providers 28%
- Private educational institutions 18%
- Public educational institutions 16%
- Public training provider 15%
Regional Profile

North America

Factors determining job location decisions

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<tr>
<th>Industry</th>
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<th>Secondary</th>
<th>Tertiary</th>
</tr>
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<td>Labour cost</td>
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<td>Talent availability</td>
<td>Organization HQ</td>
<td>Ease of importing talent</td>
</tr>
<tr>
<td>Chemistry, Advanced Materials &amp; Biotechnology</td>
<td>Talent availability</td>
<td>Labour cost</td>
<td>Production cost</td>
</tr>
<tr>
<td>Consumer</td>
<td>Talent availability</td>
<td>Labour cost</td>
<td>Quality of the supply chain</td>
</tr>
<tr>
<td>Energy Utilities &amp; Technologies</td>
<td>Labour cost</td>
<td>Production cost</td>
<td>Talent availability</td>
</tr>
<tr>
<td>Financial Services &amp; Investors</td>
<td>Talent availability</td>
<td>Organization HQ</td>
<td>Geographic concentration</td>
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<td>Geographic concentration</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>Talent availability</td>
<td>Labour cost</td>
<td>Geographic concentration</td>
</tr>
<tr>
<td>Oil &amp; Gas</td>
<td>Talent availability</td>
<td>Production cost</td>
<td>Labour cost</td>
</tr>
<tr>
<td>Professional Services</td>
<td>Talent availability</td>
<td>Labour cost</td>
<td>Strong local ed. provision</td>
</tr>
</tbody>
</table>

Range of options: Flexibility of labour laws, Geographic spread, Quality of the supply chain, Ease of importing talent, Labour cost, Location of raw materials, Organization HQ, Production cost, Strong local education provision, Talent availability.

Emerging job roles

- Software and Applications Developers and Analysts
- Data Analysts and Scientists
- Managing Directors and Chief Executives
- General and Operations Managers
- Sales and Marketing Professionals
- Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products
- Human Resources Specialists
- Financial Analysts
- Electrotechnology Engineers
- Financial and Investment Advisers

Technology adoption (share of companies surveyed)

- User and entity big data analytics: 88%
- Internet of things: 78%
- App- and web-enabled markets: 76%
- Machine learning: 74%
- Cloud computing: 70%
- Augmented and virtual reality: 66%
- Digital trade: 59%
- Encryption: 58%
- New materials: 55%
- Wearable electronics: 53%
- Distributed ledger (blockchain): 52%
- 3D printing: 46%
- Autonomous transport: 45%
- Stationary robots: 43%
- Quantum computing: 39%
- Non-humanoid land robots: 38%
- Humanoid robots: 25%
- Biotechnology: 24%
- Aerial and underwater robots: 22%
Regional Profile
North America

Average reskilling needs (share of workforce)

- Less than 1 month ........... 13%
- 1 to 3 months ............... 14%
- 3 to 6 months ............... 10%
- 6 to 12 months .............. 9%
- Over 1 year .................. 9%
- No reskilling needed ...... 46%

Responses to shifting skills needs (share of companies surveyed)

<table>
<thead>
<tr>
<th>Activity</th>
<th>Likely</th>
<th>Equally Likely</th>
<th>Unlikely</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lock to automate the work</td>
<td>84%</td>
<td>11%</td>
<td></td>
</tr>
<tr>
<td>Hire new permanent staff with skills relevant to new technologies</td>
<td>83%</td>
<td>13%</td>
<td></td>
</tr>
<tr>
<td>Retrain existing employees</td>
<td>81%</td>
<td>15%</td>
<td></td>
</tr>
<tr>
<td>Hire new temporary staff with skills relevant to new technologies</td>
<td>66%</td>
<td>19%</td>
<td></td>
</tr>
<tr>
<td>Expect existing employees to pick up skills on the job</td>
<td>65%</td>
<td>20%</td>
<td></td>
</tr>
<tr>
<td>Outsource some business functions to external contractors</td>
<td>63%</td>
<td>27%</td>
<td></td>
</tr>
<tr>
<td>Hire freelancers with skills relevant to new technologies</td>
<td>59%</td>
<td>24%</td>
<td></td>
</tr>
<tr>
<td>Strategic redundancies of staff who lack the skills to use new technologies</td>
<td>46%</td>
<td>32%</td>
<td></td>
</tr>
</tbody>
</table>

Emerging skills

- Analytical thinking and innovation
- Creativity, originality and initiative
- Active learning and learning strategies
- Technology design and programming
- Critical thinking and analysis
- Complex problem-solving
- Leadership and social influence
- Reasoning, problem-solving and ideation
- Emotional intelligence
- Systems analysis and evaluation

Projected use of training providers (share of training)

<table>
<thead>
<tr>
<th>Provider</th>
<th>52%</th>
<th>27%</th>
<th>15%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal department</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private training providers</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private educational institutions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public educational institutions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public training provider</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Regional Profile

South Asia

Factors determining job location decisions

<table>
<thead>
<tr>
<th>Industry</th>
<th>Primary</th>
<th>Secondary</th>
<th>Tertiary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automotive, Aerospace, Supply Chain &amp; Transport</td>
<td>Talent availability</td>
<td>Quality of the supply chain</td>
<td>Labour cost</td>
</tr>
<tr>
<td>Aviation, Travel &amp; Tourism</td>
<td>Talent availability</td>
<td>Organization HQ</td>
<td>Ease of importing talent</td>
</tr>
<tr>
<td>Chemistry, Advanced Materials &amp; Biotechnology</td>
<td>Talent availability</td>
<td>Production cost</td>
<td>Labour cost</td>
</tr>
<tr>
<td>Consumer</td>
<td>Quality of the supply chain</td>
<td>Labour cost</td>
<td>Talent availability</td>
</tr>
<tr>
<td>Energy Utilities &amp; Technologies</td>
<td>Talent availability</td>
<td>Organization HQ</td>
<td>Labour cost</td>
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<tr>
<td>Financial Services &amp; Investors</td>
<td>Talent availability</td>
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<tr>
<td>Global Health &amp; Healthcare</td>
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<td>Labour cost</td>
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<tr>
<td>Information &amp; Communication Technologies</td>
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<td>Geographic concentration</td>
</tr>
<tr>
<td>Oil &amp; Gas</td>
<td>Production cost</td>
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<tr>
<td>Professional Services</td>
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</table>

Range of options: Flexibility of labour laws, Geographic spread, Quality of the supply chain, Ease of importing talent, Labour cost, Location of raw materials, Organization HQ, Production cost, Strong local education provision, Talent availability.

Emerging job roles

- Managing Directors and Chief Executives
- Sales and Marketing Professionals
- Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products
- General and Operations Managers
- Software and Applications Developers and Analysts
- Data Analysts and Scientists
- Human Resources Specialists
- Financial and Investment Advisers
- Financial Analysts
- Assembly and Factory Workers
- Autonomous transport
- Wearable electronics
- 3D printing
- Distributed ledger (blockchain)
- Stationary robots
- Quantum computing
- Non-humanoid land robots
- Biotechnology
- Humanoid robots
- Aerial and underwater robots

Technology adoption (share of companies surveyed)

- User and entity big data analytics: 91%
- App- and web-enabled markets: 78%
- Internet of things: 77%
- Machine learning: 73%
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- Biotechnology: 31%
- Humanoid robots: 24%
- Aerial and underwater robots: 18%
Regional Profile
South Asia

Average reskilling needs (share of workforce)

- Less than 1 month .......... 13%
- 1 to 3 months ............ 13%
- 3 to 6 months ............ 9%
- 6 to 12 months .......... 8%
- Over 1 year ............... 9%
- No reskilling needed ....... 48%

Responses to shifting skills needs (share of companies surveyed)

- Look to automate the work: 83% (Likely), 13% (Equally likely), 13% (Unlikely)
- Hire new permanent staff with skills relevant to new technologies: 81% (Likely), 14% (Equally likely), 15% (Unlikely)
- Retrain existing employees: 80% (Likely), 15% (Equally likely), 15% (Unlikely)
- Expect existing employees to pick up skills on the job: 73% (Likely), 15% (Equally likely), 16% (Unlikely)
- Outsource some business functions to external contractors: 66% (Likely), 25% (Equally likely), 9% (Unlikely)
- Hire new temporary staff with skills relevant to new technologies: 66% (Likely), 19% (Equally likely), 9% (Unlikely)
- Hire freelancers with skills relevant to new technologies: 58% (Likely), 24% (Equally likely), 18% (Unlikely)
- Strategic redundancies of staff who lack the skills to use new technologies: 51% (Likely), 20% (Equally likely), 29% (Unlikely)

Emerging skills
- Analytical thinking and innovation
- Active learning and learning strategies
- Creativity, originality and initiative
- Technology design and programming
- Critical thinking and analysis
- Complex problem-solving
- Leadership and social influence
- Emotional intelligence
- Reasoning, problem-solving and ideation
- Systems analysis and evaluation

Projected use of training providers (share of training)

- Internal department: 52%
- Private training providers: 28%
- Private educational institutions: 21%
- Public educational institutions: 19%
- Public training provider: 17%
### Regional Profile

**Sub-Saharan Africa**

#### Technology adoption (share of companies surveyed)

<table>
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<tr>
<th>Technology</th>
<th>Share</th>
</tr>
</thead>
<tbody>
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<td>User and entity big data analytics</td>
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</tr>
<tr>
<td>Quantum computing</td>
<td>48%</td>
</tr>
<tr>
<td>Non-humanoid land robots</td>
<td>46%</td>
</tr>
<tr>
<td>Biotechnology</td>
<td>35%</td>
</tr>
<tr>
<td>Humanoid robots</td>
<td>30%</td>
</tr>
<tr>
<td>Aerial and underwater robots</td>
<td>24%</td>
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</table>

#### Factors determining job location decisions

<table>
<thead>
<tr>
<th>Industry</th>
<th>Primary</th>
<th>Secondary</th>
<th>Tertiary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automotive, Aerospace, Supply Chain &amp; Transport</td>
<td>Talent availability</td>
<td>Production cost</td>
<td>Quality of the supply chain</td>
</tr>
<tr>
<td>Aviation, Travel &amp; Tourism</td>
<td>Talent availability</td>
<td>Organization HQ</td>
<td>Ease of importing talent</td>
</tr>
<tr>
<td>Chemistry, Advanced Materials &amp; Biotechnology</td>
<td>Talent availability</td>
<td>Labour cost</td>
<td>Geographic concentration</td>
</tr>
<tr>
<td>Consumer</td>
<td>Talent availability</td>
<td>Quality of the supply chain</td>
<td>Labour cost</td>
</tr>
<tr>
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<td>Labour cost</td>
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</tr>
<tr>
<td>Financial Services &amp; Investors</td>
<td>Talent availability</td>
<td>Strong local ed. provision</td>
<td>Ease of importing talent</td>
</tr>
<tr>
<td>Global Health &amp; Healthcare</td>
<td>Talent availability</td>
<td>Labour cost</td>
<td>Production cost</td>
</tr>
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<td>Information &amp; Communication Technologies</td>
<td>Talent availability</td>
<td>Labour cost</td>
<td>Ease of importing talent</td>
</tr>
<tr>
<td>Oil &amp; Gas</td>
<td>Talent availability</td>
<td>Production cost</td>
<td>Geographic concentration</td>
</tr>
<tr>
<td>Professional Services</td>
<td>Talent availability</td>
<td>Geographic concentration</td>
<td>Labour cost</td>
</tr>
</tbody>
</table>

Range of options: Flexibility of labour laws, Geographic spread, Quality of the supply chain, Ease of importing talent, Labour cost, Location of raw materials, Organization HQ, Production cost, Strong local education provision, Talent availability.

#### Emerging job roles

- **Software and Applications Developers and Analysts**
  - Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products
  - Human Resources Specialists
  - Financial and Investment Advisers
  - Assembly and Factory Workers
  - Electrotechnology Engineers
- **Managing Directors and Chief Executives**
- **Sales and Marketing Professionals**
- **Data Analysts and Scientists**
- **General and Operations Managers**
- **Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products**
- **Human Resources Specialists**
- **Financial and Investment Advisers**
- **Assembly and Factory Workers**
- **Electrotechnology Engineers**

The Future of Jobs Report 2018
Regional Profile

Sub-Saharan Africa

Average reskilling needs (share of workforce)

- Less than 1 month .......... 13%
- 1 to 3 months ............. 12%
- 3 to 6 months ............. 9%
- 6 to 12 months ............ 9%
- Over 1 year ............... 9%
- No reskilling needed ...... 48%

Responses to shifting skills needs (share of companies surveyed)

- Hire new permanent staff with skills relevant to new technologies: 85%
- Look to automate the work: 84%
- Hire new temporary staff with skills relevant to new technologies: 75%
- Expect existing employees to pick up skills on the job: 72%
- Retrain existing employees: 70%
- Outsource some business functions to external contractors: 65%
- Hire freelancers with skills relevant to new technologies: 58%
- Strategic redundancies of staff who lack the skills to use new technologies: 52%

Emerging skills

- Analytical thinking and innovation
- Creativity, originality and initiative
- Active learning and learning strategies
- Technology design and programming
- Complex problem-solving
- Critical thinking and analysis
- Leadership and social influence
- Reasoning, problem-solving and ideation
- Emotional intelligence
- Resilience, stress tolerance and flexibility

Projected use of training providers (share of training)

- Internal department: 48%
- Private training providers: 29%
- Private educational institutions: 20%
- Public training provider: 15%
- Public educational institutions: 14%
# Regional Profile

## Western Europe

## Technology adoption (share of companies surveyed)

<table>
<thead>
<tr>
<th>Technology</th>
<th>Share (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>User and entity big data analytics</td>
<td>90%</td>
</tr>
<tr>
<td>Internet of things</td>
<td>80%</td>
</tr>
<tr>
<td>Machine learning</td>
<td>79%</td>
</tr>
<tr>
<td>App- and web-enabled markets</td>
<td>78%</td>
</tr>
<tr>
<td>Cloud computing</td>
<td>73%</td>
</tr>
<tr>
<td>Augmented and virtual reality</td>
<td>69%</td>
</tr>
<tr>
<td>Digital trade</td>
<td>64%</td>
</tr>
<tr>
<td>Encryption</td>
<td>60%</td>
</tr>
<tr>
<td>New materials</td>
<td>57%</td>
</tr>
<tr>
<td>Wearable electronics</td>
<td>55%</td>
</tr>
<tr>
<td>Distributed ledger (blockchain)</td>
<td>54%</td>
</tr>
<tr>
<td>3D printing</td>
<td>52%</td>
</tr>
<tr>
<td>Autonomous transport</td>
<td>50%</td>
</tr>
<tr>
<td>Stationary robots</td>
<td>49%</td>
</tr>
<tr>
<td>Non-humanoid land robots</td>
<td>45%</td>
</tr>
<tr>
<td>Quantum computing</td>
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<td>Biotechnology</td>
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## Factors determining job location decisions

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<tr>
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<td>Strong local ed. provision</td>
<td>Geographic concentration</td>
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### Range of options:
- Flexibility of labour laws
- Geographic spread
- Quality of the supply chain
- Ease of importing talent
- Labour cost
- Location of raw materials
- Organization HQ
- Production cost
- Strong local education provision
- Talent availability

## Emerging job roles

| Software and Applications Developers and Analysts | Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products |
| Managing Directors and Chief Executives         | Human Resources Specialists       |
| Sales and Marketing Professionals               | Financial and Investment Advisers  |
| Data Analysts and Scientists                     | Financial Analysts                |
| General and Operations Managers                  | Assembly and Factory Workers      |

## Industry

- **Primary**: Talent availability
- **Secondary**: Quality of the supply chain, Organization HQ, Labour cost
- **Tertiary**: Production cost, Production cost, Production cost

- **Factor ranges**: Flexibility of labour laws, Geographic spread, Quality of the supply chain
Regional Profile

Western Europe

Average reskilling needs (share of workforce)

- Less than 1 month: 13%
- 1 to 3 months: 13%
- 3 to 6 months: 10%
- 6 to 12 months: 9%
- Over 1 year: 1%
- No reskilling needed: 47%

Responses to shifting skills needs (share of companies surveyed)

- Hire new permanent staff with skills relevant to new technologies: 86%
- Look to automate the work: 84%
- Retrain existing employees: 75%
- Expect existing employees to pick up skills on the job: 71%
- Hire new temporary staff with skills relevant to new technologies: 69%
- Outsource some business functions to external contractors: 63%
- Hire freelancers with skills relevant to new technologies: 60%
- Strategic redundancies of staff who lack the skills to use new technologies: 52%

Projected use of training providers (share of training)

- Internal department: 48%
- Private training providers: 27%
- Private educational institutions: 20%
- Public educational institutions: 18%
- Public training provider: 16%

Emerging skills

- Creativity, originality and initiative
- Analytical thinking and innovation
- Active learning and learning strategies
- Technology design and programming
- Complex problem-solving
- Critical thinking and analysis
- Leadership and social influence
- Emotional intelligence
- Systems analysis and evaluation
- Reasoning, problem-solving and ideation

The Future of Jobs Report 2018
Contributors

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Saadia Zahidi is a Member of the Managing Board and Head of the Centre for the New Economy and Society at the World Economic Forum. Through the System Initiative on Economic Progress and the System Initiative on Education, Gender and Work, her teams work with leaders from business, government, civil society and academia to understand and shape the new economy, advance competitiveness, drive social mobility and inclusion, close skills gaps, prepare for the future of work and foster gender equality and diversity. Saadia founded and co-authors the Forum’s Future of Jobs Report, Global Gender Gap Report, and Global Human Capital Report. Her book, Fifty Million Rising, charts the rise of working women in the Muslim world and is longlisted for the FT/McKinsey Business Book of the Year 2018. She has been selected as one of the BBC’s 100 Women and won the inaugural FT/McKinsey Bracken Bower Prize for prospective authors under 35. She holds a BA in Economics from Smith College, an MPhil in International Economics from the Graduate Institute of Geneva and an MPA from the Harvard Kennedy School. Her interests include the future of work, the impact of technology on employment, education and skills gaps, income inequality and using big data for public good.
The World Economic Forum would like to thank the Partners of the System Initiative on Shaping the Future of Education, Gender and Work for their guidance and support to the System Initiative and this report.

- A.T. Kearney
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- Afghanim Industries
- AlixPartners
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- Centrica
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- Hewlett Packard Enterprise
- Home Instead
- HP Inc.
- HSBC
- Hubert Burda Media
- IKEA Group
- Infosys
- JD.com
- JLL
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- LinkedIn
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- NYSE
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- Ooredoo
- PayPal
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- PwC
- QI Group
- Recruit Holdings
- Salesforce
- SAP
- Saudi Aramco
- SeverGroup
- Tata Consultancy Services
- The Rockefeller Foundation
- Turkcell
- UBS
- Unilever
- VMware
- Willis Towers Watson
- Workday
- WPP

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To learn more about the System Initiative, please refer to the System Initiative website: https://www.weforum.org/system-initiatives/shaping-the-future-of-education-gender-and-work.
The *Future of Jobs Report 2018* is the result of extensive collaboration between the World Economic Forum and its constituents, amplified by key regional survey partners. We would like to recognize the following organizations for their contribution to the World Economic Forum's Future of Jobs Survey and this report.

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<thead>
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A special thank you to colleagues who made distinctive contributions to the development of this report: Genesis Elhussein, Project Specialist and Ilaria Marchese, Data Specialist. Additional thanks to our colleagues in the Education, Gender and Work System Initiative, including Piya Miti Bing Chomprasob, Rigas Hadzilacos, Elselot Hasselaar, Valerie Peyre, Pearl Samandari and Lyuba Spagnoletto.

This report would not have been possible without the support of our colleagues across the Forum’s Business Engagement Team, Centre for Global Industries and Centre for Regional and Geopolitical Affairs. In particular, we would like to express our deep appreciation to Nour Chabaane, Emma Skov Christiansen, David Connolly, Renee van Heusden, Nikolai Khlystov, Julien Lederman, Wolfgang Lehmacher, Tiffany Misrahi, Andrew Moose and Julia Suit in the Forum’s Centre for Global Industries. In the Centre for Regional and Geopolitical Affairs, expansion of the report’s geographical coverage was made possible by the support of Elsie Kanza, Bertrand Assamoi, Nontle Kabanyane and Dieynaba Tandian for the Africa region; Justin Wood, Oliver Hess and Thuy Nguyen for the ASEAN region; Liam Foran for Australia; Martin Larkin, Anastasia Kalinina, Anna Knyazeva, Verena Kuhn, Rosanna Mastroiaccono and Mark O’Mahoney for the wider Europe region, Denise Burnet and Fabienne Chanavat for France and Michèle Mischler for Switzerland; Sriram Gutta and Suchi Kedia for India; Joo-Ok Lee for the Republic of Korea; Marisol Argueta, Diego Bustamante and Ana del Barrio for the Latin America region; and Malik Faraoun and Teresa Belardo for the MENA region. Finally, a special thank you to Oliver Cann and the World Economic Forum’s Media and Publications team for their invaluable collaboration on the production of this report.

We gratefully acknowledge the excellent collaboration with LinkedIn’s Economic Graph team under the leadership of Sue Duke, with contributions from Nick Eng and Kristin Keveloh.

A special thank you to Michael Fisher for his excellent copyediting work and Neil Weinberg for his superb graphic design and layout. We greatly appreciate the work of design firm Graphéine, which created the cover.
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