

## Major Findings

*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, labor market policies, business approaches to developing skills, employment arrangements and existing social contracts. Catalyzing 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.*

*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.*

1. **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.
2. **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.
3. **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.

4. **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.
5. **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.
6. **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.

7. **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.
8. **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.
9. **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.

10. **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.
11. **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.

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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.