

Executive Summary: The Future of Jobs and Skills

Disruptive changes to business models will have a profound impact on the employment landscape over the coming years. Many of the major drivers of transformation currently affecting global industries are expected to have a significant impact on jobs, ranging from significant job creation to job displacement, and from heightened labour productivity to widening skills gaps. In many industries and countries, the most in-demand occupations or specialties did not exist 10 or even five years ago, and the pace of change is set to accelerate. By one popular estimate, 65% of children entering primary school today will ultimately end up working in completely new job types that don't yet exist. In such a rapidly evolving employment landscape, the ability to anticipate and prepare for future skills requirements, job content and the aggregate effect on employment is increasingly critical for businesses, governments and individuals in order to fully seize the opportunities presented by these trends—and to mitigate undesirable outcomes.

The World Economic Forum's *Future of Jobs Report* seeks to understand the current and future impact of key disruptions on employment levels, skill sets and recruitment patterns in different industries and countries. It does so by asking the Chief Human Resources Officers (CHROs) of today's largest employers to imagine how jobs in their industry will change up to the year 2020.

DRIVERS OF CHANGE

We are today at the beginning of a Fourth Industrial Revolution. Developments in previously disjointed fields such as artificial intelligence and machine learning, robotics, nanotechnology, 3D printing and genetics and biotechnology are all building on and amplifying one another. Smart systems—homes, factories, farms, grids or entire cities—will help tackle problems ranging from supply chain management to climate change. Concurrent to this technological revolution are a set of broader socio-economic, geopolitical and demographic developments, with nearly equivalent impact to the technological factors.

We also find that on average respondents expect that the impact for nearly all drivers will occur within the next 5 years, highlighting the urgency for adaptive action today.

EMPLOYMENT TRENDS

The global workforce is expected to experience significant churn between job families and functions. Across the countries covered by the *Report*, current trends could lead to a net employment impact of more than 5.1 million jobs lost to disruptive labour market changes over the period 2015–2020, with a total loss of 7.1 million jobs—two thirds of which are concentrated in routine white collar office

Methodology

The *Future of Jobs Report's* research framework has been shaped and developed in collaboration with the Global Agenda Council on the Future of Jobs and the Global Agenda Council on Gender Parity, including leading experts from academia, international organizations, professional service firms and the heads of human resources of major organizations. Our analysis groups job functions into specific occupations and broader job families, based on a streamlined version of the O*NET labour market information system used by researchers worldwide.

The dataset that forms the basis of the *Report* is the result of an extensive survey of CHROs and other senior talent and strategy executives from a total of 371 leading global employers, representing more than 13 million employees across 9 broad industry sectors in 15 major developed and emerging economies and regional economic areas.

functions, such as Office and Administrative roles—and a total gain of 2 million jobs, in Computer and Mathematical and Architecture and Engineering related fields. Manufacturing and Production roles are also expected to see a further bottoming out but are also anticipated to have relatively good potential for upskilling, redeployment and productivity enhancement through technology rather than pure substitution.

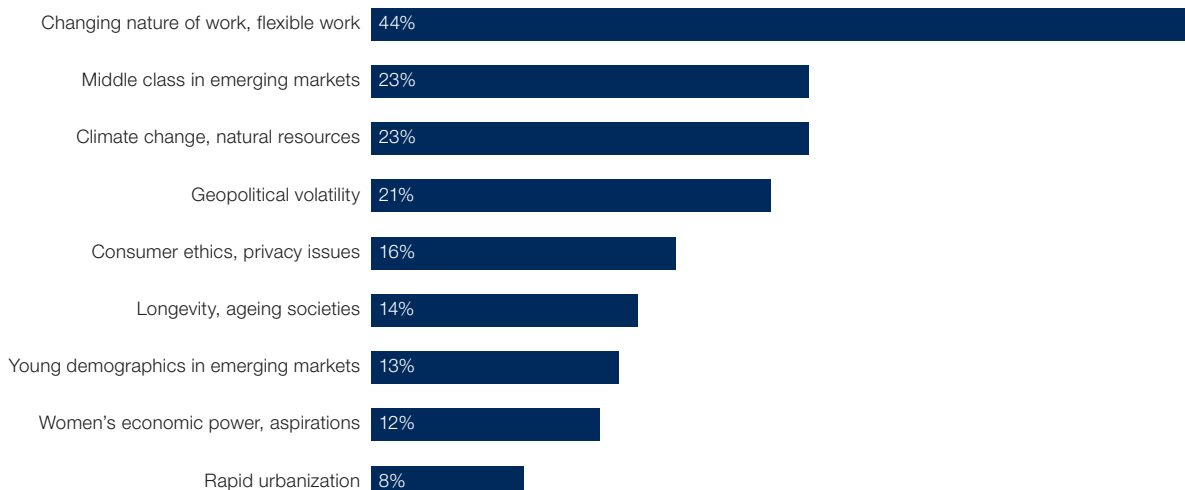
New and Emerging Roles

Our research also explicitly asked respondents about new and emerging job categories and functions that they expect to become critically important to their industry by the year 2020. Two job types stand out due to the frequency and consistency with which they were mentioned across practically all industries and geographies. The first are data analysts, which companies expect will help them make sense and derive insights from the torrent of data generated by technological disruptions. The second are specialized sales representatives, as practically every industry will need to become skilled in commercializing and explaining their offerings to business or government clients and consumers, either due to the innovative technical nature of the products themselves or due to new client targets with which the company is not yet familiar, or both. A particular need is also seen in industries as varied as Energy and Media, Entertainment and Information for a new type of senior manager who will successfully steer companies through the upcoming change and disruption.

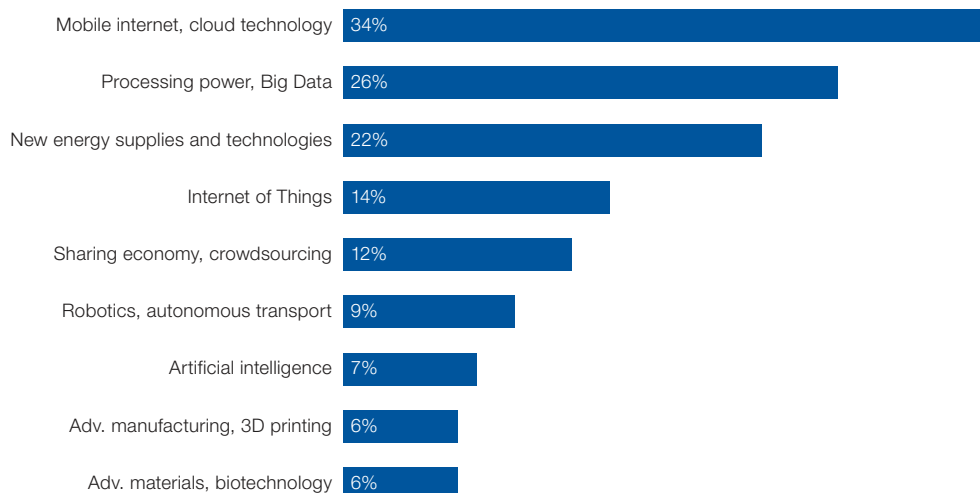
Drivers of change, industries overall

Share of respondents rating driver as top trend, %

DEMOGRAPHIC AND SOCIO-ECONOMIC



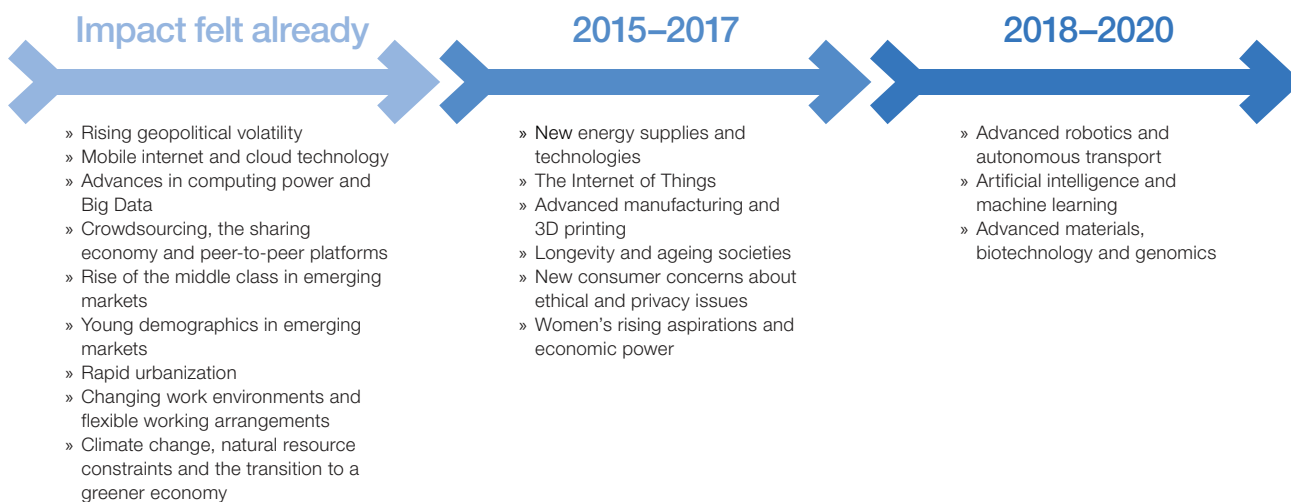
TECHNOLOGICAL



Source: Future of Jobs Survey, World Economic Forum.

Note: Names of drivers have been abbreviated to ensure legibility.

Timeframe to impact industries, business models



Net employment outlook by job family, 2015–2020
 Employees (thousands, all focus countries)



Changes in Ease of Recruitment

Given the overall disruption industries are experiencing, it is not surprising that, with current trends, competition for talent in in-demand job families such as Computer and Mathematical and Architecture and Engineering and other strategic and specialist roles will be fierce, and finding efficient ways of securing a solid talent pipeline a priority for virtually every industry. Most of these roles across industries, countries and job families are already perceived as hard to recruit for currently and—with few exceptions—the situation is expected to worsen significantly over the 2015-2020 period.

SKILLS STABILITY

In this new environment, business model change often translates to skill set disruption almost simultaneously and with only a minimal time lag. Our respondents report that a tangible impact of many of these disruptions on the adequacy of employees' existing skill sets can already be felt in a wide range of jobs and industries today.

Given the rapid pace of change, business model disruptions are resulting in a near-simultaneous impact on skill sets for both current and emerging jobs across industries. If skills demand is evolving rapidly at an aggregate industry level, the degree of changing skills requirements within individual job families and occupations is even more pronounced. Even jobs that will shrink in number are simultaneously undergoing change in the skill

sets required to do them. Across nearly all industries, the impact of technological and other changes is shortening the shelf-life of employees' existing skill sets.

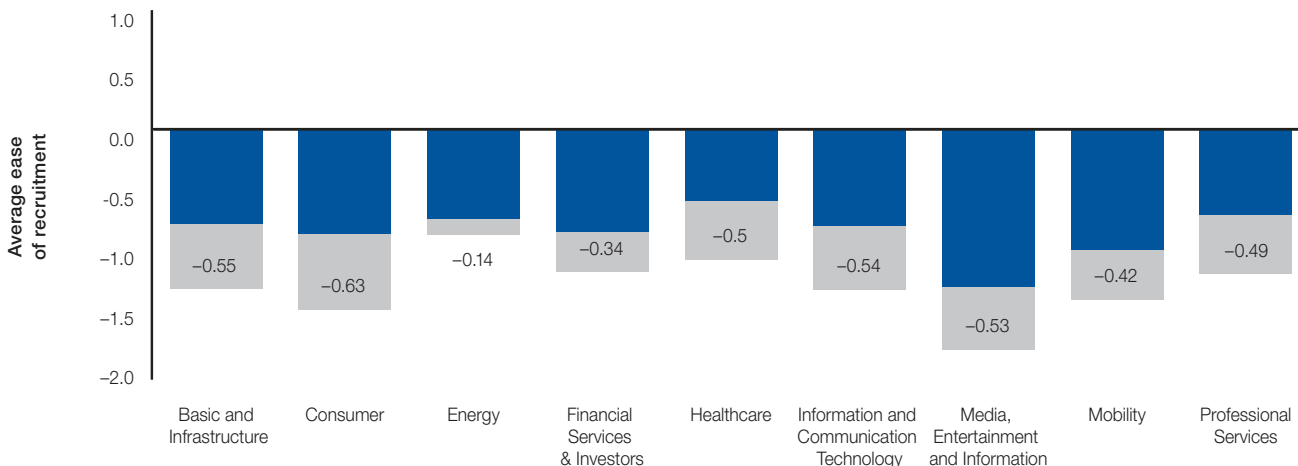
For example, technological disruptions such as robotics and machine learning—rather than completely replacing existing occupations and job categories—are likely to substitute specific tasks previously carried out as part of these jobs, freeing workers up to focus on new tasks and leading to rapidly changing core skill sets in these occupations. Even those jobs that are less directly affected by technological change and have a largely stable employment outlook—say, marketing or supply chain professionals targeting a new demographic in an emerging market—may require very different skill sets just a few years from now as the ecosystems within which they operate change.

On average, by 2020, more than a third of the desired core skill sets of most occupations will be comprised of skills that are not yet considered crucial to the job today, according to our respondents. Overall, social skills—such as persuasion, emotional intelligence and teaching others—will be in higher demand across industries than narrow technical skills, such as programming or equipment operation and control. In essence, technical skills will need to be supplemented with strong social and collaboration skills.

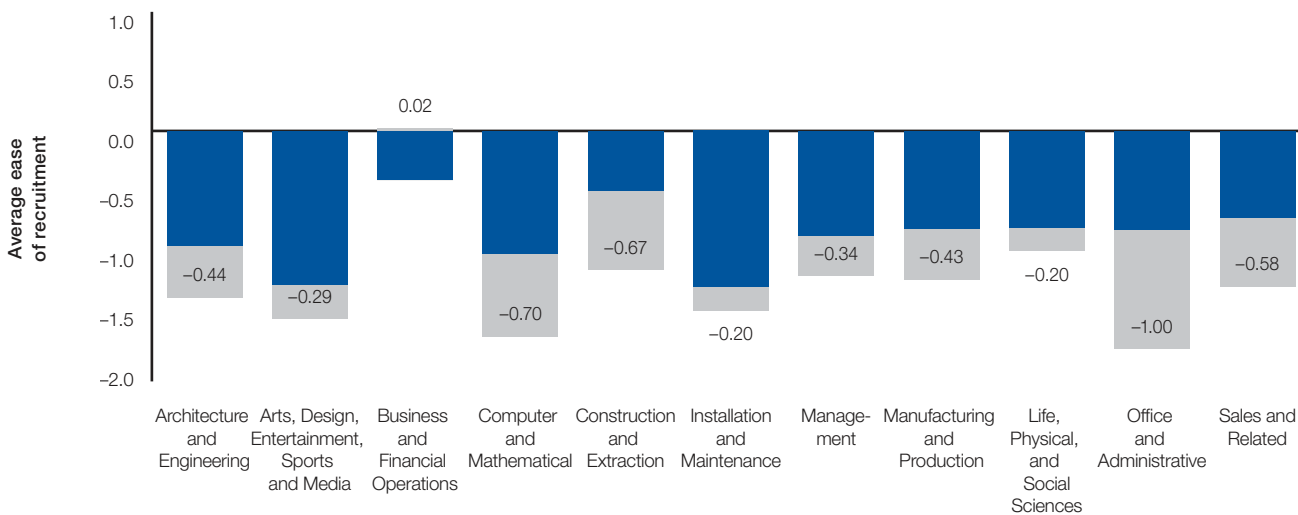
Several industries may find themselves in a scenario of positive employment demand for hard-to-recruit specialist

Expected change in ease of recruitment, 2015–2020
 Perception rating on a –2 (“very hard”) to +2 (“very easy”) scale

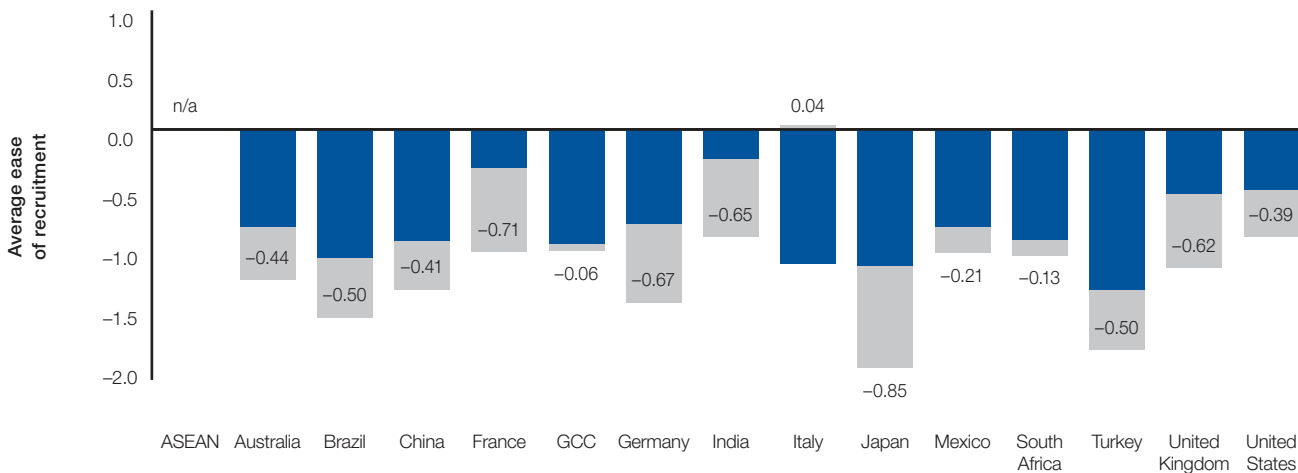
INDUSTRIES



JOB FAMILIES



COUNTRY/REGION

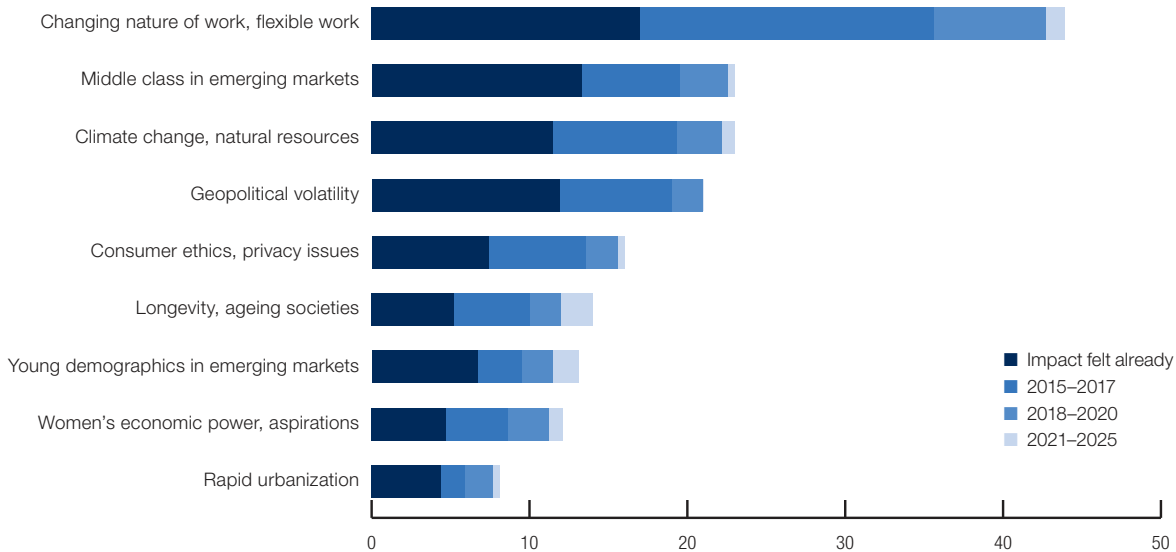


Source: Future of Jobs Survey, World Economic Forum.

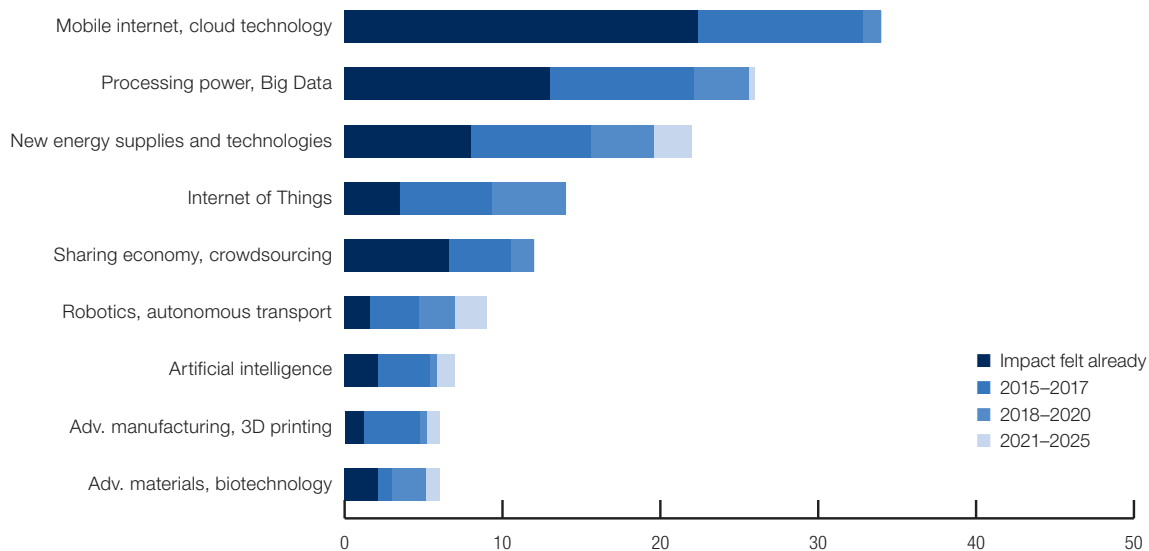
Drivers of change, time to impact on employee skills

Share of respondents, %

DEMOGRAPHIC AND SOCIO-ECONOMIC



TECHNOLOGICAL



Source: Future of Jobs Survey, World Economic Forum.

Note: Names of drivers have been abbreviated to ensure legibility.

occupations with simultaneous skills instability across many existing roles. For example, the Mobility industries expect employment growth accompanied by a situation where nearly 40% of the skills required by key jobs in the industry are not yet part of the core skill set of these functions today.

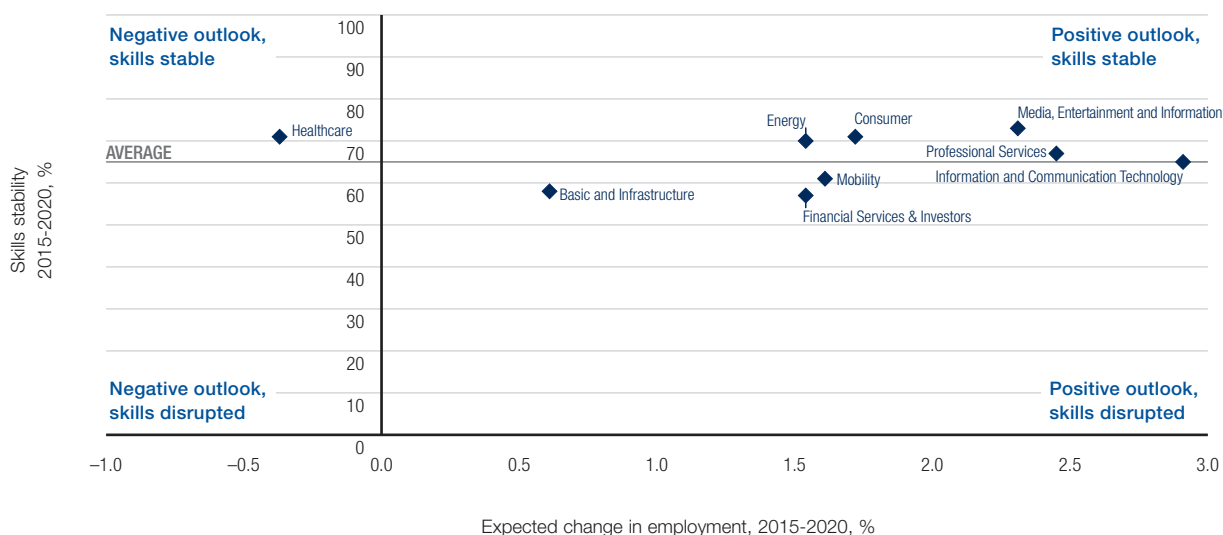
At the same time, workers in lower skilled roles, particularly in the Office and Administrative and Manufacturing and Production job families, may find themselves caught up in a vicious cycle where low skills stability means they could face redundancy without significant re- and upskilling even while disruptive change may erode employers' incentives and the business case for investing in such reskilling.

Skills Stability, 2015–2020, industries overall

Industry group	Unstable	Stable
Industries Overall	35%	65%
Media, Entertainment and Information	27%	73%
Consumer	30%	71%
Healthcare	29%	71%
Energy	30%	70%
Professional Services	33%	67%
Information and Communication Technology	35%	65%
Mobility	39%	61%
Basic and Infrastructure	42%	58%
Financial Services & Investors	43%	57%

Source: Future of Jobs Survey, World Economic Forum.

Employment outlook and skills stability, by industry



Source: Future of Jobs Survey, World Economic Forum.

FUTURE WORKFORCE STRATEGY

The impact of technological, demographic and socio-economic disruptions on business models will be felt in transformations to the employment landscape and skills requirements, resulting in substantial challenges for recruiting, training and managing talent. Not anticipating and addressing such issues in a timely manner over the coming years may come at an enormous economic and social cost for businesses, individuals and economies and societies as a whole.

The *Report* finds that business leaders are aware of these looming challenges but have been slow to act decisively. Just over two thirds of our respondents believe that future workforce planning and change management features as a reasonably high or very high priority on the agenda of their company's or organization's senior leadership.

However, many of the respondents are also acutely aware of the limitations to their current planning for disruptive change and its implications for the talent landscape. Currently, only 53% of CHROs surveyed are reasonably or highly confident regarding the adequacy of their organization's future workforce strategy to prepare for these shifts. The main perceived barriers to a more decisive approach include a lack of understanding of the disruptive changes ahead, resource constraints and short-term profitability pressures and lack of alignment between workforce strategies and firms' innovation strategies.

Across all industries, about two thirds of our respondents report intentions to invest in the reskilling of current employees as part of their change management and future workforce planning efforts, making it by far the highest-ranked such strategy overall. However, companies that report both that they are confident in the adequacy of their workforce strategy and that these issues are perceived as a priority by their top management are nearly 50% more

likely to plan to invest in reskilling than companies who do not. This group of companies is also more than twice as likely to be targeting female talent and minority talent and over 50% more likely to be supporting employees' mobility and job rotation within the firm. They are significantly less likely to plan to hire more short-term workers or to use expatriate talent.

A number of promising approaches appear underutilized across almost all industries. For example, a focus on making better use of the accumulated experience of older employees and building an ageless workforce barely register among proposed workforce strategies. There also seems to be varying openness to collaboration, whether within or across industries, with the latter seemingly much more acceptable. Finally, a key approach, partnerships with public institutions and the education sector, is only reported by 20% of respondents.

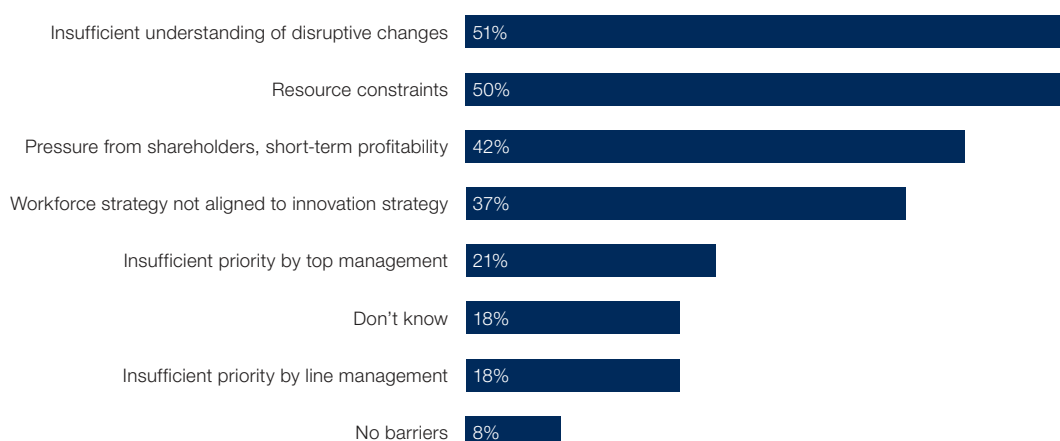
RECOMMENDATIONS FOR ACTION

Recent discussions about the employment impact of disruptive change have often been polarized between those who foresee limitless opportunities in newly emerging job categories and prospects that improve workers' productivity and liberate them from routine work, and those that foresee massive labour substitution and displacement of jobs. Both are possible. It is our actions today that will determine whether we head towards massive displacement of workers or the emergence of new opportunities.

During previous industrial revolutions, it often took decades to build the training systems and labour market institutions needed to develop major new skill sets on a large scale. Given the upcoming pace and scale of disruption brought about by the Fourth Industrial Revolution, however, this is simply not be an option. Without targeted action today to manage the near-term transition and build a workforce with futureproof skills, governments will have

Significance of barriers to change, industries overall

Share of respondents reporting barrier, %

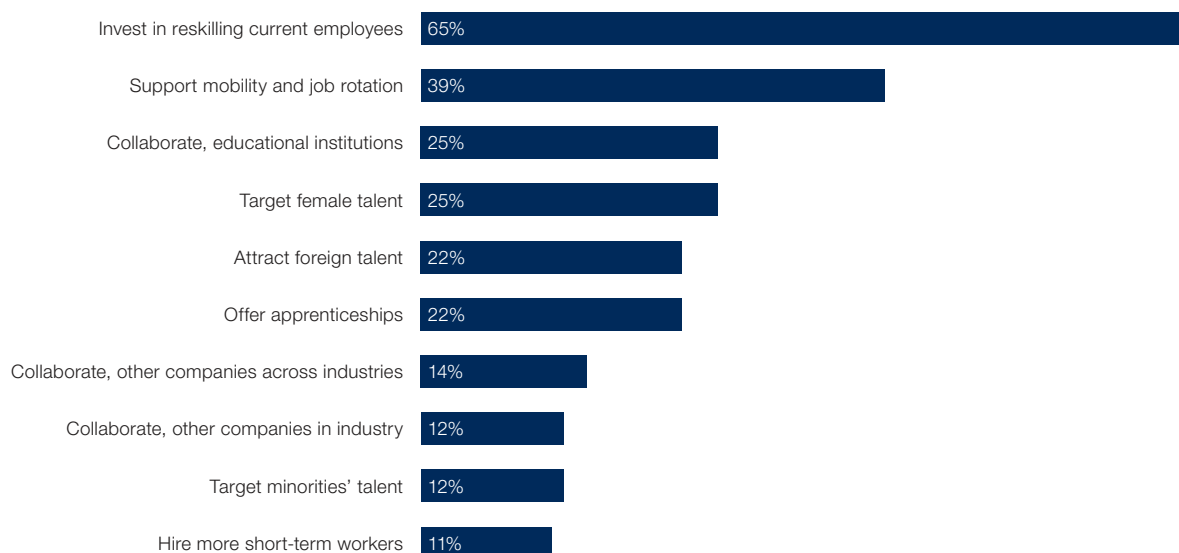


Source: Future of Jobs Survey, World Economic Forum.

Note: Names of barriers have been abbreviated to ensure legibility.

Future workforce strategies, industries overall

Share of respondents pursuing strategy, %



Source: Future of Jobs Survey, World Economic Forum.

Note: Names of strategies have been abbreviated to ensure legibility.

to cope with ever-growing unemployment and inequality, and businesses with a shrinking consumer base. Moreover, these efforts are necessary not just to mitigate the risks of the profound shifts underway but also to capitalize on the opportunities presented by the Fourth Industrial Revolution. The talent to manage, shape and lead the changes underway will be in short supply unless we take action today to develop it.

For a talent revolution to take place, governments and businesses will need to profoundly change their approach to education, skills and employment, and their approach to working with each other. Businesses will need to put talent development and future workforce strategy front and centre to their growth. Firms can no longer be passive consumers

of ready-made human capital. They require a new mindset to meet their talent needs and to optimize social outcomes. Governments will need to re-consider fundamentally the education models of today. As the issue becomes more urgent, governments will need to show bolder leadership in putting through the curricula and labour market regulation changes that are already decades overdue in some economies.

While it is clear from our data that momentous change is underway across the board, these forecasts vary in nature in different industries and regions. Efforts aimed at closing skills gaps will increasingly need to be grounded in a solid understanding of a country's or industry's skills base today and of changing future skills requirements due to disruptive

change. For example, efforts to place unemployed youth in apprenticeships in certain job categories through targeted skills training may be self-defeating if skills requirements in that job category are likely to be drastically different in just a few years' time. Indeed, in some cases such efforts may be more successful if they base their models on future expectations.

It is therefore critical that broader and longer term changes to basic and lifelong education systems are complemented with specific, urgent and focused re-skilling efforts in each industry. This entails several major changes in how business views and manages talent, both immediately and in the longer term. In particular, the *Future of Jobs Report* finds that there are four areas with short term implications and three that are critical for long term resilience.

Immediate Focus

- **Reinventing the HR Function:** As business leaders begin to consider proactive adaptation to the new talent landscape, they need to manage skills disruption as an urgent concern. What this requires is an HR function that is rapidly becoming more strategic and has a seat at the table—one that employs new kinds of analytical tools to spot talent trends and skills gaps, and provides insights that can help organizations align their business, innovation and talent management strategies to maximize available opportunities to capitalize on transformational trends.
- **Making Use of Data Analytics:** Businesses and governments will need to build a new approach to workforce planning and talent management, where better forecasting data and planning metrics will need to be central. To support such efforts, the Forum's Future of Jobs project provides in-depth analysis on industries, countries, occupations and skills.
- **Talent diversity—no more excuses:** As study after study demonstrates the business benefits of workforce diversity and companies expect finding talent for many key specialist roles to become much more difficult by 2020, it is time for a fundamental change in how talent diversity issues perceived and well-known barriers tackled. In this area, too, technology and data analytics may become a useful tool for advancing workforce parity, whether by facilitating objective assessment, identifying unconscious biases in job ads and recruitment processes or even by using wearable technologies to understand workplace behaviours and encourage systemic change.
- **Leveraging flexible working arrangements and online talent platforms:** As physical and organizational boundaries are becoming increasingly blurred, organizations are going to have to become significantly more agile in the way they think about managing people's work and about the workforce as a whole. Businesses will increasingly connect and

collaborate remotely with freelancers and independent professionals through digital talent platforms. Modern forms of association such as digital freelancers' unions and updated labour market regulations will increasingly begin to emerge to complement these new organizational models.

Longer Term Focus

- **Rethinking education systems:** Most existing education systems at all levels provide highly siloed training and continue a number of 20th century practices that are hindering progress on today's talent and labour market issues. Two such legacy issues burdening formal education systems worldwide are the dichotomy between Humanities and Sciences and applied and pure training, on the one hand, and the prestige premium attached to tertiary-certified forms of education—rather than the actual content of learning—on the other hand. Businesses should work closely with governments, education providers and others to imagine what a true 21st century curriculum might look like.
- **Incentivizing lifelong learning:** The dwindling future population share of today's youth cohort in many ageing economies implies that simply reforming current education systems to better equip today's students to meet future skills requirements—as worthwhile and daunting as that task is—is not going to be enough to remain competitive. Ageing countries won't just need lifelong learning—they will need wholesale reskilling of existing workforces throughout their lifecycle. Governments and businesses have many opportunities to collaborate more to ensure that individuals have the time, motivation and means to seek retraining opportunities.
- **Cross-industry and public-private collaboration:** Given the complexity of the change management needed, businesses will need to realize that collaboration on talent issues, rather than competition, is no longer a nice-to-have but rather a necessary strategy. Multi-sector partnerships and collaboration, when they leverage the expertise of each partner in a complementary manner, are indispensable components of implementing scalable solutions to jobs and skills challenges. There is thus a need for bolder leadership and strategic action within companies and within and across industries, including partnerships with public institutions and the education sector.

These efforts will need to be complemented by policy reform on the part of governments. As a core component of the World Economic Forum's Global Challenge Initiative on Employment, Skills and Human Capital, the Future of Jobs project aims to bring specificity to the upcoming disruptions to the employment and skills landscape in industries and regions—and to stimulate deeper thinking and targeted action from business and governments to manage this

change. The 2020 focus of the Report was chosen so as to be far enough into the future for many of today's expected trends and disruptions to have begun taking hold, yet close enough to consider adaptive action today, rather than merely speculate on future risks and opportunities. The industry analysis presented in the Report will form the basis of dialogue with industry leaders to address industry-specific talent challenges, while the country and regional analysis presented in this Report will be integrated into national and regional public-private collaborations to promote employment and skills.



COMMITTED TO
IMPROVING THE STATE
OF THE WORLD

The World Economic Forum, committed to improving the state of the world, is the International Organization for Public-Private Cooperation.

The Forum engages the foremost political, business and other leaders of society to shape global, regional and industry agendas.

World Economic Forum
91–93 route de la Capite
CH-1223 Cologny/Geneva
Switzerland

Tel.: +41 (0) 22 869 1212
Fax: +41 (0) 22 786 2744

contact@weforum.org
www.weforum.org