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THE FUTURE OF WORK: SWITZERLAND'S DIGITAL OPPORTUNITY

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IN COLLABORATION WITH
MCKINSEY & COMPANY SWITZERLAND

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PREFACE

The development of digital, automation, and artificial intelligence (AI) technologies is arguably a potent force for socioeconomic change. Labor markets will be disrupted, with many tasks being replaced by machines. There is widespread fear that job opportunities may be more limited in the future as technologies substitute a broader range of human activities. There will be significant shifts in the demand for certain skills, some becoming more in demand, and some significantly less. New types of working relationships are emerging.

While there is widespread acknowledgement that digital technologies are transforming labor markets, the conversation is now moving on to how products and service markets are being affected, how businesses should leverage these technologies to optimize their market performance, and what needs to be done to ensure that individuals have the skills and capabilities they will need.

In this report, the Swiss office of McKinsey & Company takes a perspective on these trends and their implications for Switzerland. The report was written in close collaboration with the McKinsey Global Institute (MGI), the business and economics research arm of McKinsey & Company. It draws on a number of global MGI reports, namely *A future that works: Automation, employment, and productivity* in January 2017, *Jobs lost, jobs gained: Workforce transitions in a time of automation* in December 2017, *Notes from the AI frontier: Insights from hundreds of use cases* in April 2018, *Skill shift: Automation and the future of the workforce* in May 2018, and *Notes from the AI frontier: Modeling the impact of AI on the world economy* in September 2018.

This report attempts a quantitative estimate of changes in activities and skills by 2030 in Switzerland following MGI's methodology. The main conclusions—namely that Switzerland needs to digitize its economy, and that there will be a significant corresponding shift in employment and skills—are not surprising and follow similar findings from independent think tank Avenir Suisse and the Swiss State Secretariat for Economic Affairs (SECO).*

In our midpoint scenario, we expect automation of 20 to 25 percent of all activities by 2030 and a rate of job displacement that might be double that observed in the past. We also find that digitization could have a positive overall effect on the total number of new jobs created and increase the competitiveness of the export-oriented Swiss economy. Nevertheless, Switzerland is yet to create the next global digital leaders.

The preparation of this report was led by Marco Ziegler, a McKinsey senior partner in Zurich together with Jacques Bughin, a McKinsey senior partner and a director of MGI based in Brussels, and Jan Mischke, an MGI partner based in Zurich. Felix Wenger, a McKinsey senior partner in Zurich, provided overall guidance, and Daniel Läubli and Angelika Reich, both McKinsey partners in Zurich, led the development of the final chapter. On the project team were Benedict Schneider, Johannes Berchtold, Minna Schmidt, Mita Sen, and Jonas Lehr. Gurneet Singh Dandona provided analytical support. We would like to

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*   T. Adler and M. Salvi, *Wenn die Roboter kommen – Den Arbeitsmarkt für die Digitalisierung vorbereiten (When the robots come – Preparing the work market for digitization)*, Avenir Suisse, October 2017; and *Auswirkungen der Digitalisierung auf Beschäftigung und Arbeitsbedingungen – Chancen und Risiken (Effects of digitization on employment and working conditions – opportunities and risks)*, Schweizerische Eidgenossenschaft, Der Bundesrat, November 2017.

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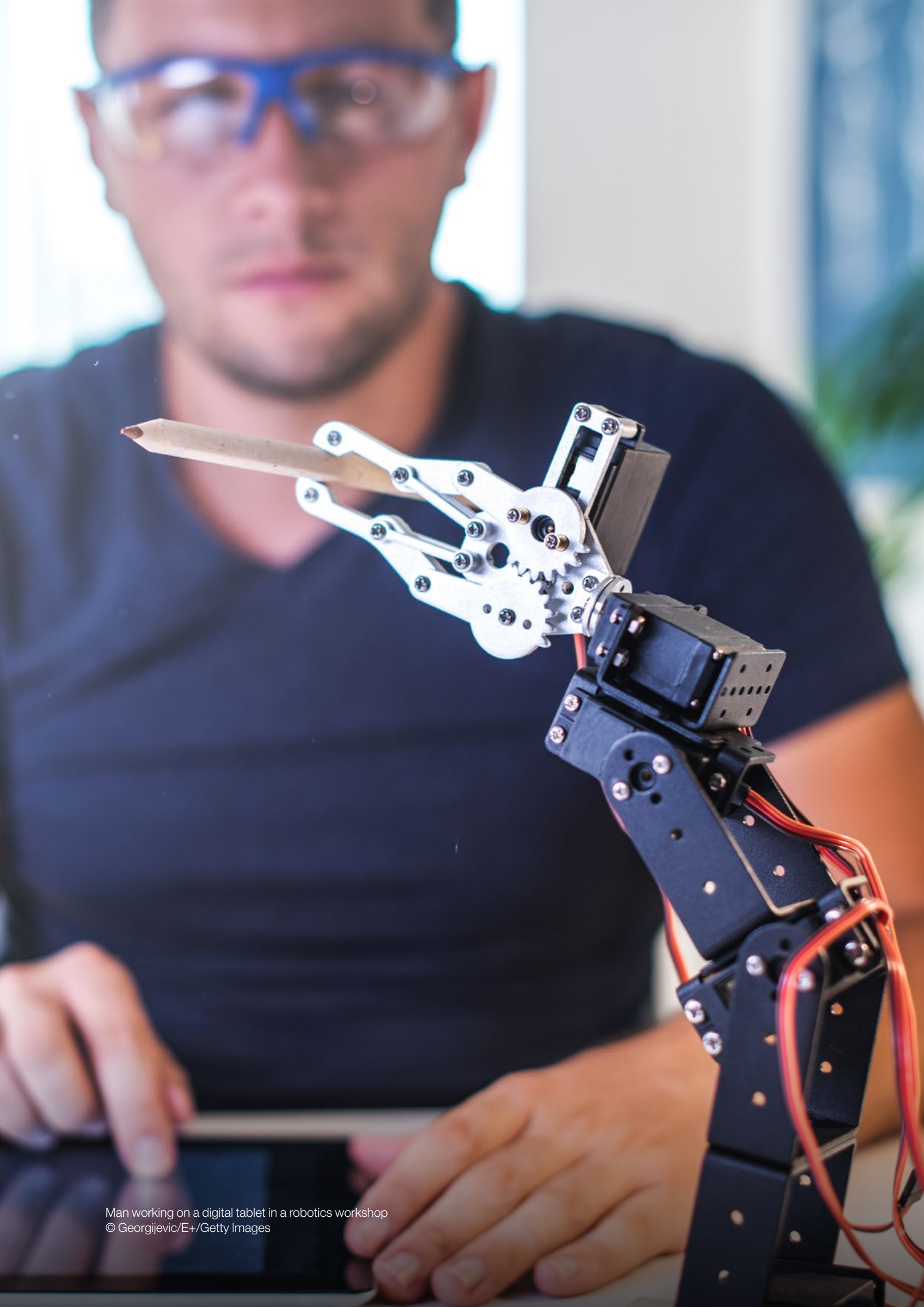
Man working on a digital tablet in a robotics workshop
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Digital, automation, and AI can revive Swiss productivity growth

0.5%
average productivity growth in Switzerland since 2010

>1%
could be added to productivity growth through digital opportunities in 2015–25

Productivity ↑

Time →
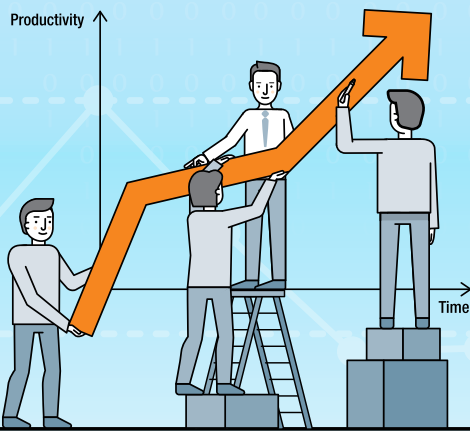
There will be disruption — but new jobs can replace old jobs

~1/5–1/4
of all tasks in Switzerland may be automated by 2030, but a **roughly equal number of new tasks** may also be created

–
1.0M
TO 1.2M
Displacement through automation and digitization

+
0.8M
TO 1.0M
New job equivalents created

Future of work
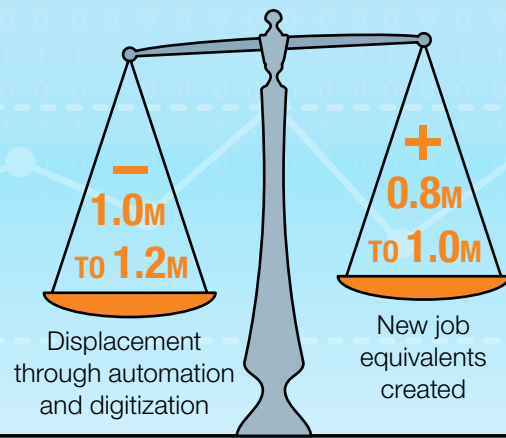
To sustain global competitiveness and inclusive growth, Switzerland needs to....

Accelerate digital transformation

- Companies need bold, large-scale digital transformation
- Policy makers need to enable digitization by opening sectors to innovation and competition

Reskill across society

- Companies need to adapt workforces to the automation era, reskilling at scale
- Switzerland may need to rethink its education system
- Immigration will need to continue to supply skilled workers

Reskill

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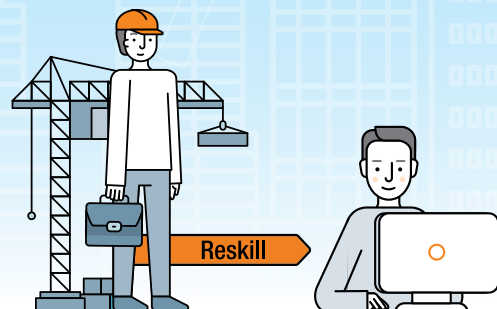
THE FUTURE OF WORK: SWITZERLAND'S DIGITAL OPPORTUNITY

Digital technologies are proliferating, automation is spreading, and advances in artificial intelligence (AI) technology are adding to the transformation of business and society. A top priority for many companies is how to optimize their use of these technologies, and how to master the massive effort required to develop the skills that will be needed in the workforce of the future. Drawing on research by the McKinsey Global Institute (MGI), this paper looks at digitization in all its forms—digital technologies themselves, automation, and AI—and the future of work in Switzerland in the period to 2030. Among our findings are:

- Today, Switzerland faces the twin challenges of an aging population and comparatively slow productivity growth (near-zero growth since the financial crisis). Digitization, automation, and AI can bring a much-needed productivity boost of about 1 percentage point annually to 2030 across advanced economies.

- Automation will disrupt labor markets and alter the characteristics of jobs, but could create as many new jobs as it displaces. More than half of all activities today are already automatable by adopting and adapting current technology. Typical technology adoption curves suggest that at least half of that potential could be realized by 2030, and possibly more if a technology race materializes. Assuming a midpoint scenario that may well turn out to be conservative, roughly one-fifth to one-quarter of work activities in Switzerland—equivalent to 1.0 million to 1.2 million jobs—could be replaced by automation by 2030. Job displacement is a regular feature of modern labor markets, but the pace of change could double. That does not necessarily mean that there will be net job losses. There is potential to create as many new job activities as are being automated. Activities equivalent to 400,000 new jobs could be created that are linked to technology itself (hardware/software), and companies implementing digital solutions. Another 400,000 job equivalents could be created as automation and AI drive real income growth, boost consumption, and increase demand for domestic employment, feeding into more economic growth. Even more jobs could be created if digitization and automation increase the competitiveness of Switzerland's export-oriented economy, and create global digital leaders.

- The impact on sectors will differ. The most extensive displacement of activities could be in retail and wholesale trade, manufacturing, finance, and the public sector—sectors that account for about half of all salaried employees and around 60 percent of Swiss GDP. Most jobs could be created in healthcare and technical and professional services. Some of the sectors in Switzerland that are likely to be more affected by displacement lag behind their counterparts in other advanced economies on digitization and need to catch up. For example, the share of online in retail is less than 8 percent, compared with 15 percent in Germany and 18 percent in the United Kingdom.

- Switzerland has already had an incentive to digitize and automate because of relatively high salaries, and is arguably well positioned to master the transition. It currently has some of the most competitive companies globally, but it needs to sustain this position and expand jobs linked to exports either by supplying digital technologies and services or adopting them rapidly in its most globalized sectors: 1.4 million jobs in Switzerland directly or indirectly depend on exports in chemicals and pharmaceuticals, machinery, watches, financial services, tourism, and information and communication technologies (ICT). Switzerland also needs to ensure that economic gains are reinvested in the economy to ensure inclusive growth in which productivity growth translates into rising consumption, investment, and robust demand for jobs rather than accumulation of wealth at the top. Fortunately—in contrast to the United States—there are few signs in Switzerland as yet of declining labor shares of income or polarization of wages.

- As Switzerland prepares for these changes to its labor markets in the digital and automation ages, it faces two imperatives: (1) accelerating digital transformation and (2) reskilling.

- First, companies need to embark on more comprehensive digital transformations, redesigning business models, customer journeys, and business processes so that they embed a "digital first" strategy. They need to develop digital operations and marketing with robotic process automation and advanced analytics, and reorganize their activities to support

digital transformation. The risk to companies that do not digitize and automate is that proactive incumbents and new, digitally enabled competitors cannibalize their business. Policy makers can encourage the transition by opening sectors to such disruption.

- Second, there is a skills imperative for Swiss companies and society more broadly. Today, Switzerland has a pool of highly skilled talent including well-educated immigrants, and a strong education system. Nevertheless, an extensive skill shift looms. We estimate that demand for tasks that require basic cognitive or physical and manual skills could decline by around 20 percent. Conversely, the need for social and emotional and technological skills is set to rise by around 20 percent and up to 50 percent, respectively. This transition will not be easy, as current job mobility is particularly low among those most strongly affected. The skill shift will exceed the regular rate at which labor and skills have dropped out of the market (through retirement, for instance). Furthermore, Switzerland's higher-education institutes only produce around 3,000 technology graduates a year—less than half the estimated number needed with advanced technological and IT skills. Education providers will need to shift their offers toward teaching technological and emotional skills, and toward lifelong learning. Executives point out that the required profiles are not sufficiently available. In McKinsey's quarterly panel survey conducted in November 2017, close to half of executives said that they will focus on training to adjust to their future workforce rather than hiring externally. Leading companies have already embarked on large-scale reskilling efforts, but more need to join. Immigration will need to continue to be part of the answer to Switzerland's shifting need for skills in the digital and automation era.

DIE ZUKUNFT DER ARBEIT: DIE DIGITALE CHANCE DER SCHWEIZ

Digitale Technologien befinden sich unaufhaltsam auf dem Vormarsch, die Automatisierung greift um sich und die Fortschritte im Bereich der künstlichen Intelligenz (KI) treiben den Wandel von Wirtschaft und Gesellschaft zusätzlich voran. Für viele Unternehmen ist heute prioritär, wie sie diese Technologien optimal einsetzen können und wie ihnen die Herausforderung gelingt, Expertise und Fertigkeiten ihrer Mitarbeitenden so zu entwickeln, dass sie optimal auf die neue Arbeitswelt vorbereitet sind. Die vorliegende Studie baut auf der langjährigen Forschung des McKinsey Global Institute (MGI) auf. Sie befasst sich mit der Digitalisierung in allen ihren Formen – digitalen Technologien, Automatisierung und KI – und mit der Zukunft der Arbeit in der Schweiz bis zum Jahr 2030. Im Zentrum stehen die folgenden Erkenntnisse:

- Die Schweiz steht heute vor der doppelten Herausforderung einer alternden Bevölkerung und eines vergleichsweise geringen Produktivitätswachstums (nahezu null seit der Finanzkrise). Digitalisierung, Automatisierung und KI gemeinsam können in hochentwickelten Volkswirtschaften wie der Schweiz bis 2030 für einen dringend benötigten Produktivitätsschub von etwa 1 Prozentpunkt pro Jahr sorgen.

- Die Automatisierung wird die Arbeitsmärkte fundamental umwälzen und die einer Beschäftigung zugrunde liegenden Tätigkeiten stark verändern. Nach unserer Berechnung wird diese Entwicklung zur Schaffung von ungefähr ebenso vielen neuen Arbeitsplätzen führen wie verdrängt werden. Mehr als die Hälfte aller Tätigkeiten lassen sich durch Übernahme und Anpassung vorhandener Technologien schon heute automatisieren. Typische Szenarien, in welchem Zeitraum Technologien in der Regel adaptiert werden, legen nahe, dass bis 2030 etwa die Hälfte des vorhandenen Automatisierungspotenzials auch realisiert werden könnte. Demnach würden bis 2030 rund ein Fünftel bis ein Viertel der Arbeitsaktivitäten in der Schweiz – das entspricht 1,0 bis 1,2 Millionen Arbeitsplätzen – durch Automatisierung ersetzt werden. Die Verlagerung von Arbeitsplätzen ist ein Merkmal moderner Arbeitsmärkte, aber das Tempo, in dem sich dieser Wandel vollzieht, könnte sich verdoppeln. Dabei muss es nicht zu einem Nettoabbau von Arbeitsplätzen kommen, da ebenso viele neue Jobs entstehen könnten: etwa 400'000 Arbeitsplätze direkt in Technologiebereichen (Hardware/Software) oder deren Implementierung durch Unternehmen; weitere 400'000 Arbeitsplätze durch reales Einkommenswachstum, das den Konsum ankurbelt und die Nachfrage nach inländischen Arbeitskräften erhöht.

- Die Auswirkungen auf die einzelnen Wirtschaftsbranchen werden sehr unterschiedlich ausfallen. Die stärkste Verlagerung von Aktivitäten könnte im Einzel- und Grosshandel, in der Industrie, im Finanzbereich und in der öffentlichen Verwaltung stattfinden – d.h. in Sektoren, auf die rund die Hälfte aller Beschäftigten und rund 60 Prozent des Schweizer BIP entfallen. Die meisten Arbeitsplätze könnten im Gesundheitswesen sowie bei technischen und professionellen Dienstleistungen entstehen. Einige Branchen, die stärker von der Verdrängung betroffen sein dürften, schliessen bei der Digitalisierung im Vergleich zu anderen Industrieländern schlechter ab und haben entsprechenden Aufholbedarf. So beträgt der Online-Anteil im Einzelhandel in der Schweiz weniger als 8 Prozent, verglichen mit 15 Prozent in Deutschland und 18 Prozent in Grossbritannien.

- Der Anreiz zur Digitalisierung und Automatisierung ist in der Schweiz aufgrund der relativ hohen Löhne bereits heute hoch. Viele Unternehmen sind gut aufgestellt, wenn es darum geht, die digitale Transformation zu meistern. Einige der wettbewerbsfähigsten Unternehmen global sind hierzulande angesiedelt. Doch diese Position muss verteidigt werden. So kann die Schweiz exportbezogene Arbeitsplätze fördern, indem digitale Technologien und Dienstleistungen entweder selbst entwickelt und bereitgestellt oder in den am stärksten globalisierten Sektoren des Landes rasch adaptiert werden: 1,4 Millionen Arbeitsplätze in der Schweiz hängen direkt oder indirekt vom Export von chemischen Produkten, Pharmazeutika, Maschinen, Uhren, Finanzdienstleistungen, Tourismus sowie Informations- und Kommunikationstechnologien (IKT) ab. Zugleich muss die Schweiz darauf achten, dass ökonomische Erträge in die Wirtschaft reinvestiert werden. Nur so können ein integratives Wachstum und eine Entwicklung sichergestellt werden, in der sich Produktivitätswachstum in höherem Konsum,

Investitionen und einer robusten Jobnachfrage niederschlägt – und nicht in einer Akkumulation von Wohlstand an der Spitze. Glücklicherweise gibt es in der Schweiz – im Gegensatz zu den USA – noch wenig Anzeichen für eine rückläufige Lohnquote oder eine übermässige Öffnung der Lohnschere.

- Im Zeitalter von Digitalisierung und Automatisierung und angesichts der sich rasch vollziehenden Veränderungen auf den Arbeitsmärkten muss sich die Schweiz zwei wesentlichen Herausforderungen stellen: (1) Beschleunigung der digitalen Transformation und (2) Aus- und Weiterbildung.

- Zum einen müssen Unternehmen die digitale Transformation entschlossener in Angriff nehmen und Geschäftsmodelle, „Customer Journeys" und Geschäftsprozesse nach einer „Digital First"-Strategie umgestalten. Sie müssen digitale Abläufe und digitales Marketing auf Basis robotischer Prozessautomatisierung und „Advanced Analytics" entwickeln und ihre Aktivitäten so organisieren, dass sie die digitale Transformation unterstützen. Unternehmen, die nicht digitalisieren und automatisieren, riskieren, von proaktiven etablierten Unternehmen und neuen, digital agierenden Wettbewerbern aus dem Markt gedrängt zu werden. Politische Entscheidungsträger können die Digitalisierung beschleunigen, indem sie Wirtschaftssektoren nicht schützen, sondern für solche Disruptionen öffnen.

- Zum anderen haben Schweizer Unternehmen und die Gesellschaft insgesamt einen hohen Bedarf, Arbeitskräfte auf die in Zukunft gefragten Fähigkeiten vorzubereiten. Die Schweiz verfügt derzeit über hoch qualifizierte Talente, darunter gut ausgebildete Einwanderer, und ein starkes Bildungssystem. Es zeichnet sich jedoch nachfrageseitig eine tiefgreifende Kompetenzverschiebung ab. Nach unserer Schätzung könnte die Nachfrage nach Mitarbeitenden in Bereichen, die einfache kognitive oder körperliche und manuelle Fähigkeiten erfordern, um etwa 20 Prozent zurückgehen. Umgekehrt wird der Bedarf in Bereichen, in denen soziale, emotionale und technologische Kompetenzen gefragt sind, um rund 20 Prozent respektive bis zu 50 Prozent steigen. Dieser Übergang wird sich nicht einfach gestalten, zumal die berufliche Mobilität bei den am stärksten Betroffenen besonders gering ist. Diese Kompetenzverschiebung wird die Rate, mit der Arbeitskräfte und Kompetenzen aus dem Markt fallen (z.B. durch Pensionierung), übertreffen. Dazu kommt, dass die Schweizer Hochschulen nur rund 3'000 Technologieabsolventen pro Jahr verzeichnen – weniger als die Hälfte des geschätzten Bedarfs im spezialisierten Technologie- und IT-Bereich. Die Bildungsanbieter sollten ihre Angebote noch stärker auf die Vermittlung technologischer und emotionaler Kompetenzen sowie auf lebenslanges Lernen ausrichten. Führungskräfte weisen darauf hin, dass es bereits heute nicht ausreichend Bewerbungen für die nachgefragten Berufsprofile gibt. In der vierteljährlichen Panelerhebung von McKinsey im November 2017 gab fast die Hälfte der Führungskräfte an, sich auf die Weiterbildung ihrer bestehenden Belegschaft zu konzentrieren, anstatt Mitarbeiter von aussen anzuwerben. Führende Unternehmen haben bereits mit umfangreichen Umschulungsprogrammen begonnen. Und auch in Zukunft wird Zuwanderung von qualifizierten Arbeitskräften eine starke Rolle spielen, um den sich ändernden Bedarf an Fähigkeiten zu decken.

AVENIR DU TRAVAIL: L'OPPORTUNITÉ NUMÉRIQUE POUR LA SUISSE

Avec la multiplication et la combinaison des technologies numériques, la généralisation de l'automatisation et les avancées des applications de l'intelligence artificielle (IA), les mutations de l'économie comme de la société ne cessent de s'amplifier et de s'accélérer. Pour la plupart des entreprises, la priorité est aujourd'hui double: déterminer comment optimiser leur utilisation de ces technologies et comment relever le défi majeur du développement des compétences requises par le capital humain du futur. S'appuyant sur les recherches du McKinsey Global Institute (MGI), cet article explore les implications pour l'économie de la Suisse de la révolution numérique sous toutes ses formes – les technologies numériques à proprement parler, l'automatisation et l'IA – et l'avenir du travail dans le pays à l'horizon 2030. Parmi les principales conclusions que nous tirons de ces travaux :

- Aujourd'hui, la Suisse est confrontée au double défi d'une population vieillissante et d'une croissance de la productivité relativement lente (croissance proche de zéro depuis la crise financière). Comme dans l'ensemble des économies développées, la numérisation, l'automatisation et l'IA sont susceptibles d'ajouter près d'un point de pourcentage par an d'ici 2030 à la croissance de la productivité du pays.

- L'automatisation engendrera des perturbations sur les marchés du travail et modifiera la nature même des emplois, mais elle pourrait créer autant de nouveaux emplois qu'elle n'en supprime. Plus de la moitié du total des tâches sont aujourd'hui déjà automatisables grâce aux efforts d'adoption et d'adaptation des technologies actuelles. L'étude des courbes typiques d'adoption de la technologie suggère qu'au moins la moitié de ce potentiel pourrait être réalisé d'ici 2030, et peut-être davantage si une course technologique a lieu entre les différents acteurs économiques. D'après un scénario médian, qui pourrait bien se révéler conservateur, environ 20 à 25% des tâches en Suisse, soit 1,0 à 1,2 million d'emplois, pourraient être automatisées d'ici 2030. Si la destruction des emplois constitue un phénomène habituel des marchés du travail modernes, le rythme des changements apportés par le développement de la technologie pourrait, lui, s'accélérer de manière inédite. Cela ne signifie pas forcément que des pertes nettes d'emploi seront à anticiper. Il existe un potentiel de création de nouvelles activités à hauteur du nombre d'activités qui sont automatisées. On l'estime à 400 000 nouveaux emplois, liés directement à la technologie elle-même (hardware/software) et à la mise en œuvre de solutions numériques au sein des entreprises. 400 000 équivalents emplois supplémentaires pourraient également être créés à mesure que l'automatisation et l'IA tirent la croissance du revenu réel, stimulent la consommation et augmentent la demande d'emplois nationaux, alimentant ainsi la croissance économique. Davantage d'emplois pourraient même être créés si la numérisation et l'automatisation augmentaient la compétitivité de l'économie suisse, tournée aujourd'hui vers l'exportation, et donnaient naissance à des leaders mondiaux du numérique.

- L'impact sera différent selon les secteurs. Les secteurs de la grande consommation et de la distribution, de l'industrie manufacturière, de la finance et de l'administration publique seront les plus touchés par le déplacement des emplois, alors qu'ils représentent près de la moitié de l'emploi salarié et comptent pour environ 60% du PIB suisse. A contrario, la plupart des emplois pourraient être générés dans le domaine de la santé et des services techniques et professionnels. Certains des secteurs en Suisse qui sont susceptibles d'être les plus touchés par la destruction d'emplois, sont désormais à la traîne en matière de numérisation par rapport à leurs homologues d'autres économies développées, et il est urgent qu'ils comblent leur retard. Par exemple, la part du commerce en ligne dans le secteur de la grande consommation en Suisse est inférieure à 8%, alors qu'elle atteint 15% en Allemagne et 18% au Royaume-Uni.

- La Suisse dispose de facteurs structurels de son économie, notamment un niveau de salaires comparativement élevé, qui favorise le déploiement du digital et de l'automatisation, la rendant à même de maîtriser cette transition. Si elle possède actuellement certaines des entreprises les plus compétitives au monde, elle a néanmoins besoin de renforcer cette position et de développer les emplois liés aux exportations, soit en fournissant des technologies et des services numériques, soit en les adoptant rapidement dans ses secteurs les plus mondialisés. Ainsi, 1,4 million d'emplois en Suisse dépendent directement ou indirectement des exportations

dans les secteurs de la chimie, de l'industrie pharmaceutique, des machines, de l'horlogerie, des services financiers, du tourisme et des technologies de l'information et de la communication (TIC). Un autre levier consiste à s'assurer que les profits économiques sont effectivement réinvestis dans l'économie afin de garantir une croissance inclusive dans laquelle la productivité se traduit par une hausse de la consommation, de l'investissement et une forte demande d'emplois, plutôt que par une concentration des richesses au sein des classes les plus favorisées. Contrairement aux Etats-Unis, peu de signes pointent vers une baisse des parts de revenus liés au travail ou une polarisation des salaires en Suisse.

- Alors que la Suisse se prépare aux changements qui surviennent sur son marché du travail à l'ère du numérique et de l'automatisation, elle est confrontée à deux impératifs: (1) accélérer la transformation numérique et (2) la requalification de sa main d'œuvre.

- Premièrement, les entreprises doivent enclencher leurs transformations numériques de manière plus holistique. Elles doivent aussi remodeler leurs *business models*, les parcours clients ainsi que leurs processus opérationnels afin d'intégrer pleinement le digital au cœur de leurs stratégies et de leurs activités. Cela passe par le développement des activités numériques et du marketing, notamment à travers l'automatisation des processus robotiques et l'usage des techniques fines d'analyse de données, ainsi que par la réorganisation de leurs activités pour soutenir la transformation numérique. Le risque qu'encourent les entreprises qui ne prennent pas le virage de la numérisation et de l'automatisation consiste en la cannibalisation de leur activité par leurs concurrents historiques très dynamiques, auxquels s'ajoutent les nouveaux concurrents disposant d'une maîtrise de l'outil numérique. Par ailleurs, les pouvoirs publics peuvent encourager la transition en ouvrant les secteurs aux entreprises qui mènent cette rupture.

- Deuxièmement, il existe un impératif autour des compétences à la fois pour les entreprises suisses comme, plus largement, pour la société. Aujourd'hui,

la Suisse possède un réservoir de talents hautement qualifiés, notamment grâce à une population issue de l'immigration bien formée et un système éducatif solide. Malgré tout, une révolution majeure des compétences se profile. Selon nos estimations, la demande de compétences physiques, manuelles et cognitives simples liées à des tâches répétitives pourrait diminuer de près de 20%. En revanche, le besoin de compétences sociales et émotionnelles, d'une part, et technologiques de l'autre, est amené à s'accroître respectivement de près de 20% et jusqu'à 50%. Cette transition ne sera pas facile puisqu'elle nécessite une mobilité professionnelle, qui est actuellement à un niveau particulièrement bas parmi la part de la main d'œuvre la plus touchée par ces bouleversements. Il s'agit d'un phénomène inédit, alors même que le décalage entre offre et demande de compétences dépassera la vitesse normale à laquelle celles-ci sortent habituellement du marché du travail (notamment par des départs à la retraite, par exemple). De plus, les établissements d'enseignement supérieur suisses ne forment qu'environ 3000 diplômés dans le domaine des technologies par an, soit moins de la moitié du nombre estimé nécessaire de diplômés disposant de compétences technologiques et informatiques avancées. Ainsi, le système éducatif va devoir intégrer un nouveau rapport à la formation, à la fois à travers une évolution des programmes vers le développement de compétences technologiques, émotionnelles et sociales, mais aussi en instaurant une culture d'apprentissage tout au long de la vie. En outre, les dirigeants soulignent que les profils requis pour leur entreprise ne sont pas disponibles en quantité suffisante. Dans le sondage trimestriel mené par McKinsey en novembre 2017, près de la moitié des dirigeants ont déclaré qu'ils se concentreraient sur la formation pour s'adapter à leur future main d'œuvre, plutôt que de recruter en externe. Si des entreprises de premier plan ont déjà entrepris une reconversion de masse de leur main d'œuvre, nombreuses sont celles qui devraient dès à présent s'associer à cet effort. L'immigration continuera d'être l'une des réponses aux besoins nouveaux de compétences dans les secteurs du numérique et de l'automatisation en Suisse.

Close- up on a contactless payment at a restaurant with a cell phone
© andresr/E+/Getty Images

1. DIGITIZATION, AUTOMATION, AND AI CAN BOOST SWISS PRODUCTIVITY

There is a common belief that digitization—and especially automation and AI—will lead to numerous job losses. However, this research finds that the use of digital technologies and automation throughout the Swiss economy can boost productivity, economic growth, and job creation if barriers to their adoption can be overcome, the costs of transition absorbed, and the transition to the digital and automation era managed effectively.

23%

of Swiss population expected to be aged 65+ in 2030

SWITZERLAND FACES A PRODUCTIVITY AND ECONOMIC GROWTH CHALLENGE

The Swiss State Secretariat for Economic Affairs projects GDP growth of 2.4 percent and 2.0 percent for 2018 and 2019, respectively. The country's unemployment rate is low and its education level is high. Switzerland is home to several leading universities and has a highly efficient labor market. However, Switzerland's economy today faces a twin challenge to the pace of economic growth: unfavorable demographics and low productivity growth.

First, underlying demographic factors are projected to cause a significant drag on economic growth. While many other advanced economies, including Germany, are expected to shrink both in their populations and their workforces, in Switzerland immigration is compensating for low birth rates; the population is projected to increase by 0.7 percent a year, from 8.4 million in 2016 to 9.5 million in 2030. The Swiss Federal Statistical Office forecasts that the number of people employed will increase from 4.9 million to 5.2 million by 2030.[1] Nevertheless, because the workforce is expected to grow at a slower rate than in the past and slower than the overall population, demographics will slow down growth. The number of Swiss citizens aged 65 and over is increasing by 2 percent a year, much faster than the 0.3 percent annual growth for 15- to 64-year-olds: the share in the population of over 65-year-olds is expected to increase by 5 percentage points to 23 percent in 2030. The aging of the population means that Switzerland's dependency ratio will rise to 67 non-working Swiss for every 100 full-time employees (FTE), up from 49 today.[2]

Second, in almost all advanced economies including Switzerland, growth in labor productivity is at a historical low following a gradual decline since the 1960s and a particularly worrying slowdown to almost zero since the mid-2000s (Exhibit 1). MGI has attributed the sharp recent slowdown in labor productivity growth to weak demand and uncertainty since the financial crisis. It has further highlighted the fact that the benefits of a first ICT wave in the late 1990s have waned while the impact of new digital technologies has not yet materialized on a large scale due to a range of adoption barriers as well as transition costs.[3]

Switzerland's productivity decline was evident long before the crisis. Its labor productivity growth has lagged that of the United States and other European economies since the 1980s. A number of factors have contributed to this situation. They include the slow pace of reforms, for instance in network industries, retail and wholesale trade, and agriculture; the concentration of market share in a relatively small number of leading firms in several sectors; high import prices; Switzerland-specific standards in sectors like construction and construction materials; and strong growth in an expensive healthcare sector.[4] In its November 2017 survey on

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[1]   *Szenarien zur Bevölkerungsentwicklung. Ergebnisse des Referenzszenarios (Scenarios for population development. Results of the reference scenario)*, Bundesamt für Statistik.

[2]   Ibid.

[3]   *Solving the productivity puzzle: The role of demand and the promise of digitization*, McKinsey Global Institute, February 2018.

[4]   *Spannungsfeld Europa—Die Wettbewerbsfähigkeit der Schweiz im Europäischen Umfeld (Switzerland's competitiveness in a world of conflicting priorities)*, McKinsey Global Institute, June 2015.

Switzerland, the OECD pointed to heavy government involvement and weak competition in sectors, such as energy, telecommunications, and transport; substantial restrictions on services trade and agricultural imports; a low rate of entrepreneurship in younger age groups; the fact that women are not achieving their potential because childcare responsibilities fall disproportionately on mothers and the tax system discourages second earners; and, finally, slowing immigration that may worsen skills shortages.[5]

Exhibit 1

Productivity growth has declined since the 1960s and is now near historical lows in advanced economies.

Trend of labor productivity growth, total economy
Annual percentage change; based on the Hodrick-Prescott filter (restriction parameter = 6)
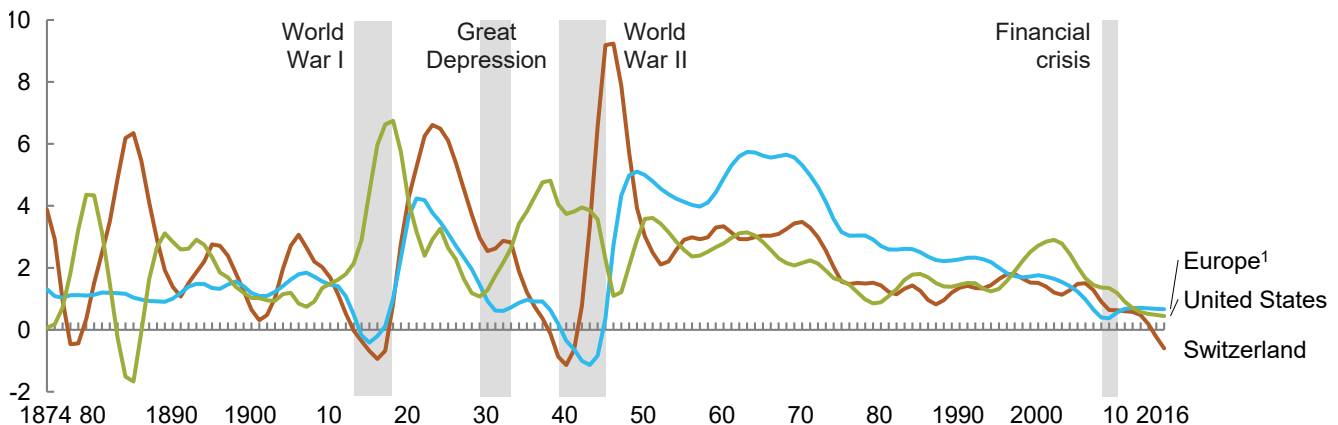
NOTE: Productivity defined as GDP per hour worked.
1 Simple average of Italy, Spain, Germany, France, Sweden, and the United Kingdom.

SOURCE: Antonin Bergeaud, Gilbert Cette, and Remy Lecat, *Productivity trends from 1890 to 2012 in advanced countries*, Banque de France working paper number 475, March 2014; McKinsey Global Institute analysis

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DIGITIZATION AND AUTOMATION OFFER THE BEST OPPORTUNITY TO RESUME PRODUCTIVITY GROWTH AND ACCELERATE THE PACE OF ECONOMIC EXPANSION

Capturing the opportunities associated with the broad range of digital technologies could be a significant driver of GDP growth in all advanced economies, including Switzerland, over the next decade (Exhibit 2).

Across advanced economies, namely France, Germany, Italy, Spain, Sweden, the United Kingdom, and the United States, MGI research has found that productivity could grow by at least 2 percent a year on average over the next decade, but that capturing this potential requires a focus on promoting demand and broad digital diffusion that could add 1.2 percentage points to productivity growth a year.[6] This is consistent with 2016 research in which MGI estimated that digitization could boost Europe's overall GDP by $ 2.8 trillion (approximately CHF 2.8 trillion) in 2025, equating to an increase of 10 percent above baseline GDP projections, or roughly 0.8 percentage points a year.[7] This additional growth would

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5 *Um das Wachstum der Schweiz anzukurbeln, empfiehlt die OECD mehr Wettbewerb und weitere Reformen (In order to boost Switzerland's growth, the OECD recommends more competition are further reforms)*, Medienmitteilungen der Schweizerischen Bundesverwaltung (press releases from the Swiss Federal Administration) (https://www.newsd.admin.ch/newsd/message/attachments/7583.pdf).

6 More than half of the potential (1.2 percent) is expected to come from digitization, with at least 0.8 percent coming from nondigital opportunities. See *Solving the productivity puzzle: The role of demand and the promise of digitization*, McKinsey Global Institute, February 2018.

7 This estimate is based on innovations that are already spreading through European economies and have the potential to offer substantial economic benefits in the near future. The boost to GDP could be greater as the digital frontier continues to move forward. The consumer benefit may also be much bigger but cannot yet be quantified. See *Digital Europe: Pushing the frontier, capturing the benefits*, McKinsey Global Institute, June 2016.

require sectors lagging those at the frontier of digitization—such as the public sector broadly and healthcare more specifically—to double their digital intensity. We assume that Switzerland will likely have similar potential uplift to annual productivity growth of more than 1 percentage point as in other advanced economies.

Digital opportunities will be the main drivers of productivity growth in advanced economies over the next decade.

Productivity growth potential, United States and Western Europe, 2015-25
Percentage points

Digital opportunities	~1.2+	Digitization/automation offers advanced economies a 1-1.5% incremental productivity growth opportunity
Nondigital opportunities	~0.8+	
Production growth potential	~2.0+	Total productivity growth opportunity is more than 2% for the next 10 years
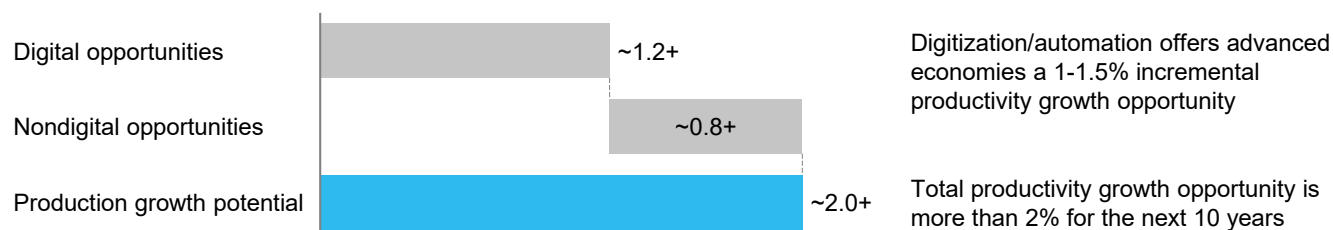
SOURCE: *Solving the productivity puzzle: The role of demand and the promise of digitization*, McKinsey Global Institute, February 2018; McKinsey Global Institute analysis

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This growth potential is significant, but it has been difficult to capture to date. MGI has previously estimated that Europe had captured only 12 percent of its potential from the early set of digital technologies, ranging from 10 percent in Germany to 17 percent in the United Kingdom (and compared with 18 percent in the United States).[8]

A large part of the potential boost to productivity growth may arise from the replacement of labor by recent developments in AI-based automation that offers significant opportunities to innovate and adopt new business models (see Box 1, "Artificial intelligence at a glance").

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[8] *Digitization, AI, and the future of work: Imperatives for Europe*, McKinsey Global Institute briefing note prepared for the EU Tallinn Digital Summit, September 2017.

Box 1: Artificial intelligence at a glance

AI is expected to lead to a new wave of automation and boost the performance of digital technologies. In this report, our definition of AI is based on the ability to learn from experience, supported by big data architecture and a new generation of self-learning algorithms. AI technologies include machine learning, smart robotics, natural language processing, computer vision, autonomous vehicles, and virtual agents. MGI estimates that total investment in these technologies amounts to between $ 25 billion and $ 40 billion, with the largest share directed toward advanced machine learning technologies.[1]

The AI technologies we consider in this paper are defined as "narrow" AI, performing one narrow task, rather than general AI that seeks to perform any intellectual task undertaken by human beings. While the capabilities of AI are expanding significantly, it is worth remembering that the advanced neural-based machine learning on which AI is based has some limitations. For example, it is highly dependent on the data sets on which it is trained. At the same time, it is worth remembering that AI and algorithms have their limitations, and because of the way the systems are trained, they can be susceptible to bias. Therefore, obtaining unbiased, comprehensive data is important.[2]

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[1] *Artificial intelligence: The next digital frontier?* McKinsey Global Institute, June 2017.
[2] Ibid.

Man working at industrial robot in modern factory
© Westend61/Getty Images

2. DIGITIZATION, AUTOMATION, AND AI WILL DISRUPT LABOR MARKETS BUT CAN DRIVE NET JOB GROWTH

Automation and AI will become an increasingly critical aspect of the broader digital transformation of the global economy. Robotic process automation, smart workflows, machine learning, and other AI technologies are already beginning to transform the way companies operate as well as labor markets.

The opportunity offered by digitization and automation is often less discussed than the potential risks they pose to jobs. There is widespread fear that the spread of these technologies will lead to large job losses and high unemployment. However, we find that if Switzerland handles the transition to the digital, automation, and AI era effectively, it can create as many new jobs as those that are likely to be displaced, leaving no substantial negative impact on employment. Indeed, if the potential of digitization and automation is fully captured, the resulting higher productivity and enhanced competitiveness could even create many new jobs overall and support growth in real incomes and GDP.

Using conservative assumptions and an average or midpoint scenario based on technology benchmarks, we expect that about one-fifth to one-quarter of all tasks performed in Switzerland's labor market may be automated by 2030; however, a roughly equal number of new tasks may also be created (Exhibit 3).[9]

Exhibit 3

Over the long term, the number of jobs gained through digitization and automation could be roughly equivalent to those displaced.

Displacement through automation and digitization
−
1.0M TO 1.2M

+
0.8M TO 1.0M
New job equivalents created

Status quo 2018 **4.9M**

SOURCE: Bundesamt für Statistik (Swiss Federal Statistics Office); McKinsey Global Institute Global Automation Impact Model; McKinsey Global Institute analysis

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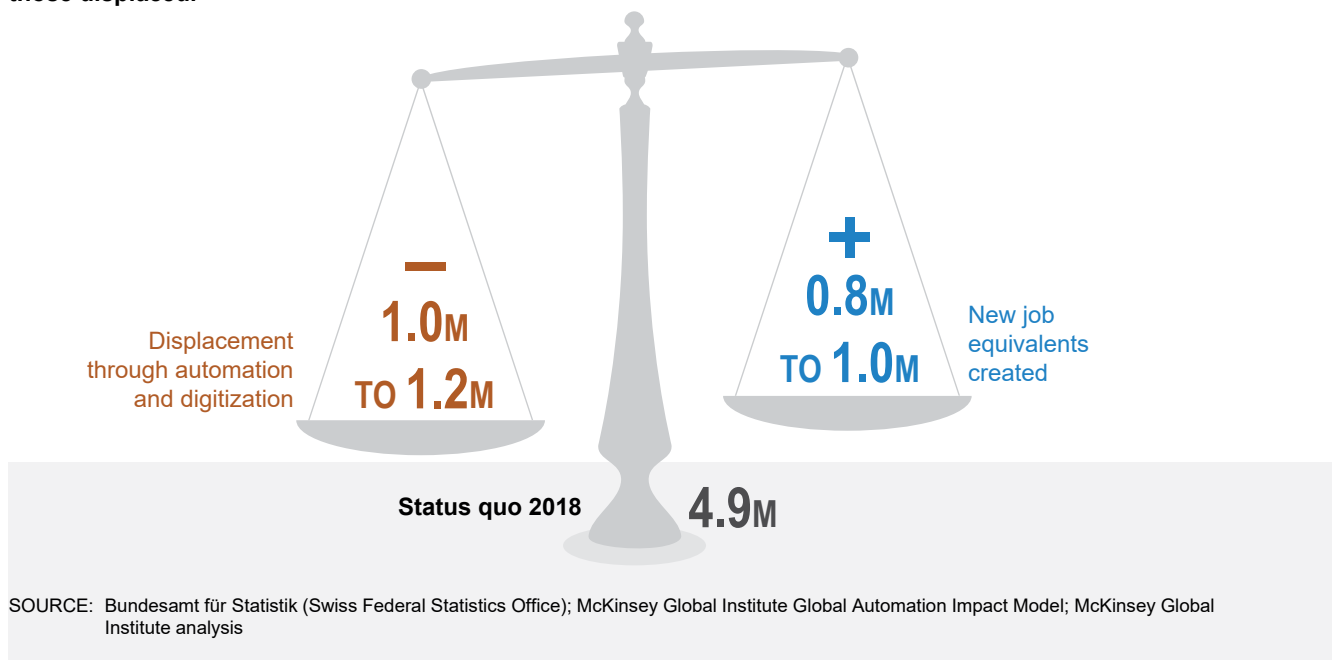
[9] The estimate draws on MGI's 2017 report on the future of work. See *A future that works: Automation, employment, and productivity*, McKinsey Global Institute, January 2017. We note that technological diffusion depends on many factors, including the maturity of technology, its expected impact, and its business-stealing versus innovative effects. A recent survey on AI suggests that a technology race may unfold for some AI technologies, which may mean that diffusion is faster than the average speed of diffusion of past technologies. See *Notes from the AI frontier: Modeling the impact of AI on the world economy*, McKinsey Global Institute, September 2018.

Many newly created jobs would be technology related, but—as is typical with general-purpose technologies—large spillovers may spread across all sectors. Many jobs are likely to be created outside the technology sector if digital and automation technologies boost productivity, enabling firms to lower prices for consumers, pay higher wages, or distribute profits to shareholders—all increasing economy-wide demand.[10] The major uncertainty will be the shape of future demand and, for a small open economy like Switzerland, its competitiveness as an export-oriented economy.

APPROXIMATELY ONE-QUARTER OF CURRENT WORK ACTIVITIES COULD BE DISPLACED BY AUTOMATION BY 2030

We analyzed the automation potential through a study of task-by-task technical automation feasibility (see Box 2, "Automation of work methods").[11]

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[10] *Jobs lost, jobs gained: Workforce transitions in a time of automation*, McKinsey Global Institute, December 2017. Also see David Autor and Anna Salomons, *Does productivity growth threaten employment?*, working paper prepared for the ECB Forum on Central Banking, June 2017.

[11] *A future that works: Automation, employment, and productivity*, McKinsey Global Institute, January 2017.

Box 2: Automation of work methods

Many methods have been used to estimate the effects of AI and automation on work. In 2013, Frey and Osborne published a major study aiming to quantify the number of jobs that are susceptible to automation based on known technology.[1] They used expert assessment techniques to determine the automation potential of 70 occupations, and then extrapolated this to the remaining occupations through the use of machine learning. Their broad finding was that a large majority of the total existing jobs could be automated.[2] In 2016, Arntz, Gregory, and Zierahn expanded on this work, acknowledging that it is particular work tasks rather than full occupations that can be automated. Based on the link between occupations, the automation potential from Frey and Osborne, and the link between occupations and tasks from the OECD PIACC database, Arntz et al. estimated the implied link between tasks and automation potential, leading to a much lower potential for job automation. Both approaches fundamentally relied on the expert assessment of automation potential.

In 2017, MGI took a new, bottom-up approach to assessing automation potential. Based on breaking down around 800 occupations into about 2,000 tasks, MGI analyzed how each of the 2,000 tasks drew upon 18 capabilities, such as general motor skills, sensory skills, and emotional sensing, and then analyzed to what degree known technology performs compared to humans in each of the 18 capabilities. This approach did not use expert judgment but relied on the economics of tasks.

MGI estimated the technical feasibility of automation by examining the type of activities performed in the relevant occupations and to what extent these activities are susceptible to being automated by currently existing automation technologies. For example, data processing or predictable physical activities (such as assembly line work in a factory) could be automated by up to 70 percent, while managerial activities have the least potential for automation at below 10 percent (Exhibit 4).[3]

The second important factor to consider when assessing automation is the speed at which new technologies are adopted. The modeled adoption curve is based on historical adoption of technology (percentage over time to reach full adoption potential) and differentiates between early, midpoint, and late scenarios based on clusters of observed adoption rates. The speed of adoption is also affected by the wage rate in the country—higher labor costs make automation more economically attractive—and by the mix of occupations and sectors.

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[1] Carl Benedikt Frey and Michael A. Osborne, *The future of employment: How susceptible are jobs to computerization?*, Oxford Martin Programme on Technology and Employment, September 2013.

[2] Melanie Arntz, Terry Gregory, and Ulrich Zierahn, *The risk of automation for jobs in OECD countries: A comparative analysis*, OECD Social, Employment, and Migration Working Papers, number 189, May 14, 2016.

[3] *Jobs lost, jobs gained: Workforce transitions in a time of automation*, McKinsey Global Institute, December 2017.

There is technical potential to automate 46 percent of all working tasks in Switzerland

About half of all activities globally could be automated by using existing and available digital technologies by 2030, and Switzerland's automation potential is in line with this global figure. Our analysis finds that 46 percent of hours worked today have the potential to be automated by using currently available technology; this is slightly below the global average of 50 percent.

About one million current job equivalents could be shifted in Switzerland by 2030

Potential automation does not mean actual automation. In reality, the number of tasks that are automated depends on how quickly technology diffuses through all sectors of an economy and how effective companies are in reorganizing workflows.

Using the distribution of diffusion rates of early technologies from previous MGI research, one can determine an average, a very aggressive, and a slow case of diffusion.[12] In the most aggressive "early adoption" scenario—corresponding, say, to fast digital technologies, such as corporate social media—close to half of working hours in Switzerland could be automated

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[12] *A future that works: Automation, employment, and productivity*, McKinsey Global Institute, January 2017.

Exhibit 4

To estimate jobs lost and jobs gained, MGI created a taxonomy and then assessed jobs at risk from the bottom up.
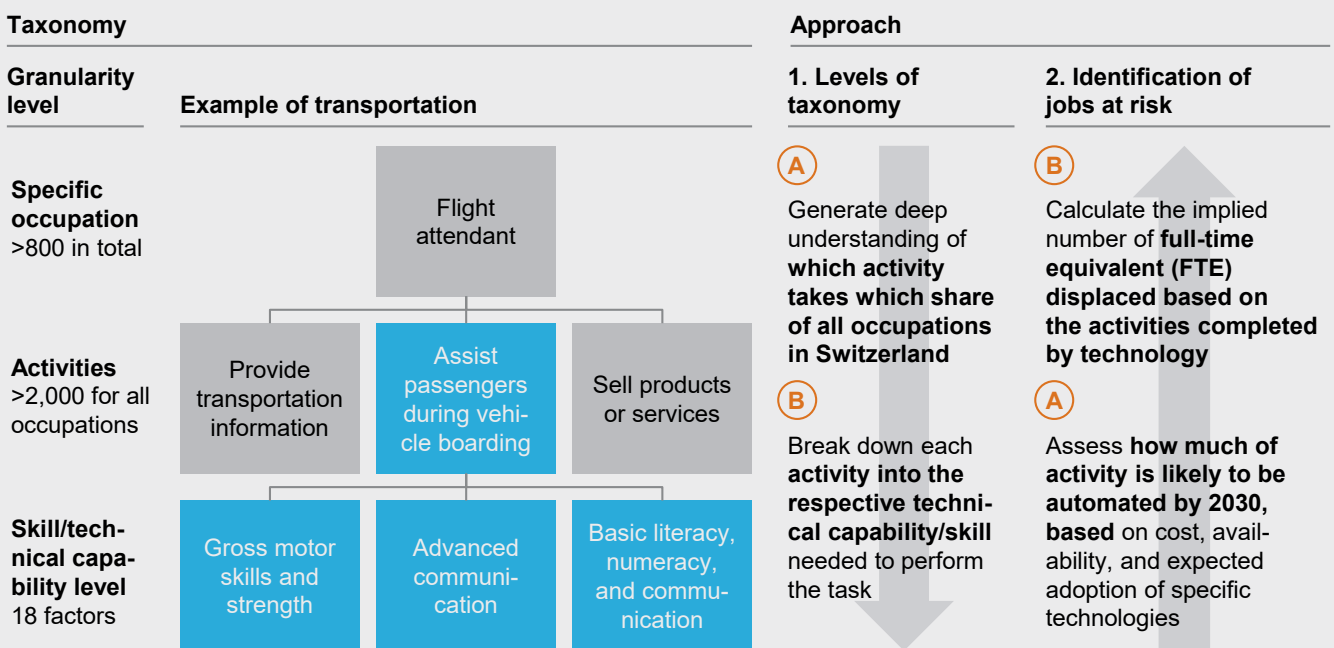
NOTE: Swiss labor data, calculated based on baseline of FTE 2014 plus new workers entering the labor force; MGI Jobs Lost, Jobs Gained Model.

SOURCE: McKinsey Global Institute analysis

We conducted this analysis on Switzerland, using country-specific data on sector employment and applying a global estimate for the breakdown into occupations and activities. We then applied MGI's global numbers for the technical automation potential by activity and a Switzerland-specific adoption curve. Finally, we refined the results using feedback gained during discussions with industry leaders and experts in Switzerland (see also p. 59).

by 2030.[13] Such early adoption could generate a significant productivity boost, but it also poses risks (and thus barriers) as it implies very rapid and very deep change in Swiss society. Social, cultural, and capital barriers are likely to prevent adoption being as rapid as assumed in the early-adoption scenario, and there will be more time for the government, companies, and individuals to adjust to the change.

In the midpoint scenario that matches the average benchmarks of former technology diffusion curves, between 20 and 25 percent of work activities would be automated by 2030 in Switzerland (Exhibit 5). This is based on technology adoption over 23 years and results in the equivalent of 1.0 million to 1.2 million of job equivalents being displaced.

Exhibit 5

In MGI's midpoint adoption scenario, about 20-25% of work activities in Switzerland is expected to be automated by 2030.

Time spent on current work activities
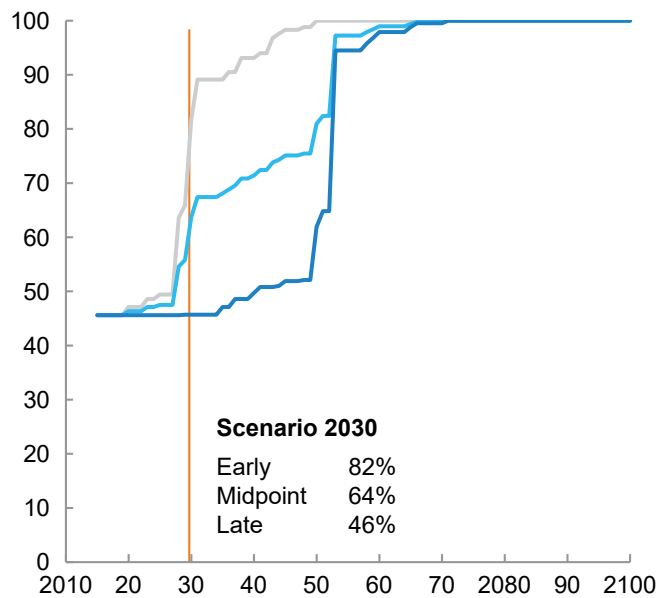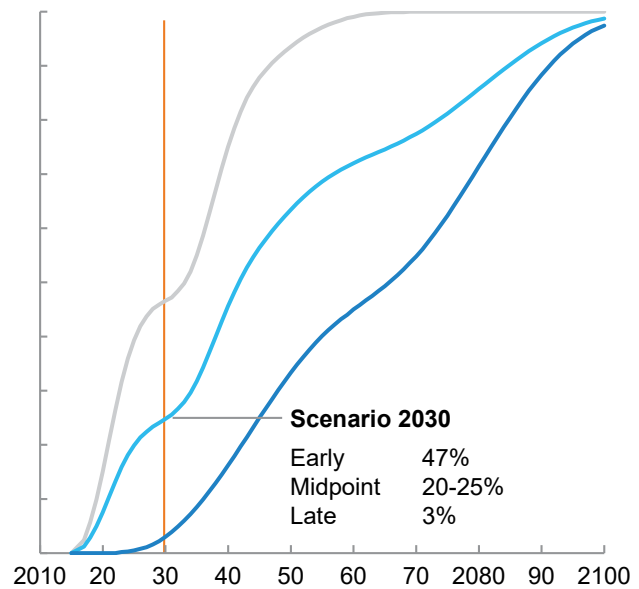
SOURCE: McKinsey Global Institute analysis

In the late scenario—corresponding, say, to the experience of small and medium-sized enterprises (SMEs) adopting online sales and enterprise resource planning (ERP) in Europe—diffusion will be much slower, and only an estimated equivalent of 0.2 million job equivalents would be displaced by 2030.[14]

This latter case would limit the substitution of jobs by automation and AI technology. However, if enough companies opt not to use AI exhaustively, there may be another type of

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[13] One characteristic of early adoption would be even faster digital technologies such as corporate social media, for example. Social media refers to internet-based applications such as social networks, blogs, multimedia content-sharing sites, or wikis. Most enterprises that use social media tend to do so for image building and/or marketing products in order to reach as wide an audience as possible. Ten years since their development in the corporate world, almost half (47 percent) of EU-28 enterprises make use of any type of social media, according to the latest Eurostat figures. For Eurostat's explanation, see *Digital economy and society statistics*, March 2018. (www.ec.europa.eu/eurostat/statistics-explained/index.php/Digital_economy_and_society_statistics_-_enterprises).

[14] The share of EU-28 enterprises that used ERP software applications was 34 percent in 2017. Use by small enterprises (those with 10 to 49 employees) was only 28 percent, but use at large enterprises employing at least 250 people was up to 76 percent.

risk—that Swiss companies lose their global competitiveness. This, in turn, may also lead to jobs disappearing.[15] Consider, for instance, a US technology company taking market share from Swiss insurers by offering online insurance in Switzerland. If this were to impact 20 to 30 percent of Swiss insurance services, this could result in the displacement of 20,000 to 30,000 jobs.[16]

Repetitive tasks are more at risk of displacement, and only few jobs will disappear entirely

Looking a little more closely at individual occupations, we find that the activities that are most susceptible to automation include predictable physical tasks as well as the collection and processing of data. These three activity categories make up 50 percent of working hours in Switzerland and, in each case, their automation potential is greater than 60 percent (Exhibit 6).

Exhibit 6

Around half of all hours worked in Switzerland are susceptible to automation.

Time spent on activities that can be automated by adapting currently demonstrated technology
2016, percent

	Manage[1]	Expertise[2]	Interface[3]	Unpredictable physical[4]	Collect data	Process data	Predictable physical[5]
	9	21	21	35	63	70	71
Total wages, 2014 USD billions	18.3	37.4	31.0	21.2	**38.8**	**32.6**	**28.8**

46% currently automatable

20-25% automated by 2030

Time spent in all Swiss occupations Percent

50%

Total: 100.2
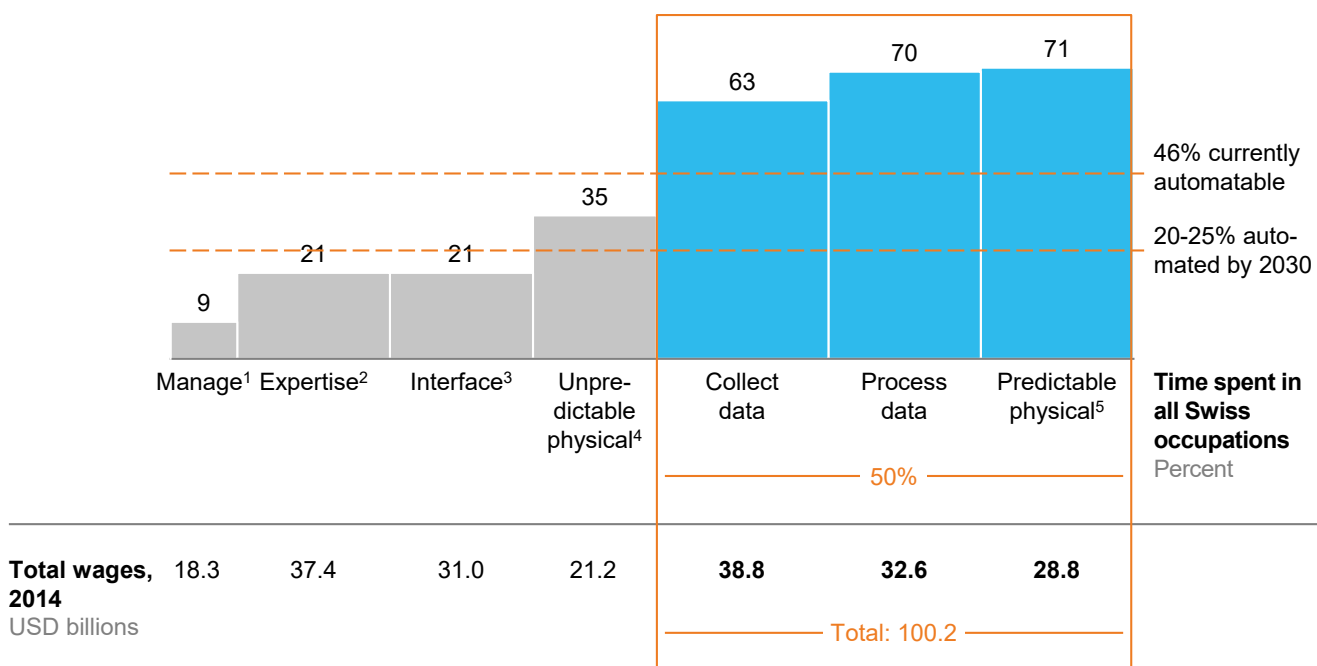
NOTE: Numbers may not sum due to rounding. Labor data are for 2014 and are assumed to be constant.
1 Managing and developing people.
2 Applying expertise to decision making, planning, and creative tasks.
3 Interfacing with stakeholders.
4 Performing physical activities and operating machinery in unpredictable environments.
5 Performing physical activities and operating machinery in predictable environments.

SOURCE: McKinsey Global Institute analysis

MGI's global research finds that 60 percent of jobs have 30 percent of constituent, automatable tasks, but very few current jobs can be replaced entirely. This finding also applies to Switzerland (Exhibit 7).

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15 Jacques Bughin, "Why AI isn't the death of jobs," *MIT Sloan Management Review*, May 24, 2018.
16 Around 110,000 people were employed in the Swiss insurance industry in 2016, according to the Bundesamt für Statistik.

Exhibit 7

Different occupations are more or less susceptible to automation.

Share of automatable activities	Share of occupations with an automation potential greater than x% in 2014	Example occupations
Percent	Percentage of all occupations in Switzerland	

>0	████████████████████████ 98	Psychiatrists, legislators
>10	██████████████████████ 91	
>20	████████████████ 72	Fashion designers, chief executives
>30	████████████ 60	
>40	██████████ 50	
>50	████████ 41	Bus drivers, nursing assistants, web developers
>60	██████ 34	
>70	█████ 27	Stock clerks, travel agents, dental lab technicians
>80	████ 19	
>90	██ 9	Machine operators, assembly line workers
100	█ 1	

SOURCE: McKinsey Global Institute Global Automation Impact Model; McKinsey Global Institute analysis

All jobs are composed of activities that can be automated to a different degree. The job of a stock clerk, for example, requires a great deal of repetitive data entry. The automation technology is affordable, and many firms are already using such software. However, a stock clerk does not only enter data, but also, for instance, deals with returned items, refills shelves, and may open or close the store. In short, a high share of stock clerk activities can be automated, but not all.

Tasks within highly qualified jobs—including managerial jobs—may also be automated. For instance, cloud technology enables managers to supervise the progress of employees' work much faster than before. Engineers will have (even) more tools available to handle work efficiently, so that even parts of their work could be automated.

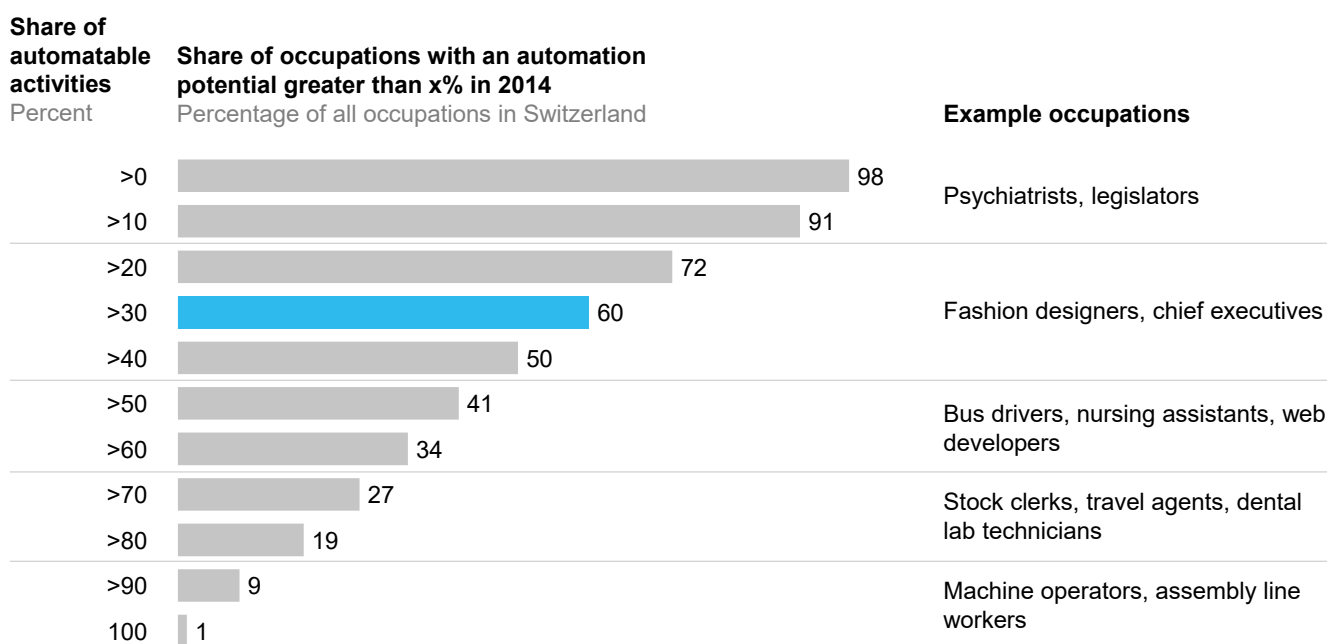## Job displacement is not new, but the pace of change may accelerate from recent history

There is always churn in the labor market, and over the past decade, one study estimated that 10 percent of all jobs were lost in Switzerland, but also that 10 percent of jobs were newly created every year.[17] Most of this churn has been within sectors and among similar jobs. What lies ahead as the transition to the digital and automation era unfolds is likely to be as profound as anything we have seen in history, including the deep disruption engendered by the industrial revolution in Europe.

The industrial revolution radically changed the way people work, causing major disruption to labor markets and to society. In England, over 160 years, the share of workers in agriculture slumped from 56 to 19 percent and the relative output of farm and nonfarm workers doubled from 46 percent to 93 percent.[18] Living standards for workers decreased and average real wages stagnated for decades even as productivity rose. However, in the

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[17] *In der Schweiz entstehen täglich 1350 neue Stellen (1,350 new jobs are created daily in Switzerland)*, economiesuisse, November 2017.

[18] Gregory Clark, *The industrial revolution as a demographic event, UC Davis Department of Economics* (www.faculty.econ.ucdavis.edu/faculty/gclark/210a/readings/irwash1.pdf).

second phase of the industrial revolution, real wages doubled for about 32 years and then surpassed productivity growth.[19] The need to adapt rapidly to new conditions was acute. In Switzerland, there have been large disruptions in the labor market in the relatively recent past. Between 1950 and 1970, for instance, employment in the primary sector roughly halved, while employment in the tertiary sector increased by about the same amount. The imperative to adapt may be even stronger as the world transitions to digital and automation technologies than it was in the past.

However, history also clearly tells us that technological innovation can be a powerful stimulus to economic growth and job creation. In the past, mechanization created jobs on an unprecedented scale (Exhibit 8).

Exhibit 8

Switzerland's secondary sector grew until the 1960s, but then started declining as employment shifted toward the services sector.

People employed in the primary, secondary, and tertiary sector in Switzerland
Share of total, percent

From 1950 to 1970, employment in the primary sector of Switzerland fell by ~50%
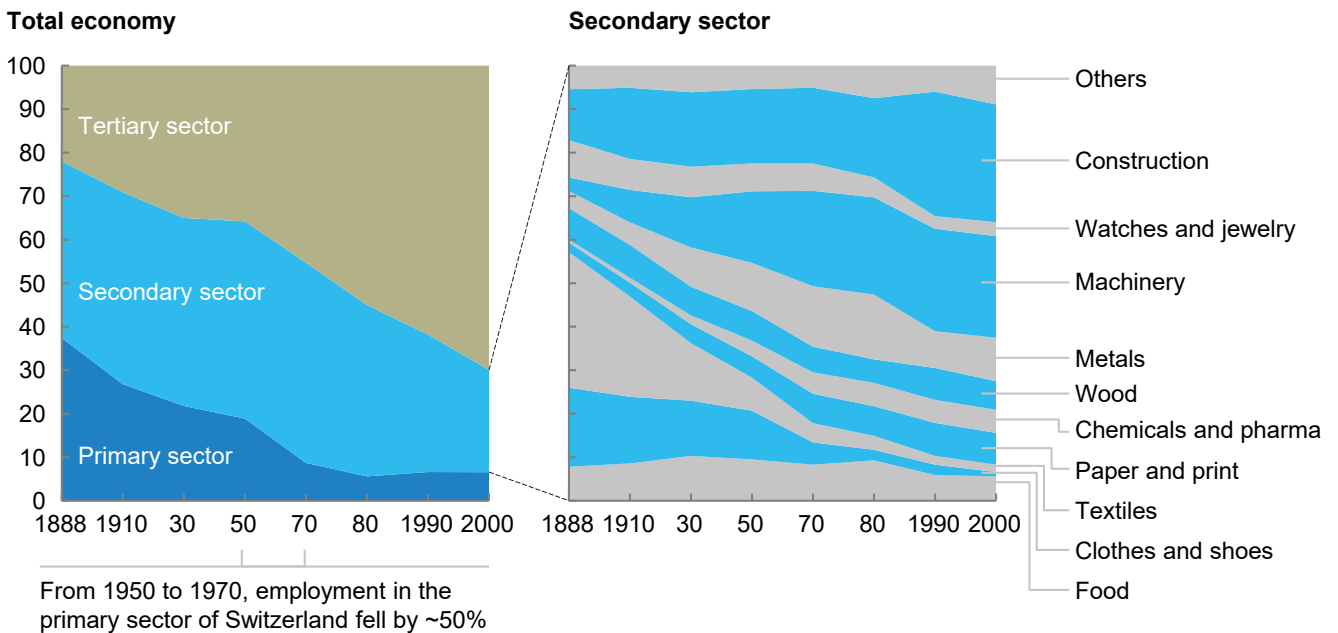
SOURCE: Historisches Lexikon der Schweiz; McKinsey Global Institute analysis

Technological displacement remains a feature of modern economies. Consider, for example, that about half of the 1 percent of annual productivity gains in the period between 2000 and 2016 were related to automation, with the other half coming from innovation in products, services, organizations, and business models. This implies an annual displacement rate resulting from automation of around 0.5 percent.

However, the speed of change may rise in Switzerland. Assuming jobs are displaced entirely when more than 70 percent of tasks of the job are automated, this would translate to a rate of technical displacement of around 1 percent a year.[20] That is more than double the estimated rate in the past.

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[19] Robert C. Allen, "Engels' pause: Technical change, capital accumulation, and inequality in the British industrial revolution," Explorations in Economic History, volume 46, issue 4, October 2009; and Clark Nardinelli, Industrial revolution and the standard of living, The Library of Economics and Liberty (http://www.econlib.org/library/Enc/IndustrialRevolutionandtheStandardofLiving.html).

[20] In Switzerland, 27 percent of jobs have more than 70 percent of tasks that are technically automatable. We assume that about half of that potential is realized by 2030 in line with our midpoint adoption scenario.

THERE IS POTENTIAL TO CREATE AS MANY NEW JOBS AS ARE BEING DISPLACED

We project that the jobs displaced can largely be offset by job gains resulting from the adoption of digital, automation, and AI technologies, and because rising real incomes translate into higher consumption (Exhibit 9). Overall, close to one million jobs could be created—around the same number as those displaced. Note that we only model job gains related to technology and automation in this analysis, with ceteris paribus assumptions on the impact of workforce growth, nonautomation-related productivity gains, and so on (see the technical appendix of MGI's January 2017 report on the future of work for details on the methodology).[21]

Exhibit 9

Jobs displaced by digitization and automation may largely be offset by new jobs created in the long term.

Jobs gained due to automation
Millions
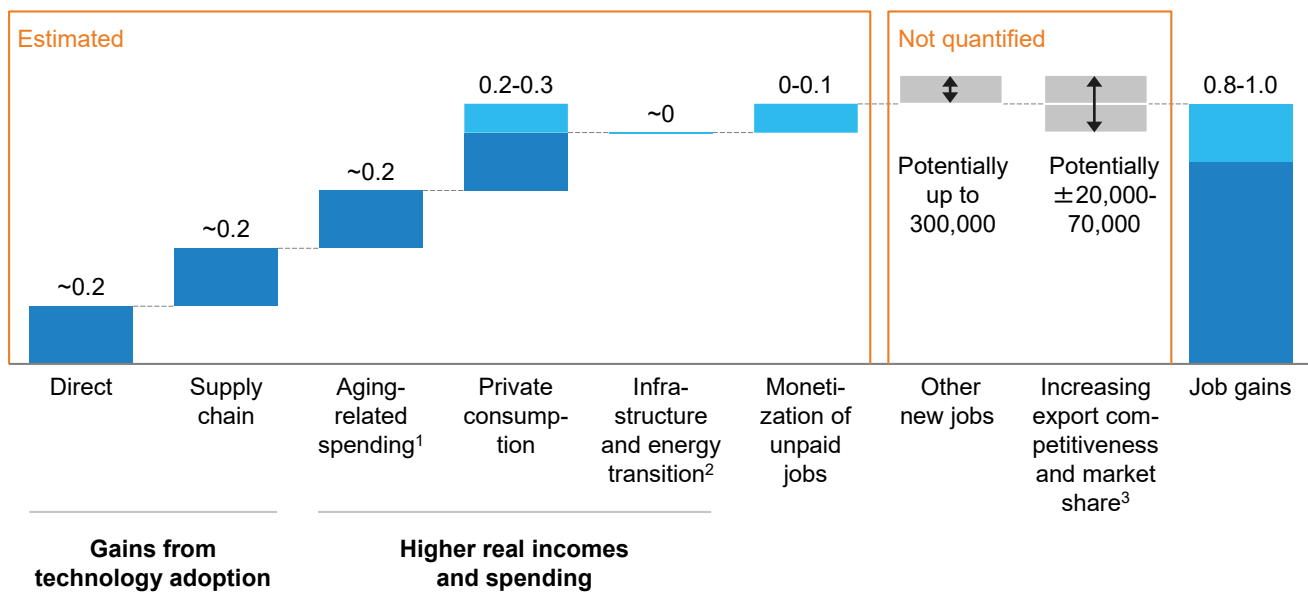
1 This reflects higher spending for healthcare and long-term care enabled by higher incomes and does not reflect aging-related changes in the workforce.
2 Only 15,000 jobs expected to be created for energy transition.
3 We assume a potential for further specialization in exporting sectors, driving higher gross exports where the proceeds are likely spent on a different set of imports. Therefore, we are not assuming an expansion in net exports at the cost of the global economy.

SOURCE: McKinsey Global Institute analysis

Our analysis suggests that about 0.4 million jobs are likely to be created as a result of the adoption of new spending on IT hardware and software, the people needed to support them (such as programmers to build or customize a back-end automation), and IT services. This figure includes indirect jobs along the supply chain of these sectors, an example being a catering service for an IT company.

Another 0.4 million to 0.5 million jobs are likely to be created as the result of higher real incomes made possible by the higher productivity growth enabled by digitization and automation. Part of that income will translate into higher consumer spending, and part will fund rising, aging-related costs and raise demand for healthcare workers, for instance.

Another trend that may generate new employment—although in limited numbers—is the transition in energy production and consumption to renewables, such as wind and solar as

21 *A future that works: Automation, employment, and productivity*, McKinsey Global Institute, January 2017.

their cost continues to decrease. Globally, MGI has modeled an ambitious shift into renewables and higher investment in energy efficiency and found that this could create an additional four to seven million jobs worldwide. In the case of renewable electricity production in Switzerland, we estimate that some 20,000 jobs could be created.

Yet another potential source of new jobs is the monetization of unpaid work that worldwide is largely undertaken by women. If more countries around the world succeed in raising women's labor-force participation, there is huge potential to marketize the high share of unpaid care work women carry out at home, such as cooking, childcare, and cleaning, creating new employment.[22] In Switzerland, this opportunity may not be as extensive as in other countries, because it already has a relatively high rate of female labor-force participation. The participation of women aged over 15 was at 63 percent in 2017, compared with a European Union (EU) average of about 51 percent. Nevertheless, there is potential for improvement. Iceland, for example, had a participation rate of 73 percent in 2017, according to the World Bank. In addition, there is the potential to monetize previously unpaid work. For instance, we have seen an increase in the number of people offering dog-walking services.

Beyond these specific potential sources of new jobs are opportunities that cannot be anticipated today and that may arise as the result of enhanced export competitiveness and the creation of completely new jobs.

Innovation, competitiveness, and exports will matter

In a small open economy like Switzerland, trade competitiveness matters for job creation.[23] Over the past 15 years, Switzerland has expanded its exports from approximately 50 to 65 percent of GDP. Net exports grew from about 6 to 11 percent of GDP. The largest categories of exports today are chemicals and pharmaceutical products; machines, appliances, and electronics; watches and precision instruments; financial services; and tourism.[24]

Assuming Switzerland can adopt digital technologies rapidly and increase its global competitiveness and exports, in an illustrative scenario some 20,000 to 70,000 jobs could be created.[25] Today, around 1.4 million jobs in Switzerland are dependent on the exports of the top six exporting sectors. Around 460,000 jobs are directly dependent on these exports, another 390,000 jobs are indirectly dependent on the value chain, and another 570,000 are created through spending by people employed by exporting companies and their suppliers (induced effect) (Exhibit 10). Imagine Switzerland achieved export growth of around 5 percentage points of GDP. This would impact about 70,000 jobs in total—between 20,000 and 25,000 directly and another 45,000 to 50,000 jobs indirectly or through induced effects.[26] We note that this calculation is highly simplified and rests on many implicit assumptions, including the assumption that workers in additional export-related activities are incremental rather than simply displacing workers in domestic sectors. To put this in perspective, in 2017, the pharmaceutical industry employed 45,500 people, and, through its effects on other sectors, around 130,000 to 140,000 jobs depended on this industry.[27] An upside of 70,000 new jobs

~1.4M
Swiss jobs depend on the top six exporting sectors

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[22] Around three-quarters of unpaid care work globally is undertaken by women. See *The power of parity: How advancing women's equality can add $12 trillion to global growth*, McKinsey Global Institute, September 2015.

[23] There is some debate about how much trade competitiveness matters in the long run for jobs, which some assume will always balance out with the supply of workers, as has, in the long run, historically happened. But this balance can be challenged by wage floors (that is the amount of "good" or well-paying jobs) as well as by fairly long transition periods of digital technology adoption.

[24] We do not include precious metals and gemstones, license fees, or merchanting and commodity trading due to their unclear link to employment.

[25] Global competitiveness is increased through automation and digitization technologies, since production costs can be brought down through innovating and improving products and services offered. See, for instance, *Digital globalization: The new era of global flows,* McKinsey Global Institute, March 2016.

[26] These changes could be positive or negative—exports could expand or contract. A change of plus or minus 5 percent of exports could potentially impact 50,000 to 140,000 employed individuals.

[27] Resulting in a total of around 180,000 jobs created in pharmaceuticals with a total job-to-job multiplier of 4.2. See *Bedeutung der Pharmaindustrie für die Schweizer Volkswirtschaft (Importance of the pharmaceutical industry for the Swiss economy)*, BAK Economic Intelligence, November 11, 2017.

from exports would effectively add another export industry half the size of Switzerland's pharmaceuticals sector today.

Job gains also assume that rising real incomes from digitization and AI raise demand in Switzerland and do not leak abroad on a large scale. Demand could shift abroad if Switzerland were to lose its attractiveness for global business investment. Demand could also be impacted if economic gains accumulate at the top end of the income distribution where propensities to consume are low.

Exhibit 10

About 1.4 million jobs in Switzerland depend on 6 key export sectors.

Exports
2014, CHF billions

Chemicals and pharma	85
Machinery appliances	33
Financial services	20
Watches	22
Tourism	16
Telecom and ICT	13
Total	190

Export-related jobs
People employed, thousands

Chemicals and pharma	395
Machinery appliances	252
Financial services	209
Watches	164
Tourism	306
Telecom and ICT	92
Total	1,418

Jobs directly created in the industry   Jobs created along the value chain   Jobs created through employee spending

NOTE: Estimates are based on export data from SNB and output to job multipliers from WIOD; job multipliers for USD are used, based on a foreign exchange rate of USD to CHF in 2014 of 1.09.

SOURCE: Swiss National Bank; World Input-Output Tables; McKinsey Global Institute analysis

There will also be entirely new jobs created which are hard to imagine today. Some of the new jobs created by technology over the years were relatively easy to anticipate—think about the growth in the number of computer programmers as the software industry grew. In the current and forthcoming era, we know that there will be demand for data scientists. But who would have foreseen the rise in the number of nutritionists, or indeed the emergence of a completely new profession—the drone defender who offers the service of keeping drones away from residential properties? Studies in the United States have shown that, on average every year, 0.5 percent of the workforce have been working "new jobs" for the past 20 years. If this held true in Switzerland, we might expect up to 6 percent of the 2030 labor supply to be active in entirely new job profiles from today.[28] This would equate to up to 300,000 potential new jobs. However, since this approximation cannot be separated properly from the monetization of unpaid jobs (for instance, dog walkers) or increased spending (dieticians, for instance), we have not included this impact in our estimates of additional jobs created by 2030.

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[28] *Jobs lost, jobs gained: Workforce transitions in a time of automation*, McKinsey Global Institute, December 2017.

A TRANSFORMATION OF SKILLS IS NEEDED TO MATCH THE TRANSFORMATION OF ACTIVITIES

The potential number of jobs gained can only be attained if available skills match the need for such jobs; otherwise, job opportunities might remain vacant or be transferred to other countries. While the analysis in this report suggests that job gains can compensate for losses in terms of numbers, new (and existing) jobs and activities will require different skills.

We estimate that demand for tasks that require basic cognitive or physical and manual skills will both decline by around 20 percent, which translates into 175,000 and 250,000 fewer employees, respectively. In contrast, demand for social and emotional, and technological skills is set to rise by approximately 20 percent and around 15 percent, respectively—or the equivalent of 145,000 and 65,000 new jobs (see Box 4 in Chapter 4 for details of our methodology). In a scenario that includes an estimate of skill shifts within sectors, jobs, and activities related to increasing use of digital technology as well as direct shifts of activities due to automation, there may be a much higher need for technological (particularly basic digital) skills as employees increasingly work alongside technology. In such a scenario, there could be more than 200,000 more employees needed for jobs requiring technological skills (Exhibit 11).

Exhibit 11

Demand is likely to rise for technological, social, and emotional skills, but decline for manual and basic cognitive skills.

Work time allocated to skills needed
People employed equivalents, thousands, rounded

■ Automation-related shift in activities only
■ Further use of digital technologies within sectors, jobs, and activities

Skill category	Today		Job equivalents
		Displaced	Added
Technological skills	460		65 to 285
Social and emotional skills	855		145 to 175
Higher cognitive skills	1,025		-20 to 20
Physical and manual skills	1,440	-435 to -255	
Basic cognitive skills	805	-205 to -175	
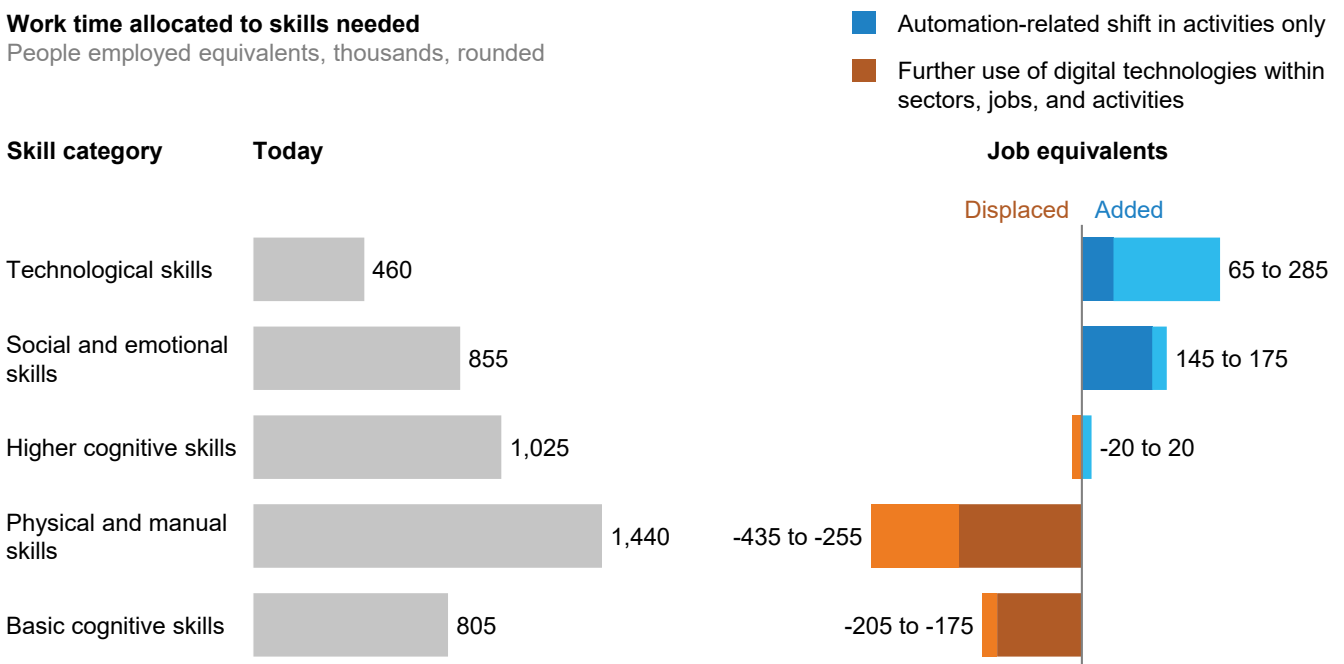
NOTE: Calculation based on evaluation of change in people employed in an occupation from *A future that works: Automation, employment, and productivity,* McKinsey Global Institute, January 2017.

SOURCE: McKinsey Global Institute analysis

A smooth skills transition cannot be taken for granted. Particularly in jobs with high automation potential, mobility between occupations—which will be needed—has been low (Exhibit 12).

Exhibit 12

Close to half of the displaced workforce has low job mobility and is therefore most vulnerable to automation.

Jobs displaced until 2030 by category and current job mobility
Percent

Current job mobility index	Percentage of jobs displaced	Legend
		■ Technicians and associate professionals
		■ Service jobs[1]
		■ Professional
		■ Operator and transport[2]
		■ Managers
		■ Crafters[3]
		■ Administration-related labor

>60
Medical doctors, legal professionals, life science professionals, software developers, architects, engineers

2 | 7 | 4 → 13

50-60
Building supervisors, life science technicians, nurses and midwives, ship and aircraft controllers, authors, journalists, librarians

5 | 2 | 1 | 2 → 10

40-50
Secretaries, artistic professionals, cashiers and ticket clerks, handicraft workers, clerical support workers, travel attendants

9 | 4 | 18 → 31

30-40
Child care workers, client information workers, hairdressers, tellers, welders and other metal workers

3 | 1 | 5 | 8 → 17

20-30
Builders, cleaning staff, agricultural and forestry workers, electrical equipment installers, truck, bus, and locomotive drivers

4 | 5 | 9 | 3 → 20

High reskilling need

2018
Machine operators, transport workers, manufacturing workers, assemblers

2 | 4 | 2 → 8

NOTE 1: The index is based on normalizing each of the 5 variables: (1) job mobility (job changes refers to the share of workers changing occupations); (2) mobility to low automatable jobs; (3) job zone (length of education and/or experience); (4) baseline skills (average of digital and basic skills from OECD PIAAC database) and (5) digital skills (average of digital and basic skills from OECD's PIAAC database) resulting in scores using the full range from 1-100.

NOTE 2: Rough estimates are based on MGI's jobs lost, jobs gained analysis for Switzerland and uses Denmark as the benchmark on job mobility. See *Shaping the future of work in Europe's digital front-runners*, McKinsey & Company, October 2017.

1 E.g., laundry workers and cleaners.
2 E.g., bus and truck drivers.
3 E.g., printing-related work.
4 E.g., clerks and support workers.

SOURCE: McKinsey Global Institute analysis

Doctor using digital tablet in hospital
© FS Productions/Blend Images/Getty Images

3. DIGITIZATION, AUTOMATION, AND AI WILL HAVE STRONG IMPACT AT THE SECTOR LEVEL

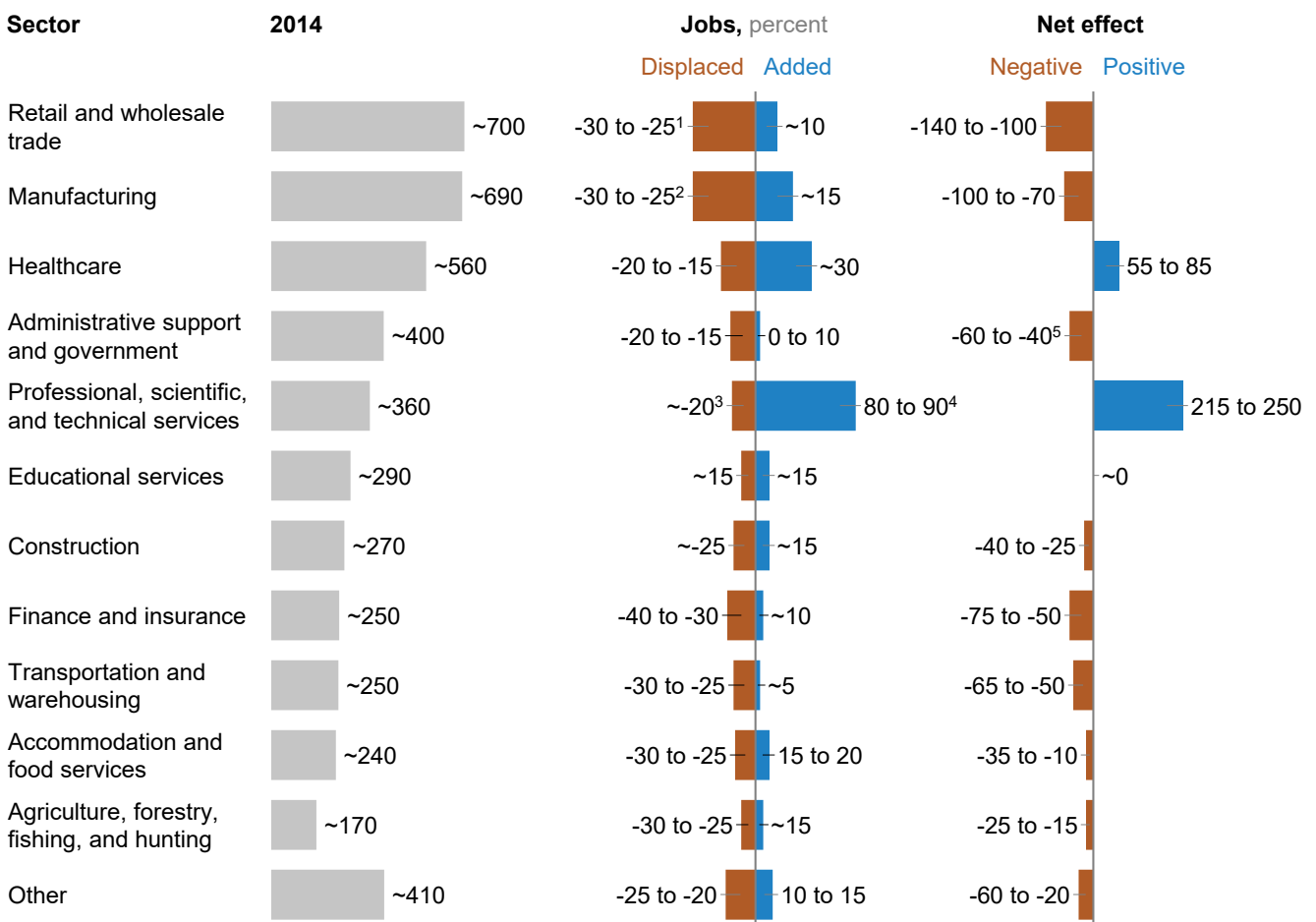Looking at some key sectors of the Swiss economy, automation and AI will have a large and very different net impact on jobs—negative and positive. In this chapter, we look at four sectors—retail and wholesale trade, manufacturing, the public sector, and finance—that together account for around 60 percent of Swiss GDP and around 45 percent of Swiss employment. We consider global trends in digitization, the current status of the sector in Switzerland, and the potential impact of digitization, automation, and AI technology on employment. These four industries will be affected in very different ways (Exhibit 13).

Exhibit 13

The largest potential job losses could be in retail, manufacturing, and finance, but professional services and healthcare could create new jobs.

People employed per sector
Thousands, rounded and ranged

Sector	2014	Jobs, percent		Net effect	
		Displaced	Added	Negative	Positive
Retail and wholesale trade	~700	-30 to -25[1]	~10	-140 to -100	
Manufacturing	~690	-30 to -25[2]	~15	-100 to -70	
Healthcare	~560	-20 to -15	~30		55 to 85
Administrative support and government	~400	-20 to -15	0 to 10	-60 to -40[5]	
Professional, scientific, and technical services	~360	~-20[3]	80 to 90[4]		215 to 250
Educational services	~290	~15	~15	~0	
Construction	~270	~-25	~15	-40 to -25	
Finance and insurance	~250	-40 to -30	~10	-75 to -50	
Transportation and warehousing	~250	-30 to -25	~5	-65 to -50	
Accommodation and food services	~240	-30 to -25	15 to 20	-35 to -10	
Agriculture, forestry, fishing, and hunting	~170	-30 to -25	~15	-25 to -15	
Other	~410	-25 to -20	10 to 15	-60 to -20	

1 E.g., retail salespeople.
2 E.g., crafters and machine feeders.
3 E.g., bookkeepers.
4 Mainly driven by IT professionals (such as software developers) who may have insourced at some stage.
5 Depending on will to implement.

SOURCE: McKinsey Global Institute analysis

The largest negative net impact on jobs is likely to be in retail and wholesale trade, manufacturing, and finance sectors, where automation could displace between 25 and 30 percent of jobs. According to our model, automation could displace 100,000 to 140,000 net jobs in retail and wholesale trade, 70,000 to 100,000 in manufacturing, 40,000 to 60,000 jobs in administration and government, and 50,000 to 75,000 in finance and insurance.

However, some sectors could add a substantial number of net jobs. For instance, our model implies that professional, scientific, and technical services could add up to 215,000 to 250,000 net jobs and healthcare around 55,000 to 85,000.[29]

A substantial structural shift has been observed in Switzerland for some time. Avenir Suisse has found that the "digital sector" (ICT, media, financial services, professional services, telecommunications, research and development, and entertainment) expanded its employment by 44 percent from 1997 to 2014, while the "physical sector" added only 12 percent more jobs. However, the productivity of the digital sector increased by only 9 percent compared with 33 percent cumulatively in the physical sector, suggesting that more digital transformation and more translation of digitization into tangible productivity gains is needed.[30]

RETAIL AND WHOLESALE TRADE: A SHIFT TO ONLINE AND DIGITIZATION OF PROCESSES WILL LIKELY LEAD TO NET JOB LOSSES

The retail and wholesale sector contributed 14 percent of Swiss GDP in 2016 and employed around 700,000 people, making it the most important source of jobs in the economy. In 2017, retail accounted for around half of all individuals employed in the sector, wholesale trade 35 percent, and auto trade and repair a further 15 percent. In retail, over the past decade, employment was stable and labor productivity increased on average by 2 percent a year (Exhibit 14).

Exhibit 14

Employment in retail trade has stayed stagnant as increased competition and margin pressure has placed more focus on delivering productivity through gross value added.

Employment (FTE), real GVA in 2010 CHF, productivity (real GVA per FTE)—retail (excl. wholesale)
Index, year 2000 = 100

Average annual growth, 2000-15
Percent
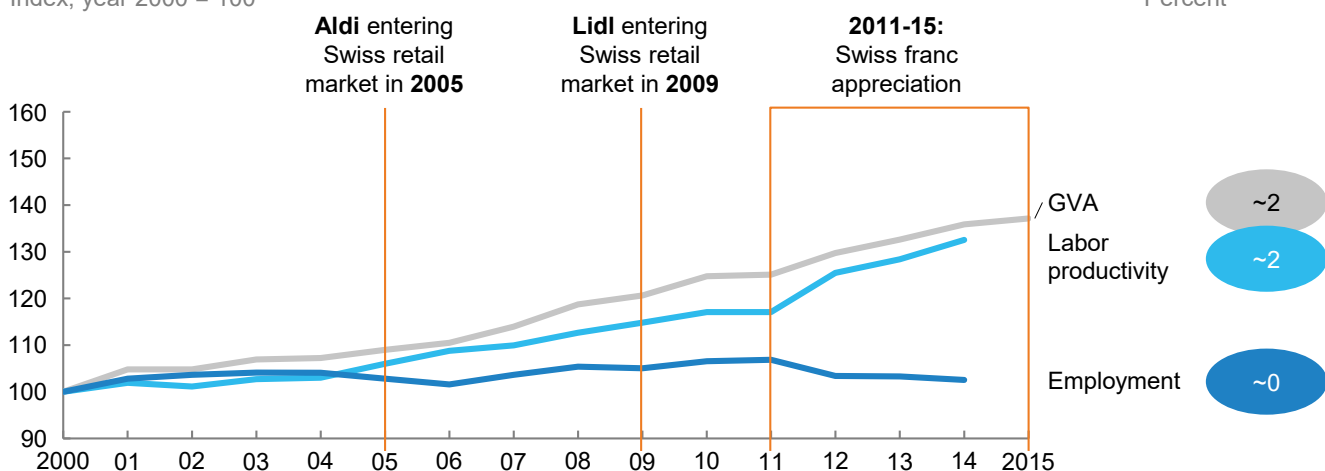
SOURCE: Bundesamt für Statistik; McKinsey Global Institute analysis

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29 It should be noted that some of the employees added in the professional service industry may be insourced to other sectors, depending on market dynamics.

30 T. Adler and M. Salvi, *Wenn die Roboter kommen – Den Arbeitsmarkt für die Digitalisierung vorbereiten (When the robots come – Preparing the job market for digitization)*, Avenir Suisse, October 2017.

18%

annual growth in self-checkouts expected

Prices in Swiss retail have been relatively high compared to neighboring countries.[31] This has prompted discount retailers from Germany to enter the Swiss market: Aldi in 2005 and Lidl in 2009. The increase in the value of the Swiss franc against the euro from approximately 1.5 in 2009 to between 1.0 and 1.15 from 2011 to 2018 triggered a wave of "shopping tourism" to Switzerland's neighboring countries. These developments have put Swiss retailers under significant pressure to raise productivity (and cut prices charged to consumers), which has led to a strong focus on automation.

Global trends in digitization, automation, and AI in retail

Around the world, the digitization of retail has centered on the rise of e-commerce, but the digital revolution in the way we shop is about much more than buying products and services online. The offline retail world is transforming, too, as it seeks to compete with e-commerce in terms of cost, speed, and customer service. Imagine being greeted by name in a grocery store that uses facial recognition software, where you can provide instant feedback if you cannot find what you want, can use coupons on your mobile phone, and can walk out apparently without paying, because payment is simply taken automatically from your account. We are close to this reality today with self-checkouts—one recent study suggests that self-checkouts are set to grow at around 18 percent a year.[32] Amazon is piloting stores with fully automated checkouts, but it will take some time before the technology becomes standardized and accepted by customers. Nevertheless, moving to fully automated paying and shipping is not a large stretch.[33] The back end is being automated, too. Robot cleaners and automated storerooms already exist. Optimized order management systems are already helping retailers to reduce costs.[34] The critical warehouse size required for automation technologies to become profitable is steadily decreasing. Founded in 2009, Zurich-based Scandit has introduced software that quickly scans and categorizes parcels in warehouses, and expects this to boost revenue significantly.[35]

Three key trends that are set to transform this sector are worth highlighting. The first is the continued evolution of an integrated omnichannel experience, which combines offline and online. MGI research shows that 85 percent of shoppers in China are already omnichannel consumers.[36] In mid-2017, Alibaba opened three Hema supermarkets in Beijing and Shanghai. Although these are physical stores, they offer an omnichannel experience. Customers shop, eat, and order groceries for delivery using their mobile phones (and pay using Alipay). Every item in the store has a barcode, so customers can obtain information. Alibaba claims that sales are between three and five times higher than those of a traditional supermarket.[37] Consumer goods and retail companies need to take this strong consumer preference into account if they are to retain their customers and win new ones.

The second trend is a move toward data-driven business models where retailers can monetize consumer data gathered from loyalty cards and digital media and social networks, enabling them to understand customers' preferences in real time, tailor their offers accordingly, and influence consumers' purchasing decisions. One specialty retailer was experiencing stagnation in its revenue and profits from existing customers, and decided to redesign the promotions sent to the more than five million members of its loyalty-card program. The retailer recognized that by combining data from various functional groups—

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31   Simon Bradley, *What to do about Switzerland's eye-watering prices?* swissinfo.ch, July 11, 2017.

32   *Global retail self-checkout terminals market 2018-2022*, Research and Markets (https://www.researchandmarkets.com/research/npbczt/global_retail?w=5).

33   In December 2016, Amazon launched a store without cashiers called Amazon Go. See Leena Rao, "Amazon Go debuts as a new grocery store without checkout lines," *Fortune*, December 5, 2016.

34   *The future of retail analytics*, State of the industry research series, EKN, 2013.

35   Scandit's competitors, revenue, number of employees, funding, and acquisitions, Owler (https://www.owler.com/company/scandit).

36   This is according to the 2017 McKinsey China iConsumer Survey. See *Digital China: Powering the economy to global competitiveness*, McKinsey Global Institute, December 2017.

37   Adam Najberg, *Hema supermarket offers shoppers a new retail experience*, Alizila, July 17, 2017.

in this case, customer loyalty, marketing, and merchandising finance—it could identify subsegments among its customers and figure out what types of direct mail resulted in the most incremental profit for each segment. Once the retailer understood what data it needed, it developed a focused process to extract and clean the relevant data and used it in its promotion redesign.[38] In the United States, 400 staff members in the business intelligence operations unit at retailer Sears accomplished complex big-data-driven customer segmentation that would previously have required PhD-level specialist analysts.[39]

The third trend—related to the second—is the increasing use of AI applications that enhance retailers' ability to find out what shoppers want quickly and in detail. For instance, machine learning personalizes promotions to match shoppers' profiles. Computer vision with deep learning identifies articles put in shopping bags, adding data from sensors, and enables nonstop checkout and automatic payment. AI-enhanced robots can continuously track inventory, recognize empty shelves, and restock them; other robots fill bags in warehouses.[40]

Switzerland lags behind other advanced economies on e-commerce

In Europe, retail ranks 14 of 22 sectors on the MGI Industry Digitization Index. Although large retailers digitized early and have continued to be at the digital forefront of the sector, there is a long tail of small firms that are far less advanced in their digital journeys.[41]

Swiss consumers are shifting rapidly to more digital consumption channels. In the past two to three years, online purchases have increased by 10 to 15 percent per year. In 2017, e-commerce accounted for around 7.5 percent of all retail trade.[42] This is a lower share than in neighboring countries. In the United Kingdom, for instance, online accounted for 17.8 percent of retail trade in 2017; in Germany, the share was 15.1 percent (Exhibit 15). A number of factors appear to lie behind Switzerland's comparatively slow adoption of online retail, including the relatively small size of the market, and the fact that online orders to and from Switzerland may be subject to customs duties, which makes it less attractive for foreign e-commerce to enter the market, and that may mean that many SMEs are not using an online channel.[43] There is significant scope to reduce costs as e-commerce and web stores enable companies to reach large pools of new customers. The cost to serve them could fall by 50 to 70 percent.[44]

In online business-to-customer sales, Switzerland has established local e-commerce competitors to global players. In 2017, Switzerland's online market was led by a local e-commerce player Digitec, followed by zalando.ch, amazon.de's sales into Switzerland, and shops like nespresso.ch, brack.ch and leshop.ch.[45]

Switzerland has advanced further on automation technologies such as self-checkouts. The two leading Swiss grocery retailers Migros and Coop offer various options. In 2018, 2,200 of the 10,000 checkouts at Migros were self-checkouts, and 15 percent of Coop's checkouts

7.5%

e-commerce share of 2017 Swiss retail vs. 17.8% in the UK and 15.1% in Germany

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[38] Peter Breuer, Jessica Moulton, and Robert Turtle, *Applying advanced analytics in consumer companies*, McKinsey & Company, May 2013.

[39] *Digital Europe: Pushing the frontier, capturing the benefits*, McKinsey Global Institute, June 2016.

[40] *Notes from the AI frontier: Insights from hundreds of use cases*, McKinsey Global Institute, April 2018.

[41] *Digital Europe: Pushing the frontier, capturing the benefits*, McKinsey Global Institute, June 2016.

[42] *Retail e-commerce sales as share of retail trade in selected countries from 2014 to 2017*, Statista, 2017.

[43] Laura Angelstorf, *E-commerce in Switzerland: How SMEs can foster sales with online trade*, Switzerland Global Enterprise, August 12, 2016; and Ecommerce in Switzerland, Ecommerce News Europe (https://ecommercenews.eu/ecommerce-per-country/ecommerce-switzerland/).

[44] Paul-Louis Caylar, Kedar Naik, and Olivier Noterdaeme, *Digital in industry: From buzzword to value creation*, McKinsey & Company, August 2016.

[45] *Digitec bleibt auch 2017 umsatzstärkster Schweizer Onlineshop (Digitec remains the highest-earning Swiss online shop)*, werbewoche.ch, August 31, 2017.
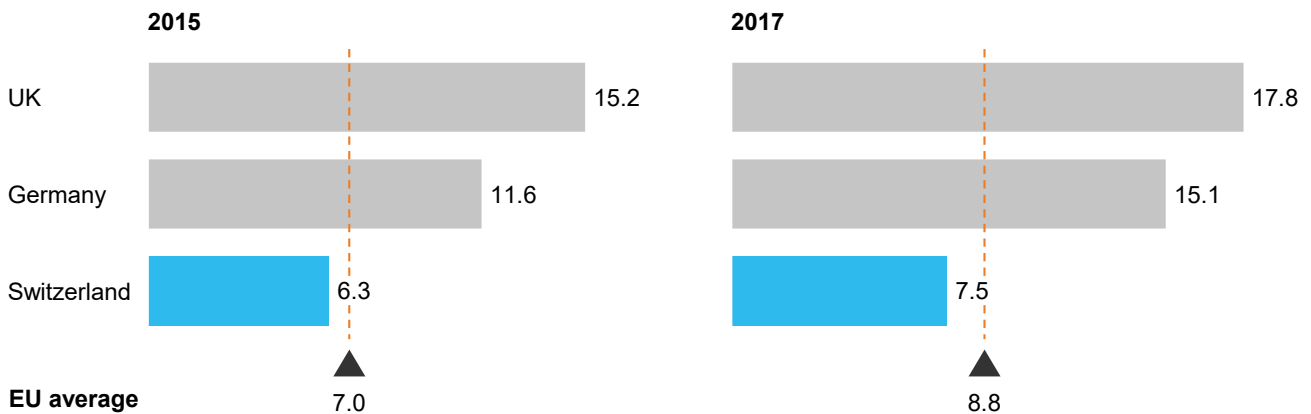
are self-service. Switzerland also ranks in the top 30 percent of countries in Europe using digital payments, according to the Bundesamt für Statistik.[46]

Exhibit 15

Switzerland has a lower share of online retail than its neighbors—below the European Union (EU) average.

Share of online sales
Percentage of value

	2015		**2017**	
UK	████████████	15.2	████████████	17.8
Germany	█████████	11.6	██████████	15.1
Switzerland	████	6.3	████	7.5
EU average	▲ 7.0		▲ 8.8	

NOTE: Share of online sales comes from Statista; data on people having ordered something in the past 3 months comes from the Bundesamt für Statistik.

SOURCE: Statista; Bundesamt für Statistik; McKinsey Global Institute analysis

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Rising consumption and the use of new technologies would dampen job displacement but is not likely to be able to halt declining sector employment

Major job transformations loom for Swiss retailers. Just over half—55 percent—of all hours worked in Swiss retail are repetitive and highly susceptible to automation (if all available technologies were to be applied). This share of automatable hours is on a par with banking and finance at 45 to 50 percent, and manufacturing at 50 to 55 percent, but much higher than in healthcare where human interaction is still central and where only 10 to 15 percent of tasks are liable to be automated.

In our midpoint adoption scenario, we estimate that 25 to 30 percent of all tasks in Swiss retail and wholesale could be displaced over the next 12 years (Exhibit 16). This displacement largely reflects the automation of simple manual tasks and the digitization of back-office work such as order filling. Front-office operations and material handling will also change very significantly as it will be possible to automate warehouse operations, manage supply chains digitally, and place orders automatically. The jobs most susceptible to automation include shop-floor assistants or cashiers.

While rising real incomes and consumption and technology-related job creation may create around 10 percent new jobs (examples include growth in e-commerce, the expansion of floor areas, and convenience formats), this will not be enough to compensate for job losses. Overall employment in the sector looks set to decline by up to a net 100,000 to 140,000 people employed. This raises critical questions for sector leaders on how to deal with the transitions ahead. Can employees filling low-skill jobs being automated be retrained and redeployed to fill needs in growth areas? How much of the net decline can be managed by natural attrition, and what are potential solutions for those exceeding that rate? Can timelines of digital adoption be managed to balance the rate of job declines with much needed productivity and competitiveness increases?
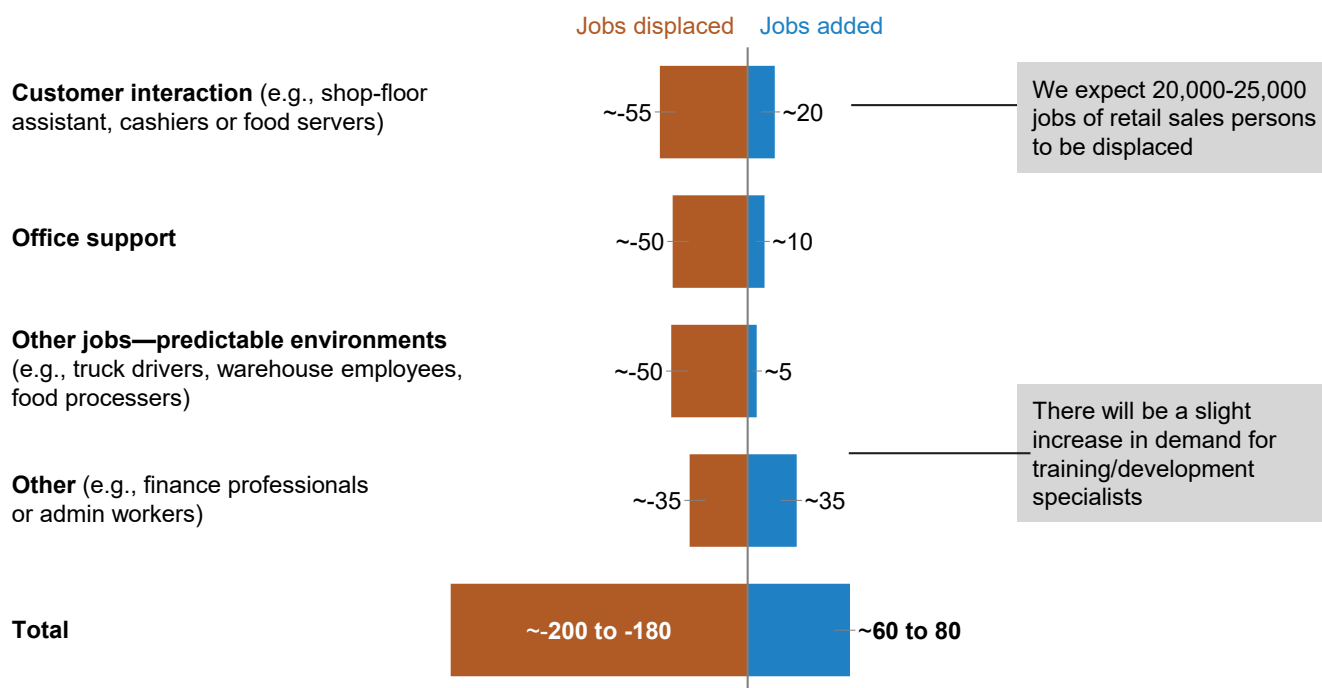
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[46] *E-Commerce und E-Banking*, Bundesamt für Statistik.

Exhibit 16

By 2030, the number of people employed in customer-facing and back-office retail and wholesale may decline.

Change in number of people employed in retail and wholesale
By occupation category, employees, thousands

Jobs displaced   Jobs added

Customer interaction (e.g., shop-floor assistant, cashiers or food servers)
~-55   ~20

We expect 20,000-25,000 jobs of retail sales persons to be displaced

Office support
~-50   ~10

Other jobs—predictable environments (e.g., truck drivers, warehouse employees, food processors)
~-50   ~5

There will be a slight increase in demand for training/development specialists

Other (e.g., finance professionals or admin workers)
~-35   ~35

Total
~-200 to -180   **~60 to 80**

SOURCE: McKinsey Global Institute analysis

MANUFACTURING: THERE IS FURTHER POTENTIAL FOR INDUSTRIAL AUTOMATION AND DIGITIZATION IN PRODUCT AND SERVICE DEVELOPMENT

Manufacturing is important to Switzerland, accounting for around 18 percent of GDP in 2016, and employing around 700,000 people. Employment has held steady over the past 15 years, in contrast to many other advanced economies where manufacturing employment has been in decline. According to the US Bureau of Labor Statistics, around 12 million people were employed in manufacturing in the United States in 2015, down around 25 percent from 16 million in 2000. Swiss manufacturing productivity has grown at an average annual rate of 2.3 percent over the past 15 years. Within this average, pharmaceuticals have outperformed the rest of the sector with average annual productivity growth rising by around 4.6 percent (Exhibit 17).

Despite the relatively solid state of Swiss manufacturing, companies face pressure to innovate and automate because of intense global competition and high wage levels that leave them vulnerable to the increasing ability of low-wage, low-cost economies to produce high-tech products. One other challenge faced by Swiss manufacturers is the recent appreciation of the Swiss franc after the Swiss National Bank waived defending the minimum Swiss franc exchange rate with the euro of 1.20.

Historically, employment in manufacturing in Switzerland has been more resilient than in other countries. High-margin industries such as pharmaceuticals and watchmaking were able to focus on value creation and export growth in the recent past, and have increased productivity and employment rather than reducing workforces (Exhibit 18).

Exhibit 17

Since 2000, productivity growth in pharmaceuticals has been much higher than in other manufacturing industries.

Employment (FTE), real GVA in 2010 CHF, productivity (real GVA per FTE)
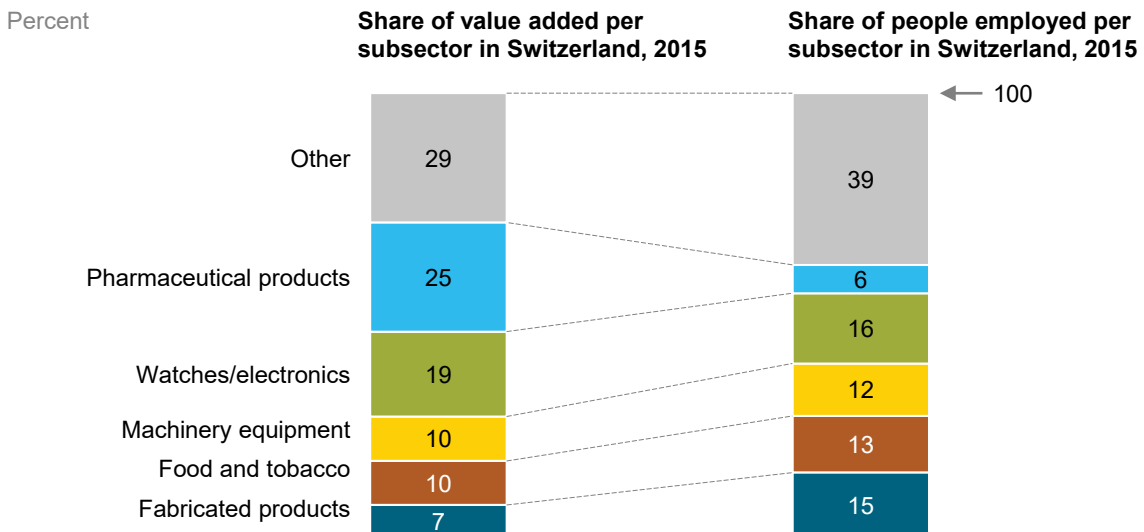Index, year 2000 = 100

Average annual growth, 2000-15
Percent

GVA — 8-9 — Pharma industry

Labor productivity — 4-5

Employment — ~4

GVA — ~2

Labor productivity — ~2 — Manufacturing
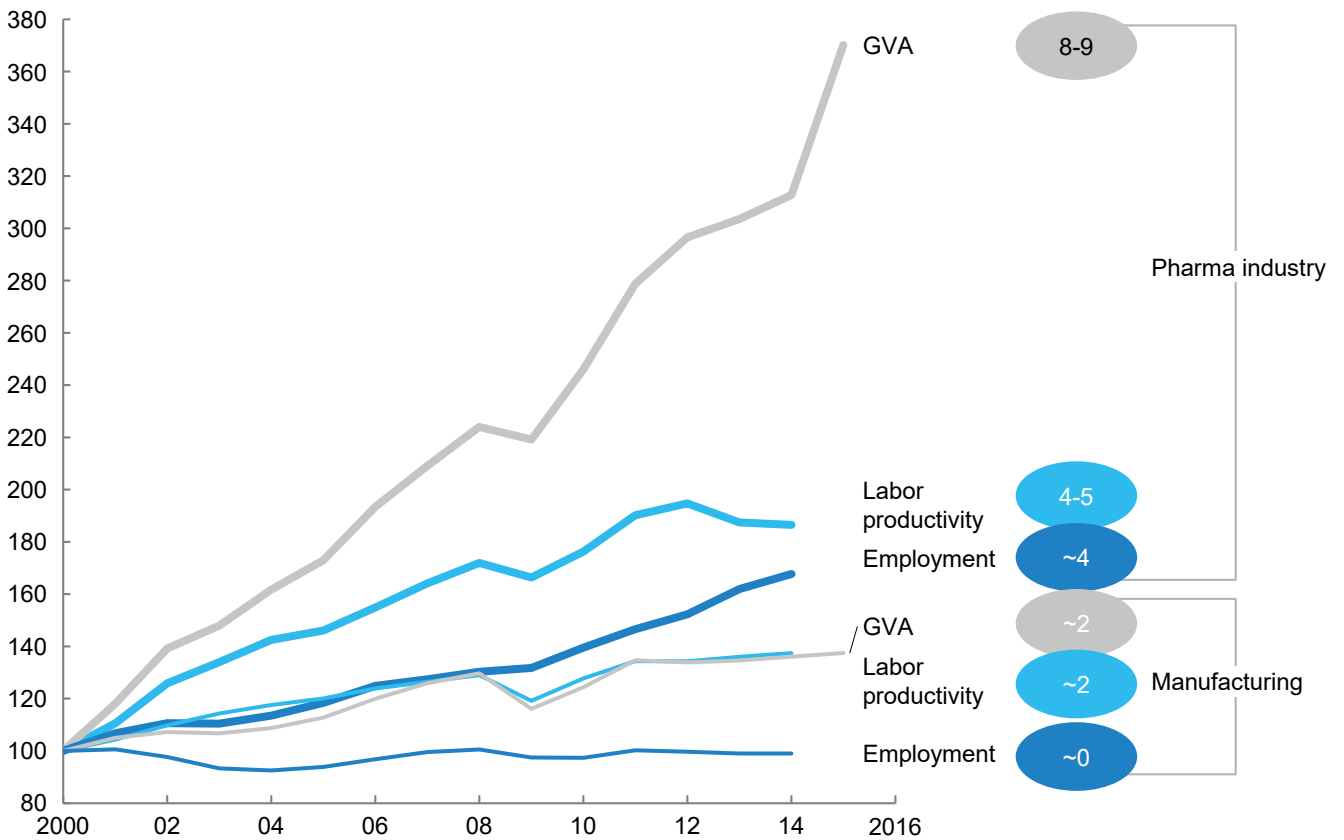
Employment — ~0

SOURCE: Bundesamt für Statistik; McKinsey Global Institute analysis

Exhibit 18

Swiss manufacturing subsectors vary in their shares of value added created and employment, with pharmaceuticals having by far the highest value added per employee.

Percent

Share of value added per subsector in Switzerland, 2015

Share of people employed per subsector in Switzerland, 2015

← 100

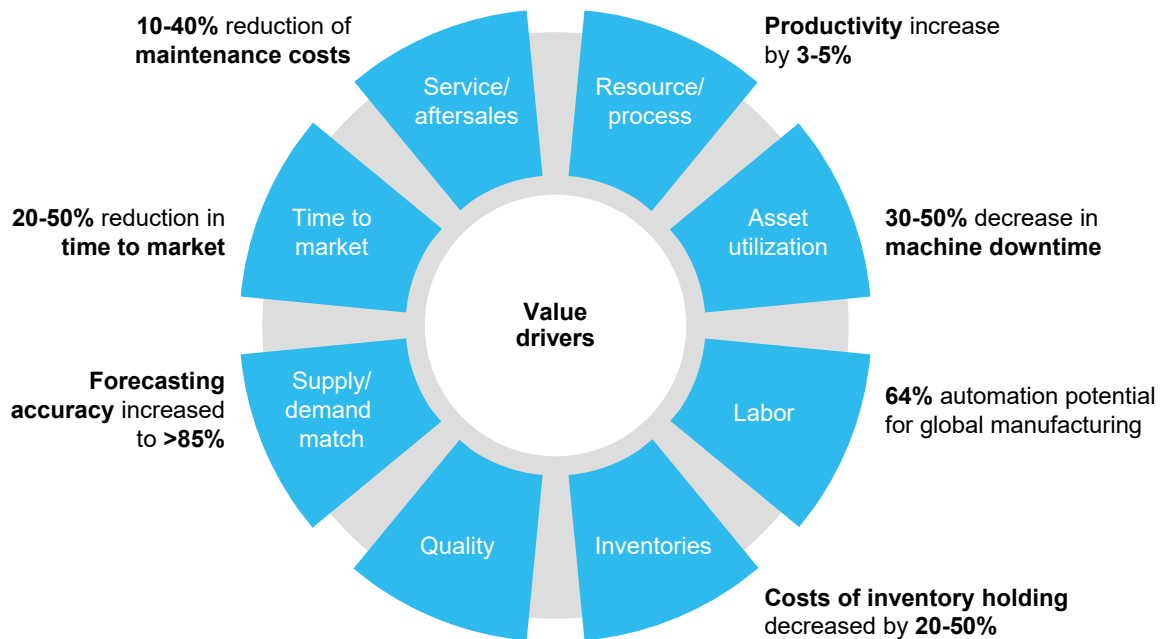|	Share of value added	Share of people employed
Other	29	39
Pharmaceutical products	25	6
Watches/electronics	19	16
Machinery equipment	10	12
Food and tobacco	10	13
Fabricated products	7	15

SOURCE: Bundesamt für Statistik; McKinsey Global Institute analysis

Global trends in digitization, AI, and automation in manufacturing

A range of disruptive technologies, also known as Industry 4.0, is enabling the digitization of the manufacturing sector and boosting performance in every part of the manufacturing value chain (Exhibit 19).[47] Industry 4.0 is being driven by an explosion in the data available, advances in analytics and machine learning, new types of interaction between humans and machines, such as touch interfaces and augmented-reality systems, and the ability to give digital instructions to the physical world. Such innovations enable smart, cost-effective, highly automated plants that can produce on a large scale. The fully digital, automated production site with very little—or even no—manual human intervention is becoming a reality (Exhibit 20).

Exhibit 19

Industry 4.0 can enhance performance throughout the manufacturing value chain.

10-40% reduction of **maintenance costs**

Productivity increase by **3-5%**

20-50% reduction in **time to market**

30-50% decrease in **machine downtime**

Forecasting accuracy increased to **>85%**

64% automation potential for global manufacturing

Costs of inventory holding decreased by **20-50%**

Value drivers: Service/aftersales, Resource/process, Time to market, Asset utilization, Supply/demand match, Labor, Quality, Inventories

SOURCE: *Industry 4.0: How to navigate digitization of the manufacturing sector*, McKinsey Digital, 2015; McKinsey Global Institute analysis

Use of advanced robotics in smart manufacturing is a powerful lever for higher productivity. Advanced robotics can increase labor efficiency and therefore potentially reduce labor costs by between 20 and 50 percent. Digitized quality management could save 20 to 40 percent on the indirect cost of labor, while advanced analytics can shave 5 to 10 percent off the cost of manufacturing. Conversely, new technologies can enable plants that produce highly customized products, or even cheap to set up and run "factory-in-a-box" operations for rapid response to remote or niche markets.

The digitization of manufacturing is not simply about putting robots on an assembly line, but rather encompasses the entire value chain from market research to forecasting demand, developing products, procurement, production, quality inspection, and distribution and after-sales services. Digital tools enable the customization of R&D. "Digital twins" of physical objects can now, in near real time, validate designs and produce prototypes without

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[47] For further discussion, see *Manufacturing the future: The next era of global growth and innovation*, McKinsey Global Institute, November 2012; *Industry 4.0: How to navigate digitization of the manufacturing sector*, McKinsey Digital, 2015; *The great re-make: Manufacturing for modern times*, McKinsey & Company, June 2017; *Making it in America, Revitalizing US manufacturing*, McKinsey Global Institute, November 2017; and *Industry 4.0: Reinvigorating ASEAN manufacturing for the future*, Digital Capability Center Singapore, McKinsey & Company, February 2018.

ever having to actually build them in reality. Supply chains are being digitized with major implications for cost. Real-time optimization of supply chains and capacity can potentially lower the cost of managing inventories. Digital procurement, including digitized analysis and online orders, can streamline processes and potentially reduce procurement costs. Today, a control tower is able to coordinate entire distributed networks of suppliers that stretch around the globe, synthesizing information from radio frequency identification tags, GPS tracking, and other sources. These technologies can also lead to improved inventory control and minimize downtime. Inventory is ordered directly as soon as a need is detected, and predictive maintenance is carried out on machines.

Exhibit 20

Zero manual intervention is the vision for the factory of the future.
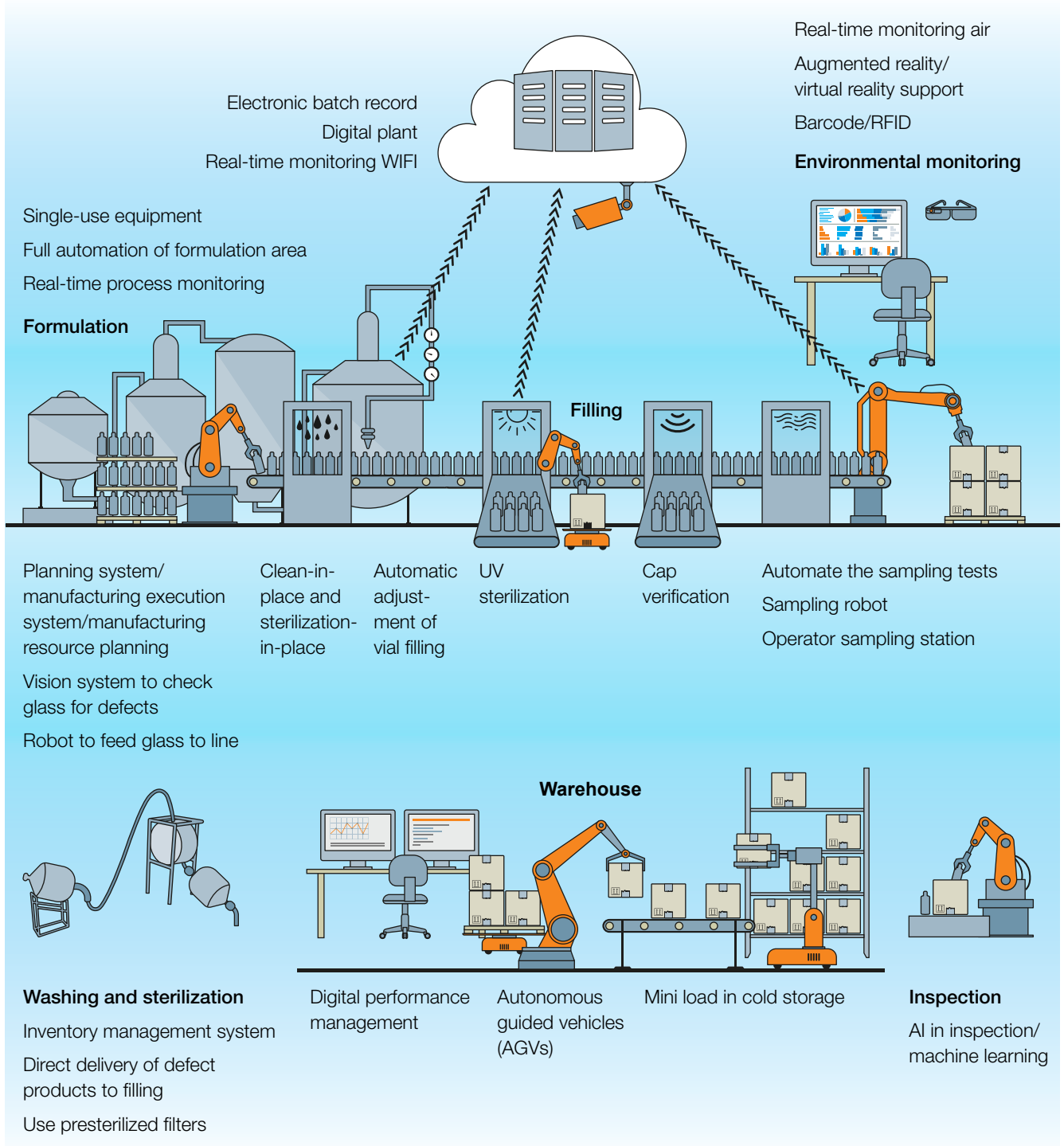
SOURCE: McKinsey & Company; McKinsey Global Institute analysis

Automation and digitization offer significant opportunities for Swiss manufacturers

Swiss mechanical and electrical engineering industries are characterized by the presence of many SMEs that typically produce high-value-added products with a high degree of customization; high labor costs have already led most companies to offshore or outsource the most manual and repetitive tasks. The offering of many companies has expanded, driven by increased demand for automation globally. Participation in global markets is therefore key. Most critical for this industry is therefore export competitiveness, as typically more than 90 percent of products are exported. Digital and automation will be key to maintaining innovation focus and a competitive position but other factors (for example, free trade agreements, currency) will also play a role. We have even seen some first examples of reshoring, where Swiss companies are returning the manufacture of products to highly automated production sites in Switzerland. Two examples are the production of Ovomaltine Crunchy Cream in Neuenegg, and Ypsomed's insulin infusion sets in Solothurn.[48]

In the rest of this section, we briefly focus on three key Swiss manufacturing segments: pharmaceuticals; watchmaking and electronics; and the machinery, electrical, and metals industry.

The pharmaceutical industry

Switzerland has had a leading pharmaceutical industry for a century. Today, the sector accounts for as much as 5 percent of GDP, and employs around 1 percent of the workforce. Switzerland hosts the global headquarters of two of the world's biggest pharmaceutical companies, and hosts the Europe and the Middle East headquarters, R&D centers, and global functions of several other global pharmaceutical companies.

5%
of Swiss GDP from the pharmaceutical sector

Overall, the pharmaceutical industry has a low level of digitization.[49] However, Swiss pharmaceutical companies are now putting digitization at the top of their agenda. Novartis' CEO Vasant Narasimhan states: "I really think of our future as a medicines and data science company, centered on innovation and access."[50] In January 2008, Roche announced that it was entering a partnership to develop an integrated digital diagnostics platform to improve oncology and critical care treatment.[51]

In this industry, digitization and automation are likely to create increased value and output rather than displace workers. Margins in the sector are healthy, employees are largely highly skilled, and many repeatable tasks have been automated or moved abroad in the past. Digital technologies and analytics can support decision making, shorten timelines, and improve quality. Clinical trials, for instance, could become faster and cheaper. The use of data to tailor treatments for specific patients will create more value for all healthcare stakeholders.

The skills profile of the pharmaceutical industry will continue to shift. For instance, there will be increasing demand for data scientists as well as "translators" working at the intersection of business and research. Switzerland has a strong talent base with the ETH in Zurich and the EPFL in Lausanne as well as research-focused universities in Basel, and has a track record of attracting some of the best global talent.

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[48] Ypsomed half-year figures 2017-18, November 9, 2017 and Giorgio V. Müller, "Thanks to automation, industry is returning to Switzerland," *Neue Zürcher Zeitung*, July 17, 2017.

[49] Expert interviews. The McKinsey Industry Digitization Index for Europe suggests that pharmaceutical companies have a particularly low level of digitization of labor (that is, business processes and work in general). See *Digital Europe: Pushing the frontier, capturing the benefits*, McKinsey Global Institute, June 2016. Also see Brian Cox, Amit Paley, Michelle Prevost, and Nisha Subramanian, *Closing the digital gap in pharma*, McKinsey & Company, November 2016.

[50] Sarah Neville and Ralph Atkins, "Novartis's new chief sets sights on 'productivity revolution," *Financial Times*, September 25, 2017.

[51] Roche media release, January 8, 2018 (https://www.roche.com/media/releases/med-cor-2018-01-08.htm).

59k

people employed in Swiss watchmaking

Watchmaking and electronics

Switzerland has been famous for watchmaking since the industry originated in Geneva in the mid-16th century. In 2016, the watchmaking industry was Switzerland's third-largest exporter behind mechanical and electrical engineering, and chemical and pharmaceutical industries. In 2015, around 59,000 people were employed in this sector, which generates 1.5 percent of the country's GDP.[52]

Arguably the greatest threat to jobs in the watch industry from digitization relates to the product itself. Sales of smart watches and wearables are growing at double-digit rates (although there is evidence that sales are beginning to slow).[53] The Swiss watch industry is closely monitoring technological advances and the new consumer demands that derive from them. It is becoming apparent that consumers with a millennial mindset in particular are increasingly expecting a comparatively expensive watch to have built-in sensor capacity to provide health, fitness, and sleep data. While this means new requirements for watchmakers that need to rapidly move from the mechanical to the mechanical-digital world, a total disruption of the industry does not appear to be in prospect. Consumer data indicate that a desire to see e-mails arrive on the wrist is not as universal as some thought. Several Swiss watchmakers have already started to incorporate sensors into traditional luxury watches, but more work is needed. Thus far, the traditional watch industry seems to be stable overall. Between 2008 and 2010 and from 2015 to 2016, sales dropped, but they now appear to be growing again, particularly in the case of high-value watches.[54]

Sales channels are evolving as digitization becomes more widespread. As for many luxury brands, the sales process is part of generating perceived value for the customer, the shift to online and omnichannel may be challenging although online sales of luxury items continue to increase.[55] On the other hand, social media offer watchmakers huge potential to reach new target markets.[56]

60%

fall in 3-D printing costs 1990-2014

The machinery, electrical, and metals industry

The Swiss machinery, electrical, and metals industry employs 320,000 people with a further 500,000 people abroad, according to the Swiss Federal Department of Foreign Affairs.[57] Ninety-nine percent of companies in this sector are SMEs employing fewer than 250 people. With exports valued at CHF 63 billion in 2015 or 31 percent of total exports, this is Switzerland's second-largest export sector.

Automation is already underway in this sector and will continue as more advanced—and cheaper—robots as well as additive manufacturing technologies such as 3-D printing and rapid prototyping can be deployed in more specialized, smaller companies. For example, 3-D printing costs fell by 60 percent between 1990 and 2014, and industrial robot costs decreased by 5 percent a year between 2000 and 2012.[58] The two Swiss Federal Institutes of Technology (ETH, EPFL) are at the forefront of this research, for instance working through the Swiss Advanced Manufacturing Research Center (SAMARC) to develop additive

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[52] Watchmaking industry, Discover Switzerland (https://www.eda.admin.ch/aboutswitzerland/en/home/wirtschaft/taetigkeitsgebiete/uhrenindustrie.html).

[53] Wearable technology – statistics and facts, Statista (https://www.statista.com/topics/1556/wearable-technology).

[54] *Swiss watch exports June 2018*, Federation of the Swiss Watch Industry, 2018; *Swiss watch industry prospects and challenges*, Credit Suisse, October 2013.

[55] Antonio Achille, Sophie Marchessou, and Nathalie Remy, *Luxury in the age of digital Darwinism*, McKinsey & Company, February 2018.

[56] Paige Weiners, *How luxury brands are adapting to an omnichannel world*, Forbes Communications Council, June 2, 2017.

[57] *Machine, electrical engineering and metals industry*, Schweizerische Eidgenossenschaft, Discover Switzerland (https://www.eda.admin.ch/aboutswitzerland/en/home/wirtschaft/taetigkeitsgebiete/maschinen---elektro--und-metallindustrie.html).

[58] Paul-Louis Caylar, Kedar Naik, and Olivier Noterdaeme, *Digital in industry: From buzzword to value creation*, McKinsey & Company, August 2016.

manufacturing technologies such as 3-D printing, and aiming to facilitate the transition of findings from basic research into new manufacturing processes. Examples of this work include high-precision micromanufacturing of ceramics that can be used in the healthcare industry (such as dental plastic surgery) or the development of 4-D printing (3-D printed structures that change their shape after printing in response to the environment).[59]

There are Swiss players in the sector that are among the leading suppliers of automation and digital production equipment globally. One example is ABB, a global corporate with around $ 35 billion of sales and 135,000 employees as of 2017. ABB has developed "Yumi," a two-armed assembly robot that enabled human-robot collaboration in a normal production environment.[60]

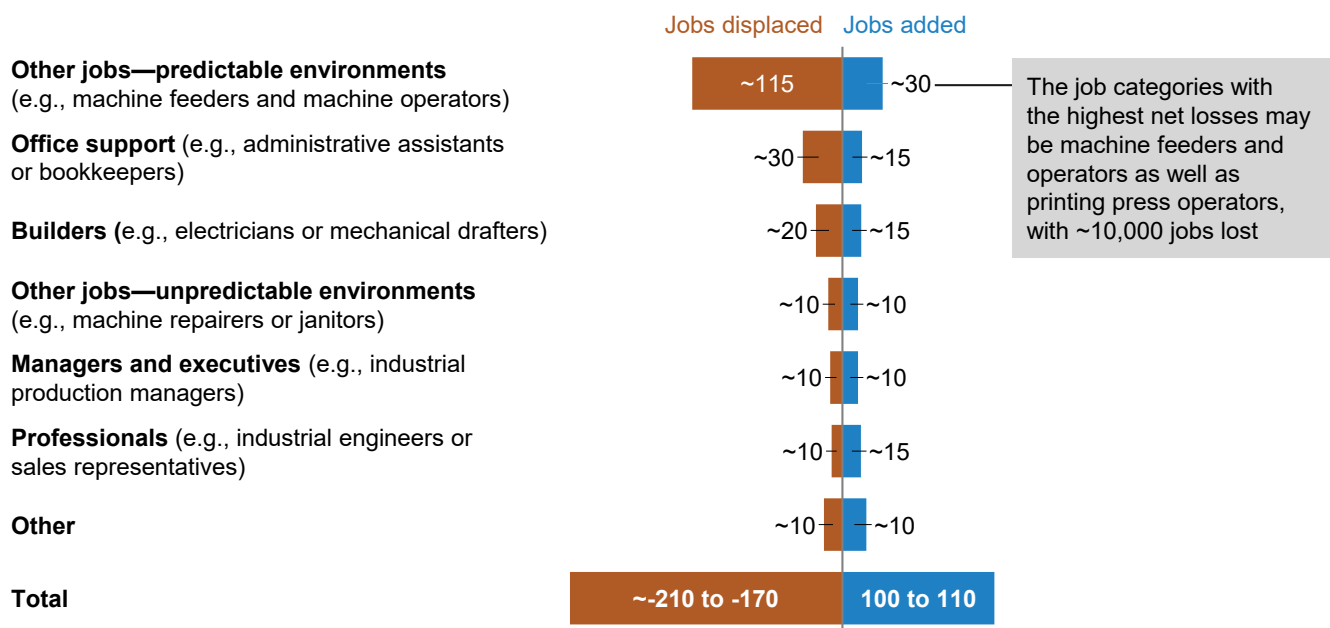## Digital, automation, and AI are likely to have a net negative impact on employment in the sector

Overall, our analysis suggests that 25 to 30 percent of jobs in manufacturing could be displaced. This is almost twice the percentage of new jobs that might be created on average, leaving a net decline of around 15 percent (Exhibit 21). Particularly in manufacturing, this scenario is sensitive to the evolution of competitiveness and exports. If fast-digitizing firms can further extend competitiveness and capture global market shares, higher growth might further compensate for more automation-related job losses than modeled in our base case. There is also increasing discussion in advanced economies about reshoring of manufacturing as increased robotics use compensates wage differentials with lower-cost locations. However, we note that, due to heavy automation, typically very few jobs go along with successful reshoring.

Exhibit 21

By 2030, there could be major shifts in manufacturing employment due to automation, especially among people engaged in predictable tasks.

Change in number of people employed in manufacturing
By occupation category, employees, thousands

Jobs displaced   Jobs added

Other jobs—predictable environments (e.g., machine feeders and machine operators) — ~115 | ~30

Office support (e.g., administrative assistants or bookkeepers) — ~30 | ~15

Builders (e.g., electricians or mechanical drafters) — ~20 | ~15

Other jobs—unpredictable environments (e.g., machine repairers or janitors) — ~10 | ~10

Managers and executives (e.g., industrial production managers) — ~10 | ~10

Professionals (e.g., industrial engineers or sales representatives) — ~10 | ~15

Other — ~10 | ~10

Total — ~-210 to -170 | 100 to 110

The job categories with the highest net losses may be machine feeders and operators as well as printing press operators, with ~10,000 jobs lost

SOURCE: McKinsey Global Institute analysis

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[59] *Strategic focus area: Advanced manufacturing* (www.sfa-am.ch).
[60] ABB company website (https://new.abb.com/products/robotics/industrial-robots/yumi).

Most of the jobs displaced will involve tasks that can be performed by robots, such as machine feeding or operating. The second-largest segment of activities that could be displaced involves typical office support or back-office activities. Such trends are unfolding across sectors, but Swiss manufacturing has already been automating or offshoring these kinds of jobs, and therefore the impact on the sector may be less than in others.

We also envisage that some more highly skilled roles may be displaced, including electricians, machine repairers, industrial production managers, and industrial engineers, but that technological innovation will more than compensate for this displacement by creating new roles in the highly skilled category, such as sales professionals, automation engineers, and new kinds of repairers. Moreover, the productivity of existing high-skilled workers has the potential to increase as they work alongside machines—for instance, new software can decrease the overall time an electrician needs to fulfil a certain task.

PUBLIC SECTOR: THERE IS GREAT POTENTIAL TO DIGITIZE ADMINISTRATION, DISPLACING JOBS, BUT LARGE EXPECTED NET JOBS GAINS IN HEALTHCARE

The public sector in Switzerland accounts for 17 percent of country GDP and, in 2015, employed 700,000 to 750,000 people. There are three major sources of employment: public administration, education, and healthcare. From 2000 to 2015, the sector posted average employment growth of 3 to 4 percent per annum (Exhibit 22). Productivity growth was flat, although we note that most measurements of public-sector productivity are not very robust (Exhibit 23). To date, digitization has been low. On the MGI Industry Digitization Index for Europe, government (administration) ranks 16th out of 22, education 17th, and healthcare 18th.[61]

Exhibit 22

The highest share of employment in the public sector is in administration, followed by education and healthcare.

Share of people employed by sector
Top s6ix sectors by number of people employed 2017 in Switzerland, thousands, percent[1]
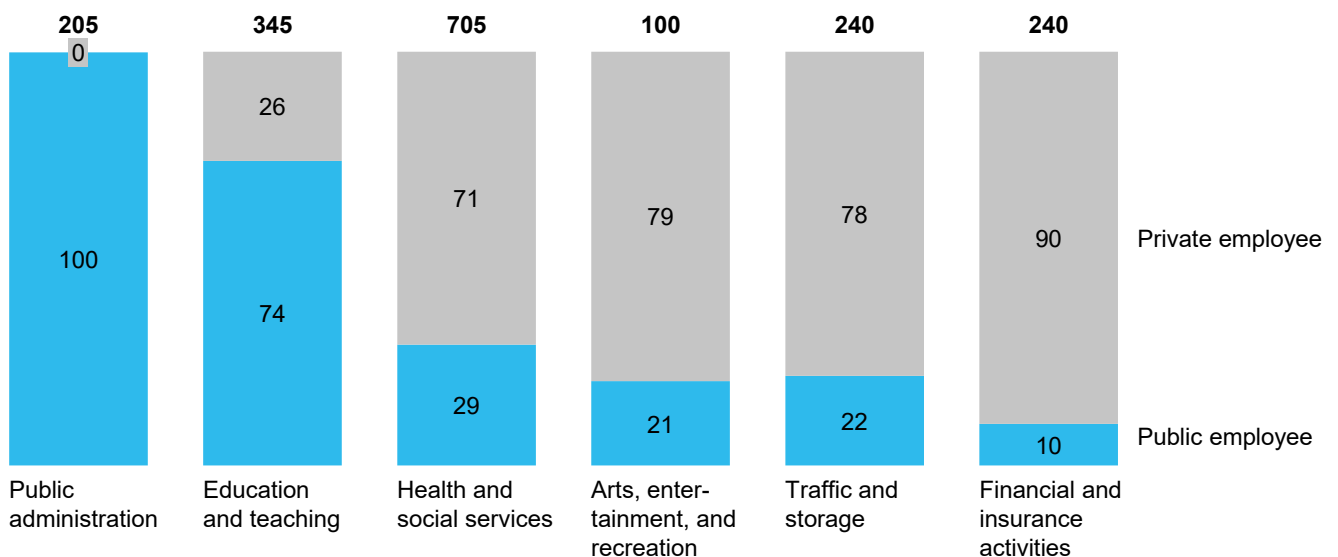
NOTE: In 2008, 15% of all people employed were financed by the public sector.
1   Share taken from 2008.

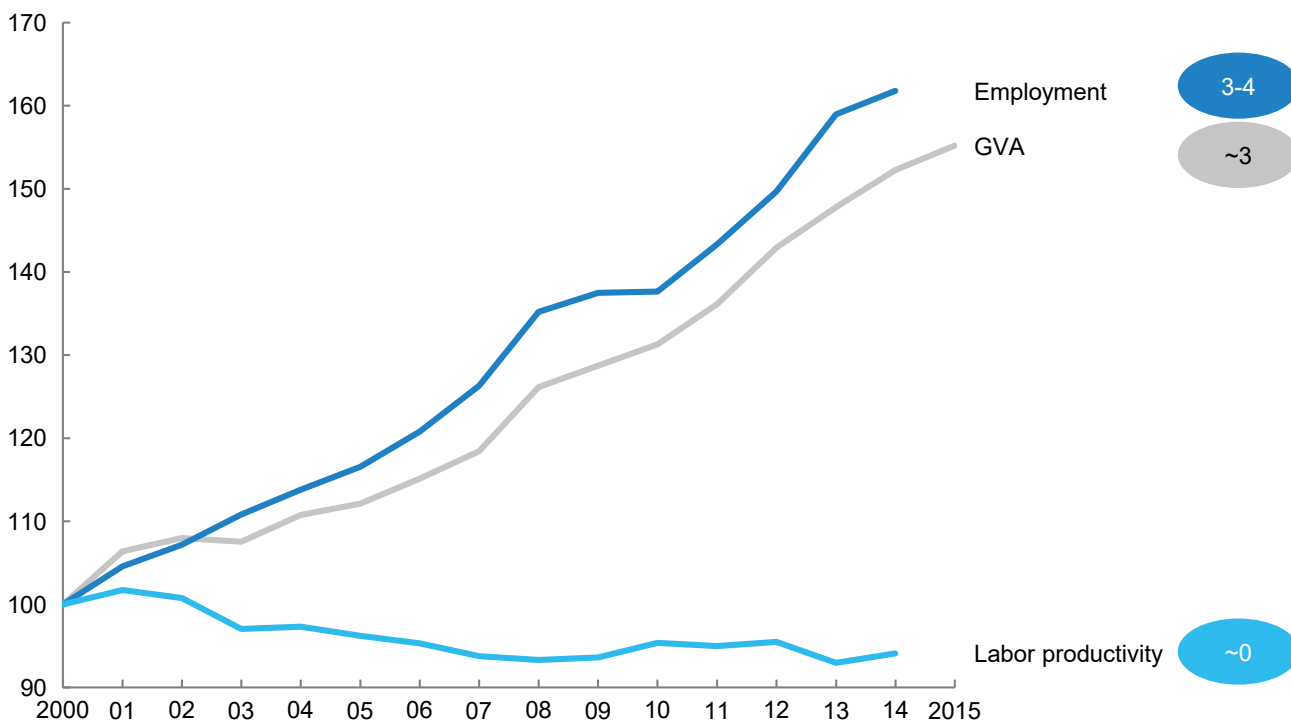SOURCE: Bundesamt für Statistik; McKinsey Global Institute analysis

[61]   *Digital Europe: Pushing the frontier, capturing the benefits*, McKinsey Global Institute, June 2016; and *Government productivity: Unlocking the $3.5 trillion opportunity*, McKinsey Center for Government, April 2017.

Exhibit 23

The Swiss public sector has above-average employment growth but below-average productivity growth.

Employment (FTE), real GVA in 2010 Swiss francs, productivity (real GVA per FTE)—public administration, education, healthcare, and social work
Index, year 2000 = 100

Average annual growth, 2000-15
Percent

Employment — 3-4

GVA — ~3

Labor productivity — ~0

NOTE: Numbers include Öffentliche Verwaltung, Erziehung und Unterricht and Gesundheits und Sozialwesen (public administration, education and health, and social work).

SOURCE: Bundesamt für Statistik; McKinsey Global Institute analysis

Global trends in digitization, automation, and AI in the public sector

Digital technologies and automation could potentially transform the sector:

- **Public administration.** Across Europe and around the world, digitization is being used to improve the speed and effectiveness of governmental, administrative, and support services for citizens to facilitate interactions among various levels of government and improve policy makers' decision making. The cost savings and quality upsides appear to be considerable. MGI research looked at the impact of big data analytics in US government services and found that they could deliver productivity gains of as much as $ 95 billion a year, and potentially as much as $ 460 billion in savings in the period to 2020.[62] Digital ID, which can be used to purchase goods online and to authenticate processes such as opening a bank account or buying a mobile phone contract (thereby enabling digitization in the private sector, too) is already used in many countries. Norway is digitizing its entire sick-leave-benefit system, and Denmark is digitizing the process for releasing prisoners, coordinating much more easily with social services. Tax and many other forms are now routinely filed online.[63]

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[62] *Game changers: Five opportunities for US growth and renewal*, McKinsey Global Institute, July 2013.

[63] For more, see *Digital by default: A guide to transforming government*, McKinsey Center for Government, November 2016; *Government productivity: Unlocking the $3.5 trillion opportunity*, McKinsey Center for Government, April 2017; and *Government 4.0 – the public sector in the digital age*, McKinsey & Company Public Services Practice, March 2018.

- **Education.** Overall, the scope for digitization in education, which relies on personal interaction between teachers and students, is lower than in other parts of the sector. However, digital is beginning to make considerable inroads in education. The online courses that are proliferating around the world constitute just one form of digital disruption in this area. Consider that China, for instance, now has 170 million monthly users of online education platforms in the case of children's education, 95 million for foreign language learning, and 45 million for professional education.[64] Innovations being discussed include personalized and adaptive learning with predictive analytics, new competency- and outcome-based delivery and funding models, and global digital degrees.[65]

- **Healthcare.** Digitization and automation in healthcare will not drive job losses but rather increase efficiency and working practices as demand for healthcare steadily grows.[66] Governments around the world are under fiscal pressure as spending on healthcare rises, and this is a strong incentive to digitize health where effective. For patients, digital technologies give them easier access to affordable high-quality healthcare. AI-enabled solutions can help inform them about, and involve them directly in, their diagnosis and treatment, and enable far more preventative care and self-management. For healthcare providers, digital technologies offer lower-cost standardized treatments enabled by big data, as well as new ways to detect illnesses and deploy personalized medical care. Telemedicine—the use of telecommunication and IT to provide clinical care from a distance—is increasing in importance, with the potential not only to open up access to healthcare for more people but also cut costs.[67] The prevalence of telemedicine is likely to increase as technologies like virtual reality improve further. AI is increasingly being used to help analyze patient data and make initial evaluations of patients' health, and can therefore reduce the workload for healthcare professionals in maintaining patient databases. AI can also support other technologies that are emerging by, for instance, evaluating data collected from wearables (on hormone levels, for instance, as Swiss start-up Ava does) to detect illnesses and deploy personalized medical care. AI-enabled digital solutions can help providers pursue more timely and effective diagnoses. For instance, AI-based image recognition and machine learning provides far more detail than MRI or X-ray images that require interpretation by the human eye. Pharmaceutical and medical-technology companies can greatly improve the way they interact with patients using digital means. Digital devices and apps can reveal far more information on how products are performing—in real time—and data analytics can help companies improve the efficiency of R&D.

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[64] *China online education market overview for Q1 2017*, China Internet Watch, May 16, 2017; and *Digital China: Powering the economy to global competitiveness*, McKinsey Global Institute, December 2017.

[65] For more, see Jan Peter aus dem Moore and Stefano Martinotti, *Enabling seamless lifelong learning journeys—the next frontier of digital education*, McKinsey & Company, December 2016.

[66] For further discussion of the role of digital in healthcare, see Gerardo Aue, Stefan Biesdorf, and Nicolaus Henke, *How healthcare systems can become digital-health leaders*, McKinsey & Company, January 2016; Venkat Atluri, Jenny Cordina, Paul Mango, Satya Rao, and Sri Velamoor, *How tech-enabled consumers are reordering the healthcare landscape*, McKinsey & Company Healthcare Systems and Services Practice, 2016; Penny Dash (MD), Florian Schaudel, Boris Körs, Florian Niedermann, and Tobias Schneider (MD), *Why digital is now crucial for private health insurers in Europe*, McKinsey & Company Healthcare Systems and Services Practice, 2018.

[67] In Switzerland (unlike in Germany where telemedicine is banned), the system is already quite well established.

28TH

ranking for Switzerland on 2016 UN e-government survey

5-15%

net job gains expected in healthcare

Switzerland has more scope to digitize public administration and healthcare

Switzerland is already relatively advanced in developing e-government, ranking 28th in the world on this metric in the UN's e-government survey in 2016.[68] We should note, however, that this ranking is lower than countries such as Singapore, Sweden, and the United Kingdom.

Switzerland has plans to progress further. For instance, from the end of 2019, all residents will be able to register and deregister electronically when moving residence. However, Switzerland can push the development of e-government further. For instance, the government of the United Kingdom's online one-stop shop at www.gov.uk is widely regarded as one of the most accessible digital government services.[69] The efficiency of this online portal leads to a reduced tax burden and frees up resources in the workforce to develop their potential in the private sector. The UK government has adopted a "digital by default" standard in 2011, which brought 800 government services online and was able to reduce government service costs by up to $2.3 billion annually.[70] Swiss politicians have called for the further digitization of public services. Ruedi Noser, a member of the upper chamber of the Swiss parliament, said that this could reduce the number of employees by 20 to 30 percent.[71]

Digital, automation, and AI technologies could make a significant contribution to raising the efficiency of Swiss healthcare, a major sector. OECD statistics show that Switzerland had the second-highest spending on healthcare as a share of GDP in the world at 12.4 percent in 2016; only in the United States was the GDP share of healthcare spending higher. Per capita spending among countries achieving a healthy average life expectancy of above 72 years varies by a factor of three, and one of the key reasons for this huge variation is health system management and policy and its impact on productivity and cost.[72]

There might be significant displacement of jobs in public administration, but large net gains can be predicted in employment in healthcare

There is a very significant opportunity to digitize and automate in the public sector. In public administration, the driver of adoption will be a bid for efficiency and improved services for citizens, and we expect net job reductions of 10 to 15 percent. However, in healthcare and education, the focus is likely to be on raising quality and freeing up resources to support further growth. We expect that growth in jobs will outweigh displacement in healthcare, leading to net job gains of 5 to 15 percent. We anticipate that employment in education will remain stable.

The largest share of Switzerland's overall automation potential is in public administration and support services such as tax collection. Here, our analysis suggests automation potential (not jobs that will be lost) of 30 to 35 percent, only minimally offset by possible job gains of 0 to 5 percent. In the public sector overall, however, job losses in administrative roles may be more than compensated for by gains in employment in healthcare and education (Exhibit 24).[73] We anticipate that only a small share of jobs in health and education will be automated because they rely on human interaction. Moreover, we expect that the share of care workers will rise, especially for the elderly as the Swiss population ages. Overall, there could be net gains of 10 to 15 percent in healthcare and 0 to 5 percent in education.

[68] United Nations e-government survey 2016, United Nations, 2016.

[69] Stephen Foreshew-Cain, *How digital and technology transformation saved £1.7bn last year*, UK Government Digital Service, October 23, 2015.

[70] *Driving German competitiveness in the digital future*, McKinsey Global Institute in collaboration with McKinsey & Company Germany, July 2017.

[71] Erich Ashwanden, "Die Schweiz braucht eine 'Ms. Digital' oder einen 'Mr. Digital' (Switzerland needs a Ms. Digital or a Mr. Digital)," *Neue Zürcher Zeitung*, November 21, 2017.

[72] *Government productivity: Unlocking the $3.5 trillion opportunity*, McKinsey Center for Government, April 2017.

[73] The Swiss Health Observatory projects a similar need for nurses (and other health workers except for doctors) for 2030 — 65,000 additional individuals. See Clémence Merçay, Laila Burla, Marcel Widmer, *Gesundheitspersonal in der Schweiz, Bestandesaufnahme und Prognosen bis 2030 (Healthcare personnel in Switzerland)*, Obsan Bericht 71, 2016.
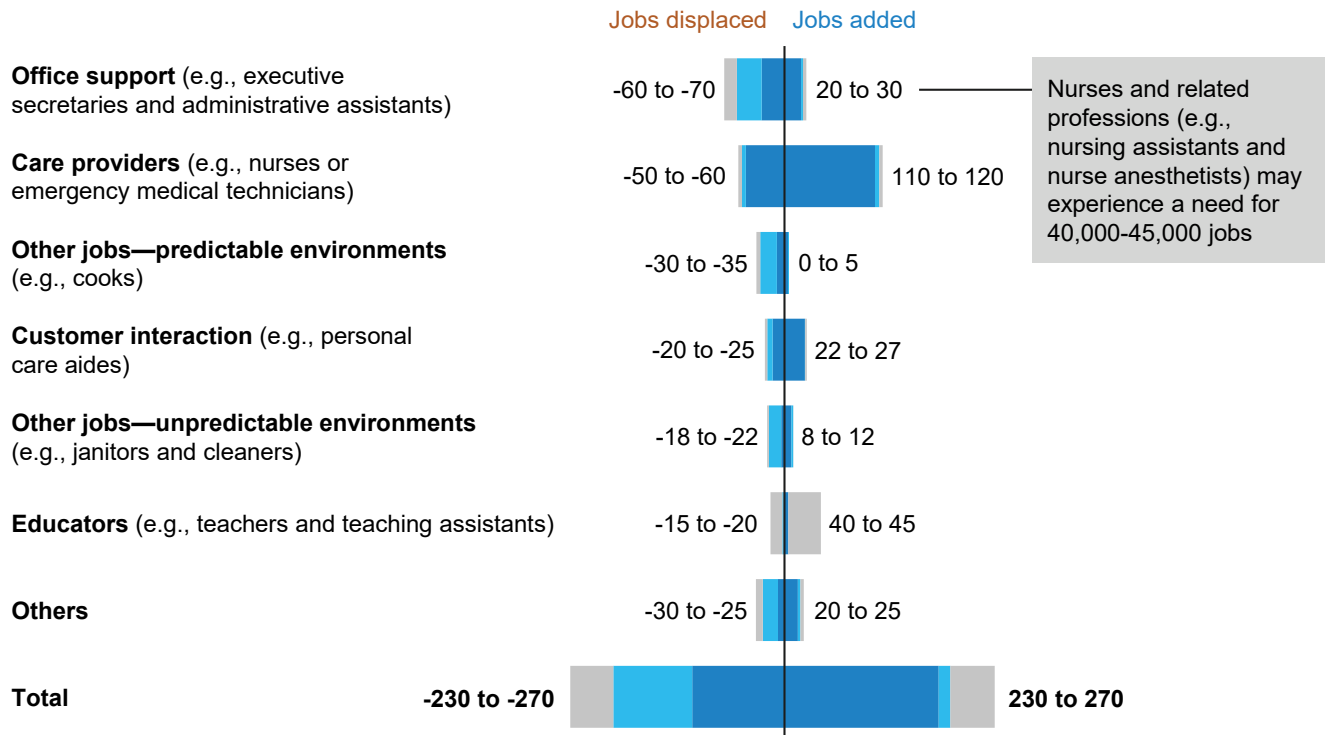
Exhibit 24

By 2030, there could be fewer office workers in the public sector, but more care workers.

Change in number of people employed in the public sector
By occupation category, employees, thousands

■ Healthcare (incl. private institutions)

■ Administrative, support, and government

■ Educational services (incl. private institutions)

Jobs displaced   Jobs added

Office support (e.g., executive secretaries and administrative assistants)   -60 to -70   20 to 30

Care providers (e.g., nurses or emergency medical technicians)   -50 to -60   110 to 120

Other jobs—predictable environments (e.g., cooks)   -30 to -35   0 to 5

Customer interaction (e.g., personal care aides)   -20 to -25   22 to 27

Other jobs—unpredictable environments (e.g., janitors and cleaners)   -18 to -22   8 to 12

Educators (e.g., teachers and teaching assistants)   -15 to -20   40 to 45

Others   -30 to -25   20 to 25

Total   -230 to -270   230 to 270

Nurses and related professions (e.g., nursing assistants and nurse anesthetists) may experience a need for 40,000-45,000 jobs

SOURCE: McKinsey Global Institute Jobs Lost, Jobs Gained Model; McKinsey Global Institute analysis

FINANCE: SWITZERLAND LAGS BEHIND OTHER ADVANCED ECONOMIES IN SHIFTING TO FULLY DIGITIZED BUSINESS MODELS

The financial sector contributes 10 percent of Switzerland's GDP—a higher share than in neighboring countries including the United Kingdom.[74] Over the past decade, a period that has been particularly volatile in terms of gross value added and productivity, the financial sector has posted 1 percent annual growth in employment, on average (Exhibit 25).[75]

The Swiss financial sector has strong foundations thanks to its business-friendly legislation, stable environment, and a currency that is perceived as a safe haven. It has leading companies and a strong global reputation. Some 25 percent of global cross-border assets managed worldwide are managed in Switzerland.[76] Around 48 percent of assets under management in Switzerland come from abroad.[77] The Swiss cities of Zurich and Geneva are ranked 11th and 20th, respectively, on the Global Financial Centers Index 2017.[78]

[74] *Switzerland as a location for financial services*, Swiss State Secretariat for International Financial Matters SIF, 2016.

[75] Some of the employment growth may come from insourcing strategies that some players have been pursuing recently.

[76] Ibid.

[77] *Banking Barometer 2017: Stability despite unfavourable environment*, Swiss Bankers Association, August 31, 2017.

[78] *Key figures on the Swiss Financial Center*, Swiss Banking Association (www.swissbanking.org/en/financial-centre/key-figures/the-swiss-financial-centre).
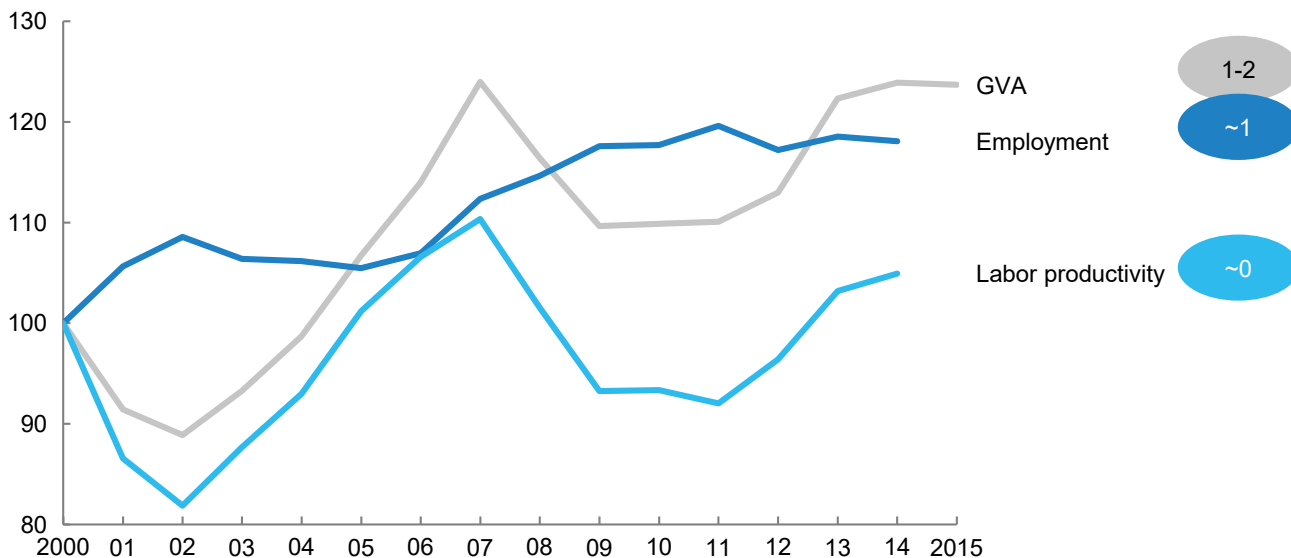
Exhibit 25

Although volatility was high, Switzerland's financial sector has achieved net growth in employment over the past 15 years.

Employment (FTE), real GVA in 2010 Swiss francs, productivity (real GVA per FTE)— finance and insurance
Index, year 2000 = 100

Average annual growth, 2000-15
Percent

SOURCE: Bundesamt für Statistik; McKinsey Global Institute analysis

However, there have been mounting pressures on the sector in recent years. Bank confidentiality and tax legislation have been under increasing international scrutiny, and the banking and insurance sector has faced challenges such as low interest rates, stricter regulation, the appreciation of the Swiss Franc, as well as—although happening more slowly than in other countries—increasing competition from start-ups, and changing consumer preferences. In anticipation of these challenges and to stay competitive, the financial sector needs to transform its business and operating model. Digital technologies and automation are a major part of the answer.[79]

Global trends in digitization, automation, and AI in finance: End-to-end digitization is a cost-saving opportunity, but there are also worries about lower returns

Banks that do not embrace digitization and automation will find themselves at risk. According to McKinsey, if retail and corporate customers switch their banking to digital companies at the same rate as people have embraced digital technologies in the past, the global industry's return on equity could fall to only 5.2 percent by 2025. This provides strong incentives to either delay this development, or digitize aggressively and lower cost. If most of the industry were to meet the challenge by digitizing their operations on a far broader front, McKinsey finds that banks could add about $ 350 billion of value and efficiency globally.[80]

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[79] For further discussion, see, for instance, Pooneh Baghai, Somesh Khanna, Eric Lamarre, Asheet Mehta, and Mateen Poonawalla, *Banks and the digital flywheel: An engine for ongoing value capture*, McKinsey & Company, July 2018; Federico Berruti, Emily Ross, and Allen Weinberg, *The transformative power of automation in banking*, McKinsey & Company, November 2017; *The new dynamics of financial globalization*, McKinsey Global Institute, August 2017; and *Notes from the AI frontier: Applications and value of deep learning*, McKinsey Global Institute, April 2018.

[80] Miklós Dietz, Matthieu Lemerle, Asheet Mehta, Joydeep Sengupta, and Nicole Zhou, *Remaking the bank for an ecosystem world*, McKinsey & Company Financial Services Practice, October 2017.

In their quest to cope with pressure on profits, financial institutions have been looking at a number of forms of automation and digitization as a way to cut costs and deliver this uplift. Many banks are digitizing branch networks, call centers, and the processing of client requests in response to customer demand for services available at any time—and on any device; and many are also striving to improve their data management and risk analytics.[81] Smart machines, cognitive agents, and AI have the potential to achieve huge efficiencies. For instance, one digitized valuation process reduced the cycle time by four-plus days, and automated 90 percent of the manual tasks. McKinsey has found that using advanced robotics to calculate the exposure of trade positions could cut the hours needed to perform this analysis from 3,000 hours to only 160.[82] Some financial institutions are also rethinking their overall IT platform strategy, either by replatforming or consolidating more markets/segments onto a single global platform. However, the outcome of these radical "experiments" will only become clear in the long term.

The shift in Switzerland has been slow thus far, but some momentum is emerging

The financial sector in Switzerland has lagged behind key international competitors on digital adoption and changing business models, and no Swiss bank has undertaken a bold digital transformation. As is the case globally, there are incentives for the industry to delay digital adoption, and consumer preferences change slowly in this sector where security is valued and price transparency is low. For example, adoption of online banking in Switzerland is at 66 percent.[83] This compares with around 90 percent in Nordic countries.[84] Moreover, barriers to entry, such as extensive regulation, shield the sector from disruptive competitors.

In some respects, Switzerland is more cautious than EU countries on the stance on innovation of its regulators and central bank. For instance, the EU is implementing the PSD2 directive to open up financial services to new kinds of business models, and has forced lower roaming charges to accelerate mobile usage; Switzerland has shied away from these approaches.[85]

Nevertheless, change is happening. Most major financial institutions have embarked on at least the digital transformation of their internal processes, which is gradually starting to result in lower cost levels.[86] UBS is currently building a digital factory to digitize its various services across the entire process and value-added chain. Credit Suisse is putting in place an investment fund to enable financial technology companies (fintechs) to use externally developed technology.[87]

Fintech companies are emerging. "Crypto Valley" in Zug has connections to international centers of blockchain innovation in London, New York, Silicon Valley, and Singapore.[88] The city has already attracted dozens of leading cryptographic companies and organizations and is now home to almost 200 blockchain companies—a significant cluster but, we should note, not as extensive as in other cities such as London.[89]

Wealth management players, too, are embracing digital. Swissquote has established itself as Switzerland's largest online investment portal with a business model that was designed to be fully digital from the outset. It focuses on offering online brokerage and other related

60%

adoption of online banking in Switzerland vs. 90% in Nordic countries

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81 Philipp Härle, Andras Havas, and Hamid Samandari, "The future of bank risk management," *McKinsey on Risk*, Number 1, 2016.

82 *The new dynamics of financial globalization*, McKinsey Global Institute, August 2017.

83 *Elektronische Zahlungen (E-Banking), internationaler Vergleich, 2005-2017*, Bundesamt für Statistik.

84 *Europe's digital progress report 2017: Use internet and ePrivacy*, Eurostat, April 27, 2017.

85 *PDD2: A revolution in the EU, and a potential headache for Switzerland*, SwissBankingDE, March 29, 2017.

86 The global banking cost-income ratio fell from 58 percent in 2011 to 54 percent in 2016. See *The current status and future of banking: Global banking annual report 2017*, McKinsey & Company, November 2017.

87 *Credit Suisse wird zum Investitions-Schwergewicht für Fintechs (Credit Suisse is the investment heavyweight for fintechs)*, finews.ch, March 14, 2018.

88 Crypto Valley website.

89 Ralph Atkins, "Swiss authorities tread wary path through 'Crypto Valley,'" *Financial Times*, March 20, 2018.

services such as foreign-exchange trading, cryptocurrencies, robo-advisory services, theme investing, and white-label offerings. By 2017, its client assets had reached CHF 24 billion, and it employed approximately 600 people.[90] While this is notable success, it also only represents roughly 0.3 to 0.4 percent of assets under management of the Swiss banking industry.[91] Looking abroad, Charles Schwab, which has had a strong focus on online wealth-management services, has more than 100 times as many assets under management.

In terms of digitization, insurers have lagged behind others in the financial industry, but this is now changing as players react to technological innovations and new entrants that are threatening to disrupt established business models. There are interesting digital experiments both in property and casualty, as well as in health insurance, for instance via direct-to-consumer applications. Products are also changing. For example, autonomous vehicles are altering the nature of auto insurance and prices are determined in different ways—by, for example, leveraging customer data. Services can be managed online and via automated interfaces, and new automated claims processes can even independently detect damage to objects.[92] And as a wealth of data becomes available in the industrial sector from the emergence of Industry 4.0, insurers can improve risk assessment and management practices.

Net employment decline likely in the Swiss financial sector

In our midpoint scenario, automation could have an impact on 30 to 40 percent of all hours worked in the financial sector in Switzerland. Applied to the financial sector workforce as it stood in 2016, this would translate into up to 100,000 employees (out of a total of 249,000) (Exhibit 26).

Exhibit 26

By 2030, a significant number of customer-facing and back-office tasks in the financial sector could be displaced.

Change in number of people employed
By occupation category, employees, thousands
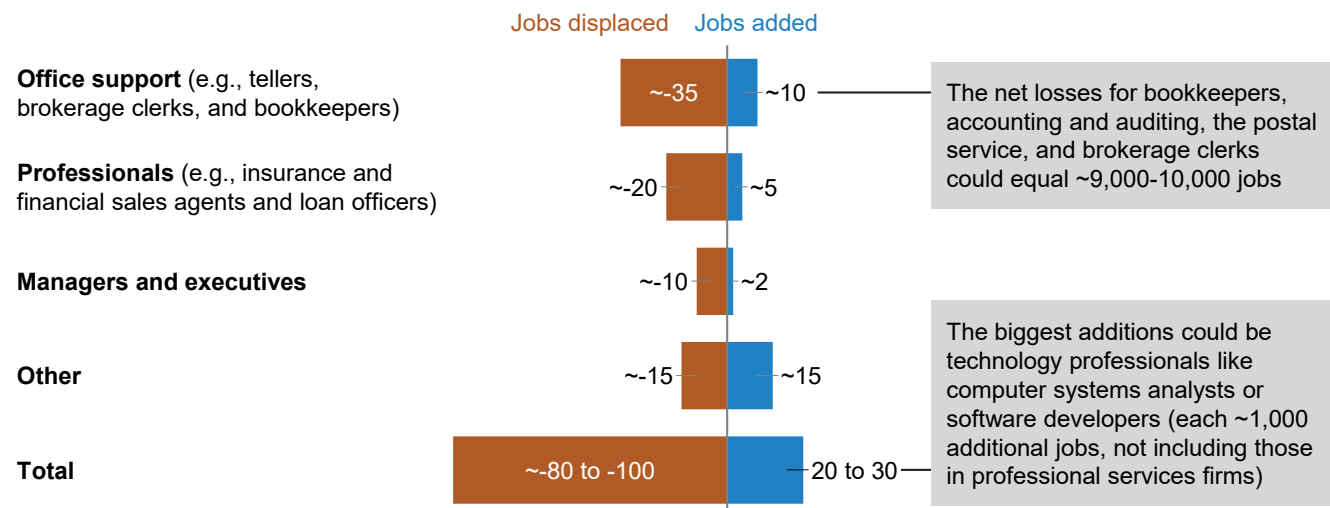
SOURCE: McKinsey Global Institute analysis

90   Swissquote investor presentation, November 2017 (https://en.swissquote.eu/sites/swissquote.com/files/2017_annual_report.pdf).

91   Banks in Switzerland managed total assets of CHF 6,650.8 billion at the end of 2016, according to the Banking Barometer 2017. See *Banking barometer 2017: Economic trends in the Swiss banking industry*, SwissBanking, August 2017.

92   Tanguy Catlin, Somesh Khanna, Johannes-Tobias Lorenz, and Sandra Sancier-Sultan, *Making digital strategy a reality in insurance*, Digital McKinsey, September 2016.

Employment in the sector is mixed. About half the hours worked are highly skilled and interactive—for example, occupations like investment banking and private banking advisory services and corporate insurance and underwriting do not lend themselves easily to automation. However, the sector also employs many people in jobs of a more repetitive nature that could be automated to a large extent. Examples include simple customer service requests, information collecting and processing, and compliance checks. Data collection and processing make up 17 and 27 percent of tasks, respectively.

On the other hand, automation and AI can also lead to job gains in financial services. Increasing incomes, demand, and prosperity in the economy can increase demand for loans, wealth management, and other financial services provided by banks, as well as for the increased protection for businesses and individuals provided by insurers. Swiss research organization BAK Economics, for example, expects Swiss financial services to post above-average growth in the long term powered by the banking industry with expected growth in productivity, the economy, and assets. BAK also anticipates that insurers will profit from solid capitalization and that reinsurers will grow with emerging markets.[93] Furthermore, some financial institutions are trying to redefine themselves as technology companies. For instance, Goldman Sachs CEO Lloyd Blankfein has declared that engineering underpins the firm's growth initiatives, citing several technology-focused acquisitions and partnerships, as well as enhancing service of customers' needs through engineering.[94] If Swiss financial institutions start moving in this direction, that could fundamentally change the nature and scale of employment they can offer.

We expect opportunities for job gains of about 20,000 to 30,000 by 2030. This would not be sufficient to compensate for declining employment levels in the sector but offers a significant upside that could be optimized if Swiss banking and insurance retains and improves its global competitiveness.

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[93] *The economic significance of the Swiss financial sector*, BAK Basel, 2015.

[94] Lloyd C. Blankfein, *Goldman Sachs presentation to Credit Suisse Financial Services Conference*, February 13, 2018 (https://www.goldmansachs.com/investor-relations/presentations/2018-credit-suisse-deck.pdf).

Man with architectural model and VR glasses
© Westend61/Getty Images

4. TWO IMPERATIVES: DIGITAL AND AI-BASED TRANSFORMATION, AND SKILLS DEVELOPMENT

As Switzerland prepares for dynamic changes to its labor markets in the digital and automation ages, it faces two imperatives. First, it needs to consider accelerating the digitization of the economy in order to remain competitive and boost growth.[95] Second, it needs to develop the appropriate skills that labor markets will require in the future, ensuring that it provides opportunities for training and reskilling, adjusting its educational system, and continuing to attract talent from outside its borders. Failing to digitize fast enough could dampen competitiveness and lead to slow growth in well-paying jobs; failing to reskill fast enough could mean that new jobs cannot be filled. The country may also want to examine whether social provision needs to be adapted in order to handle the transition to digitization and automation, and what would be needed to sustain inclusive growth. We note, however, that Switzerland currently seems better placed than many other advanced economies (see Box 3, "Ensuring inclusive growth and adapting social provision for the digital and automation age").

1ST
place for Switzerland on World Economic Forum's global competitiveness index

CHF 4-7B
invested in digital by banks in past three years

IMPERATIVE 1: UNDERTAKE DIGITAL TRANSFORMATIONS

Switzerland is well positioned to become a digital economy despite the fact that, as we have noted, key sectors lag behind their counterparts in other advanced economies on digitization. Nevertheless, companies need to undertake broader digital transformations to capture the productivity potential of digital, automation, and AI technologies and gain a competitive edge. For their part, policy makers may need to consider what regulation and competitive framework can enable companies to undertake a more decisive transition.

Switzerland is well positioned to digitize with many globally leading companies— but has hardly any digital leaders

The Swiss economy is in a good position to master its digital transformation. The country is ranked first on the World Economic Forum's global competitiveness index.[96] It ranks seventh on networked readiness.[97] It is home to 14 Fortune 500 companies, and there is a general perception that Switzerland has a good head start in AI.[98]

Yet Switzerland has scope to further step up digitization and the diffusion of automation across sectors. Take retail as an example: Switzerland currently lags behind other European countries in its share of online sales, which stand at 7.5 percent of all retail trade compared with 17.8 percent in the United Kingdom and 15.1 percent in Germany in 2017.[99] In the public sector, Switzerland ranks 28th in the world for its development of e-government according to the United Nations, behind countries such as Singapore, Sweden, and the United Kingdom. The Swiss banking industry is also significantly behind its counterparts in other leading industrial nations in terms of digitization. According to McKinsey Switzerland estimates, Swiss banks have invested between CHF 4 billion and CHF 7 billion in digital projects over the past three years, but have still failed to deliver on expectations.[100]

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[95] Due to their high wages, Swiss sectors with lower profit margins have had a strong incentive to digitize in recent years. However, Switzerland also has sectors with comparably high profit margins, such as pharmaceuticals and finance, and these have not had a strong incentive to digitize and automate.

[96] *The global competitiveness report 2017-2018*, World Economic Forum, September 26, 2017.

[97] Ibid.

[98] *How Switzerland is becoming a hub for artificial intelligence*, PAC blog, July 13, 2018; and Andrew Cave, "How Switzerland became the Silicon Valley of robotics," *Forbes*, September 26, 2017.

[99] Online share of retail trade in countries 2017, Statista.

[100] Felix Wenger and Idiko Ring, "Flaue Digitalisierung im Schweizer Bankensektor," ("Sluggish digitization in the Swiss banking sector"), *Neue Zürcher Zeitung*, June 19, 2018.

Switzerland hosts many globally leading companies, but few digital leaders. The list of unicorns—tech start-ups with $ 1 billion valuations—based in Switzerland is short: Avaloq and MindMaze.[101] In comparison, Sweden, for instance, has produced at least four unicorns (iZettle, Klarna, Skype, and Spotify). Many leading incumbents in Switzerland have digitization programs to reap efficiencies in the back end, but shy away from wholesale disruption of their business model. This is understandable in the medium term, but risky in the long run as global attackers can gain a head start that is difficult to catch up with.

Switzerland has a number of core advantages to help it drive the adoption of digitization and automation. It boasts one of the largest clusters of digital and AI capabilities, including the researchers at the Federal Institutes of Technology, as well as talent attracted by companies such as Google, Disney Research, and Microsoft. It has been an early adopter of digital solutions in the past, for example, with the first online grocery store worldwide. Last, but not least, given the relatively low cost of capital and high cost of labor, Switzerland is one of the places likely to profit first from digitization and automation.

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[101] Werner Grundleehner, "Milliardenschwere Börsenkandidaten sind 2018 am Start," ("Billions of IPO candidates at the start in 2018"), *Neue Zürcher Zeitung*, January 16, 2018.

Box 3: Ensuring inclusive growth and adapting social provision for the digital and automation age

The huge potential of automation in advanced economies raises concerns about future income equality, social cohesion, welfare, and economic growth. There are scenarios in which the labor share of income may suffer as intangible capital and digital technology is increasingly substituted for labor at rising rates of return, and income progression among lower-skilled workers and also the middle class might stagnate or decline. While Europe has fared much better in this regard, particularly in comparison with the United States, the share of disposable income going to the top decile of earners has increased from 33 percent in 1985 to 39 percent in 2014. Corporate profits, dividends, and share buy-backs have been on the rise. According to the U.S. Bureau of Labor Statistics, from 1998 to 2016, the labor share of income declined by 4.8 percentage points, and real wage growth has started to diverge from GDP growth for a multitude of reasons. As a result, growth may suffer. The propensity to consume of top decile income households is less than half that of those below the median.[1] The growth uplift from digital technologies, automation, and AI can only materialize if the benefits loop back into the economy via higher wages and consumption, rising investment, or strength in exports.

Many countries are discussing ways to mitigate such risks, with potential approaches including adjustments to fiscal policy such as reducing taxes (or income tax credits) for lower-income workers; redistribution; and wage support such as minimum or living wages. There is some support for a "robot tax" as Bill Gates has termed it—increasing taxes on capital gains as a way to redistribute some of the gains from technological progress or pay for a large expansion in training. Finland is already piloting a universal basic income, which is also being tested in Ontario, Canada.[2] We should note that Swiss voters overwhelmingly rejected a basic income plan in a referendum in mid-2016.[3]

Switzerland may be able to manage the transition better than other countries because of high levels of automation already undertaken, a high-quality education system, an effective immigration policy to bring the economy the skills it needs, and the competitiveness of its export sectors. Thus far, Switzerland has not experienced a declining labor share to any major extent over the past 30 years, according to one study.[4] Eurostat data suggest that income distribution has not materially changed over the past decade. Looking ahead, companies will need to reinvest earnings at a healthy rate into digital transformation and reskilling to sustain healthy levels of wages and aggregate demand.

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[1] *Solving the productivity puzzle: The role of demand and the promise of digitization*, McKinsey Global Institute, February 2018.

[2] The universal basic income aims to guarantee citizens a basic standard of living without the complexity of managing interconnected welfare systems. For further discussion, see *Basic income as a policy option: Can it add up?*, OECD policy brief on the future of work, May 2017.

[3] *Switzerland's voters reject basic income plan*, BBC, June 5, 2016.

[4] *Die Lohnquote in der Schweiz bleibt konstant (The wage ratio in Switzerland remains constant)*, Schweizerischer Nationalfonds zur Förderung der Wissenschaftlichen Forschung, March 2014

3x

the pay-off for bold, large-scale digitization than medium digitization

Bold, large-scale digitization is needed, but comes with risks

To capture the full benefit of digital opportunities, companies not only need to undertake individual digitization and automation projects, but also embark on full digital transformations. As we have discussed, most jobs cannot be fully automated, and therefore raising the efficiency of certain tasks does not necessarily translate into more output per worker. Instead, businesses need to consider how to reinvent their business models, processes, organization, and infrastructure alongside automation. Such an effort is relevant not only for back-end and manufacturing processes but also in the design of interfaces with customers. For instance, a retail customer's ordering process will need to be as seamless as possible, with the front and back ends working together with no friction. Within this process, data can be used to focus better on customers' needs and improve the making of business decisions using digital- and analytics-based tools, including online marketing, personalization, churn prediction, and customer relationship management. Finally, new business models can be used as an effective way to increase companies' footprints and diversify sources of revenue.

There will be many challenges during digital transformations that may hold back the transition, including the costs incurred and the cannibalization of incumbent revenues. Incumbents saddled with complex legacy systems may need to invest in renewing their systems at the same time as facing new competition from more nimble attackers that can enter the market with the latest technology at relatively low cost. And in most digitized industries, a significant share of the surplus created tends to be passed on to consumers in the form of better services at lower prices, potentially deterring some players or entire sectors from digital transformations.

Yet the costs of failing to move rapidly into the digital and automation age could be even larger. Digitization has winner-takes-all dynamics with early—and bold and large-scale—movers pulling far ahead from those who choose to delay their response. The competitive threat is not only likely to come from digitally enabled start-ups but also from fellow incumbents. One study of digitization found that, on average, bold, large-scale responses pay off twice as much as semi-bold reactions and three times as much as medium reactions.[102] Digital front-runners often benefit from scale and network effects. Companies at the upper range of the adoption curve may become more profitable, while the negative effects of digital competition on a company's earnings growth are likely to be larger for the bottom three-quarters.[103]

Policy makers need to keep the pressure up and support transformations. Beyond a well-known set of digitization drivers that range from digital hard- and soft infrastructure to e-government and open data, they will also need to emphasize industry transformations and working against disincentives among incumbents that slow adoption. Approaches need to be considered that establish or sustain an environment of creative destruction with lower barriers to entry and higher transparency for consumers in which domestic and foreign new entrants and adopting incumbents alike can scale up and keep slow adopters on their toes.

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[102] Jacques Bughin and Nicolas van Zeebroeck, "The best response to digital disruption," *MIT Sloan Management Review*, April 6, 2017.

[103] New MGI research on the economic impact of AI has also examined three groups of companies. The first group is of front-runners, which comprises around 10 percent of all companies. They adopt a broad set of AI technologies and absorb the application of technologies across their own organizations over the next five to seven years. A simulation finds that these front-runners could potentially double their returns by 2030. A second group—about 20 to 30 percent of companies—is called followers. They are adopting AI, but more cautiously. And then there is the final and largest group of laggards—around two-thirds of all companies—that stand to lose substantial parts of cashflow compared with today. See *Notes from the AI frontier: Modelling the impact of AI on the world economy*, McKinsey Global Institute, September 2018.

Five core value levers need to be considered for digital transformation

Capturing long-term value from digital means changing the core of the business. Depending on the industry, effective digital transformation may include completely new business models and ways of providing value to customers, or the automation of large parts of an organization's operations. Regardless of the context, we find that there are five core value levers that should be considered in any digital strategy and transformation.

Digitizing the customer journey

Rather than thinking about how to digitize current customer processes, companies should consider digitizing the customer or user journey—fundamentally reinventing the customer's experience from the point at which the customer is thinking about what they want to buy, to receiving the goods or service, and having a continuous relationship with a company. Digitizing every interaction usually fundamentally changes how companies work and interact with customers. Consider buying a vehicle. It is today quite realistic to anticipate that the entire consumer journey takes places digitally, from searching for a vehicle to test driving it, paying for it, and obtaining aftersales support. Redesigning and then digitizing the entire customer journey has, in McKinsey's experience, proved to be far more effective than digitizing the processes involved in the existing customer journey.

The most important component of any customer journey redesign is putting the customer front and center, and involving them along the way by inviting their input and feedback. McKinsey's experience suggests that applying design methodologies and conducting a design "boot camp" can be effective. One approach that has proved successful has been zero-based redesign of the customer journey from scratch. Such a redesign is often supported by a design expert leading the process and usually involves customers providing feedback. The key is ensuring a focus on client needs.

Once the customer journey has been designed, it needs to be translated into new supporting processes and technology. This can happen within the existing organization and IT systems, or within separate units or systems that run in parallel to the existing ones. Once the new digitized customer journeys are implemented and fully adopted by customers, they often render several existing processes and systems obsolete. In one case, a large bank redesigned its process for opening an account (eliminating 15 steps in that process), put in place an instant identification system based on passports and face-recognition software, and introduced an entirely new online, mobile, and in-branch self-service offer. Self-service sales went from zero to more than one-third of total sales, conversion rates were 50 percent higher, and the process time was reduced from between two and six days to a mere ten minutes.[104]

Automating physical and knowledge tasks

Automation is not only about robots taking over physical tasks, but about how AI technologies are increasingly being able to perform "knowledge" tasks. In e-commerce, for instance, players use physical automation (robots in warehouses) and also gradually automate knowledge work by, for instance, using algorithms that alert customers to the items they may want to buy, or algorithms that set the selling price of items automatically. On the horizon could be a major breakthrough in which machines develop an understanding of natural language—recognizing communication between people. MGI has found that if computers were to attain median human performance in natural language, the technical potential in retail to automate labor would rise from today's 53 percent to 60 percent. In finance and insurance, this step change in automation could boost the automation potential from 43 to 66 percent.[105]

60%
technical potential to automate labor in retail if computers attain median human performance in natural language

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[104] Oliver Ehrlich, Harald Fanderl, and Christian Habrich, *Mastering the digital advantage in transforming customer experience*, McKinsey & Company, May 2017

[105] Michael Chui, James Manyika, and Mehdi Miremadi, "Where machines could replace humans—and where they can't (yet)," *McKinsey Quarterly*, July 2016.

Companies should therefore look for opportunities to automate in areas that have traditionally needed human judgment. For instance, they can consider using automated data management and algorithms in recruiting to raise efficiency. Improved pattern recognition enabled by machine learning along with detailed data on potential employees could improve the effectiveness of recruitment, enabling companies to precisely pinpoint the skills and personal characteristics that are likely to make a candidate successful at a job. AI may be able to spot candidates with less conventional profiles.

Optimizing decision making

The proliferation of data, data gathering, and the spread of advanced analytics are increasingly being used by companies to make more informed decisions. There is huge diversity in the data being generated. Behavioral, transactional, environmental, and geospatial data from the web, social media, industrial sensors, payment systems, cameras, wearable devices, and human entry are all providing the unprecedented opportunity to extract value from data in a way that was not possible even in the recent past.[106] Data and data analytics enable companies to understand consumers better, and therefore allocate resources more effectively, thus reducing costs. Data can enable far more accurate and timely forecasts that can optimize logistics and distribution. In retail, e-commerce companies are using AI to predict trends, optimize warehousing and logistics, set prices, and personalize promotions.[107]

The application of AI and other technologies can be broadly beneficial for society by helping tackle "moonshot" challenges such as improving diagnostics in cancer research or tackling challenges in climate science. For example, researchers at McMaster and Vanderbilt University have used computers to predict the most effective treatment for major depressive disorders and eventual outcomes of breast cancer patients—and done so more effectively than human beings.[108]

New ways of working

The digitization of the customer journey is, in McKinsey's experience, very difficult to implement with traditional ways of working. In a traditional approach (often referred to as a "waterfall"), the new journey is redesigned first and only subsequently are new processes developed and IT specifications derived from them. Every step happens only after the previous step is complete, and it can therefore take months or years for the customer to obtain the benefits (and months or even years until the company learns how customers react and can make further improvements). In short, the traditional approach is simply too slow or expensive for effective innovation.

An agile way of working is both an important lever for creating value and an enabler of digitization. By nature, digital innovation is fast-paced and changes frequently. Staying ahead requires an approach that allows for the rapid development and prioritization of ideas, testing with customers, and scale-up in cross-functional teams. This goes beyond IT: agile ways of working can create value in different parts of an organization. The months it takes to digitize using a traditional approach can be reduced substantially by breaking down the redesign into much smaller increments ("sprints") of a few weeks. In each iteration, the new solution is developed in small increments and tested with customers immediately. To enable rapid iterations, traditional functional isolation needs to be avoided and replaced with a multifunctional team comprising people from, for instance, IT, product management, and marketing, working in close collaboration.

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[106] *The age of analytics: Competing in a data-driven world*, McKinsey Global Institute, December 2016.

[107] See *Artificial intelligence: The next digital frontier?* McKinsey Global Institute, June 2017; and *Notes from the AI frontier: Insights from hundreds of use cases*, McKinsey Global Institute, April 2018.

[108] *What's now and next in analytics, AI, and automation*, McKinsey Global Institute, May 2017.

This "test and learn" approach enables companies to react much more quickly to customers' feedback, and therefore to progress or stop the development of a solution. In environments in which the perfect solution is not known upfront and needs to be developed with the customer, such an agile way of working is therefore much faster and much more efficient.

These agile ways of working and many of the principles on which they are based (including, for instance, the agile manifesto and "scrum") were first developed in the IT department.[109] However, they are applicable to other business functions and, depending on the context, also to entire companies. Companies such as ING and Spotify are two leaders in organizing their companies in an agile way.[110]

Reinventing the IT core

One of the most difficult challenges for organizations embarking on digital transformation is knowing what to do with legacy IT structures that are often inflexible and expensive. To keep pace with a fast-evolving digital world, companies must be able to improve business capabilities continually without fear of disrupting entire systems through a major revision to their IT architecture. This enables new capabilities to be implemented more quickly. This "two-speed architecture" allows for a different pace in areas that are more focused on stability compared with capability domains where flexibility and speed are more important.[111]

Companies need to build an infrastructure that is much more flexible and enables continuous adjustment to reflect evolving business needs—managing IT architecture as an "ongoing process" rather than defining a fixed "target state." A new model of enterprise architecture that McKinsey calls "perpetual evolution" emphasizes continual changes to and modular design of business capabilities as well as the technologies behind them.[112] This new approach differs significantly from traditional management of enterprise architecture. To give just one example: in the past, single heavyweight enterprise service buses made perfectly adequate IT integration layers that contained significant business logic and often turned into a monolith. However, as many companies today receive a significant share of their business from online channels, a slow integration layer that increases page loading time will also increase bounce rate, putting a significant revenue pool at risk. As technology components such as the integration architecture are becoming a differentiating element for the entire business, the technology platform has to be designed in a way that these technologies are as easy to replace as a business capability.

The organization's broader operating model also needs to be adjusted consistently with the new enterprise architecture approach. Fast-to-market IT capabilities may be significantly slowed down by cumbersome traditional governance characterized by yearly cycles and time-consuming committee reviews. The new approach may require a significant change in mindset among senior executives who have in the past tended to request "big bang" system changes. Perpetual evolution emphasizes continual monitoring and renewal instead, and this may require the introduction of new forms of reporting and communication.

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[109] See Santiago Comella-Dorda, Swati Lohiya, and Gerard Speksnijder, *An operating model for company-wide agile development*, McKinsey & Company, May 2016; Satty Bhens, Ling Lau, and Hugo Sarrazin, *The new tech talent you need to succeed in digital*, McKinsey & Company, September 2016; Chiara Brocchi, Brad Brown, Jorge Machado, and Mariano Neiman, *Using agile to accelerate your data transformation*, McKinsey & Company, December 2016.

[110] See "ING's agile transformation," *McKinsey Quarterly*, January 2017; and Wouter Aghina, Aaron De Smet, Gerald Lackey, Michael Lurie, and Monica Murarka, *The five trademarks of agile organizations*, McKinsey & Company, January 2018.

[111] Sven Blumberg, Oliver Bossert, and Jürgen Laartz, *Deploying a two-speed architecture at scale*, McKinsey & Company, 2016.

[112] Oliver Bossert and Jürgen Laartz, *Perpetual evolution—the management approach required for digital transformation*, McKinsey & Company, June 2017.

IMPERATIVE 2: CLOSING THE SKILLS GAP

While job gains are expected to at least partly compensate for job losses due to automation, the kind of jobs in demand—and the skills needed to perform them—are likely to change radically, as we have discussed (see Exhibit 27 for more detail on the skill shifts that we expect and Box 4, "Skill taxonomy and our approach to modeling skill shifts to 2030"). The implication is that Switzerland—like many other countries around the world—needs an education, training, and reskilling revolution on a grand scale.

In banking and insurance, for example, research shows that total time spent on technological skills, especially advanced IT skills and programming, technology design, engineering and maintenance, and scientific research and development, is expected to rise by 4 percentage points. In the healthcare sector, employees will increasingly require basic digital skills as well as advanced IT and programming skills. A report by the Swiss Federal Council confirms this trend.[113] For nurses, for example, the widespread use of electronic patient dossiers and online ordering of supplies make digital literacy a core skill. Service technicians need to be able to work with smartphone-based manuals and planning tools that are increasingly becoming standard practice in Switzerland.

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[113] *Auswirkungen der Digitalisierung auf Beschäftigung und Arbeitsbedingungen – Chancen und Risiken (Consequences of digitization on employment and working conditions – opportunities and risks)*, Schweizerische Eidgenossenschaft: Der Bundesrat, November 2017.

Box 4: Skill taxonomy and our approach to modeling skill shifts to 2030

Economists, other researchers, and organizational practice experts use different definitions when discussing workforce skills. In this research, we adopt a business-oriented definition including both intrinsic abilities (for example, motor skills and strength, creativity and empathy) and specific learned skills, such as advanced IT skills and programming. This enables us to build a comprehensive view of the changing nature of workforce skills and provide a sufficient level of detail to motivate concrete actions. This research makes use of three sources of insights:

- First, we define a taxonomy of 25 workforce skills and quantify the time spent using each skill per job at the global level. We group skills into five categories: physical and manual, basic cognitive, higher cognitive, social and emotional, and technological. We quantify the time workers spend on each of the 25 skills. While workers use multiple skills to perform a given task, for the purposes of our quantification we identified the predominant skill used. For example, in banking and insurance, we mapped "prepare business correspondence" and "prepare legal or investigatory documentation" to the skill "advanced literacy and writing," which is grouped in the category of higher cognitive skills.

- Second, we quantify how automation will shift the demand for workforce skills in 2030 in Switzerland by looking at the losses and gains in activities resulting from automation as outlined in the previous sections. We then added a further scenario in which we also assumed typical sector-specific nondigital productivity gains as well as rising needs of in-sector digital skills to reflect shifts of skills requirements within activities.[1]

- Third, we complement these quantitative findings with insights from interviews with chief human resources officers and other industry executives on the opportunities created by AI technologies as well as their strategies for future skill mismatches. We also drew on the industry and function expertise and client experience of McKinsey colleagues.

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[1] For the full methodology, see *Skill shift: automation and the future of the workforce*, McKinsey Global Institute, May 2018.
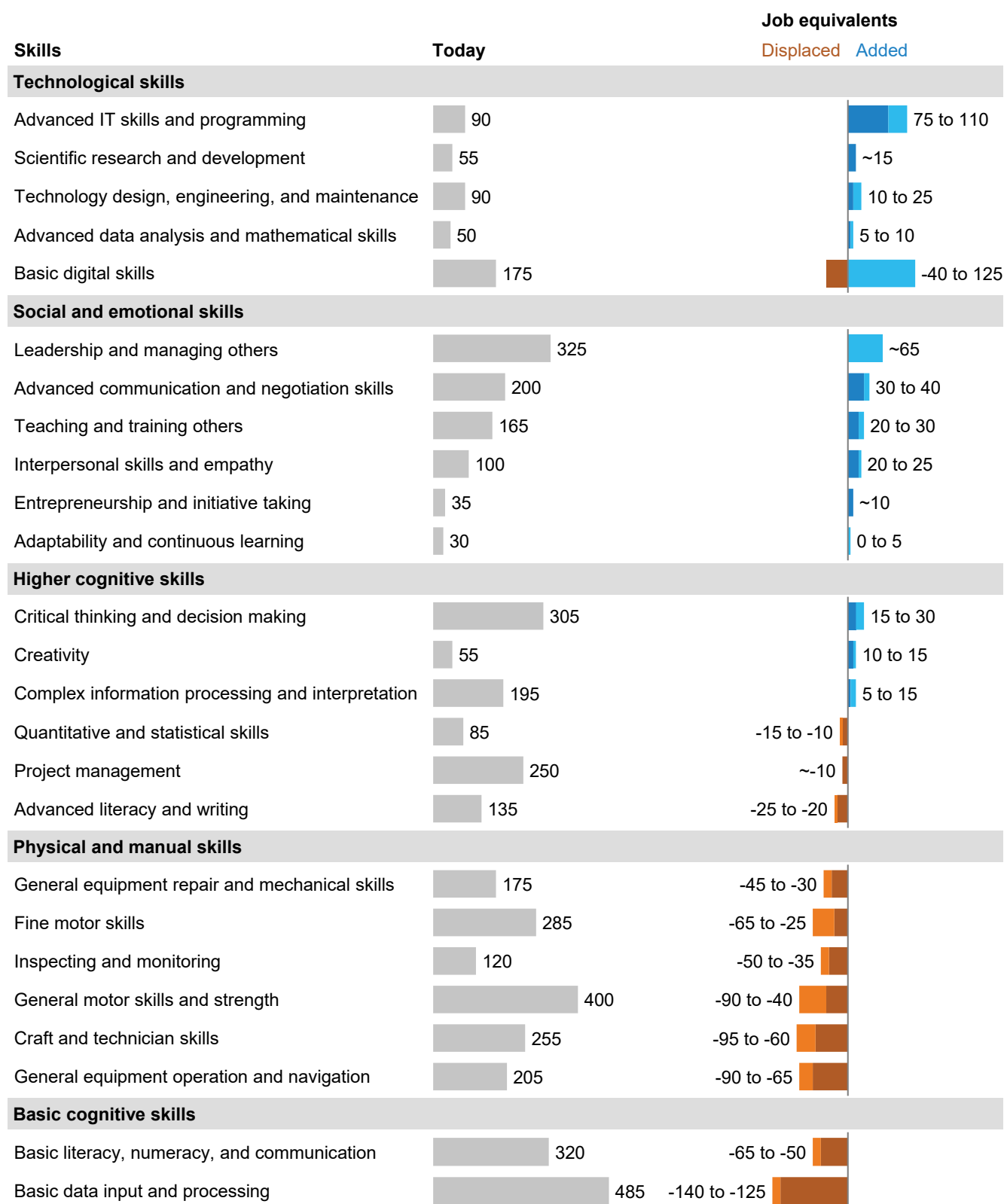
Exhibit 27

Detailed summary: demand is likely to rise for technological, social, and emotional skills, but decline for manual and basic cognitive skills.

Worktime allocated to skills needed
People employed equivalents, thousands, rounded

■ ■ Automation-related shift in activities only

■ ■ Further use of digital technologies within sectors, jobs, and activities

Skills	Today	Job equivalents Displaced / Added
Technological skills		
Advanced IT skills and programming	90	75 to 110
Scientific research and development	55	~15
Technology design, engineering, and maintenance	90	10 to 25
Advanced data analysis and mathematical skills	50	5 to 10
Basic digital skills	175	-40 to 125
Social and emotional skills		
Leadership and managing others	325	~65
Advanced communication and negotiation skills	200	30 to 40
Teaching and training others	165	20 to 30
Interpersonal skills and empathy	100	20 to 25
Entrepreneurship and initiative taking	35	~10
Adaptability and continuous learning	30	0 to 5
Higher cognitive skills		
Critical thinking and decision making	305	15 to 30
Creativity	55	10 to 15
Complex information processing and interpretation	195	5 to 15
Quantitative and statistical skills	85	-15 to -10
Project management	250	~-10
Advanced literacy and writing	135	-25 to -20
Physical and manual skills		
General equipment repair and mechanical skills	175	-45 to -30
Fine motor skills	285	-65 to -25
Inspecting and monitoring	120	-50 to -35
General motor skills and strength	400	-90 to -40
Craft and technician skills	255	-95 to -60
General equipment operation and navigation	205	-90 to -65
Basic cognitive skills		
Basic literacy, numeracy, and communication	320	-65 to -50
Basic data input and processing	485	-140 to -125

NOTE: Calculation based on evaluation of change in people employed in an occupation from *A future that works: Automation, employment, and productivity*, McKinsey Global Institute, January 2017.

SOURCE: McKinsey Global Institute analysis

Businesses are concerned about skills gaps. According to MGI's workforce skills executive survey, business leaders view a lack of talent and skill mismatches as barriers to reaping the benefits of automation, and a fundamental concern for their companies' organizational health and performance.[114] If they cannot source the talent they need to deploy the new technologies, and if they cannot upgrade the skills of their workers fast enough, they worry that this could hurt their financial performance, impede their growth, and lead to the departure of top-performing employees.

In Switzerland, the growth of the skills gap is predicted to be exacerbated by demographic change. Avenir Suisse predicts that, without immigration, the Swiss workforce will shrink by 9 percent until 2040. Combined with weak productivity growth, this further strengthens the need to boost efficiency through digitization and automation. However, realistically, this can only be achieved if today's skills gaps are closed.[115] For this to happen, there may need to be a step change in companies' approach to their workforce strategy and planning, together with a concerted effort by the private and social sectors to ensure that workers are equipped with the right skills for what is likely to be a significantly different employment landscape.

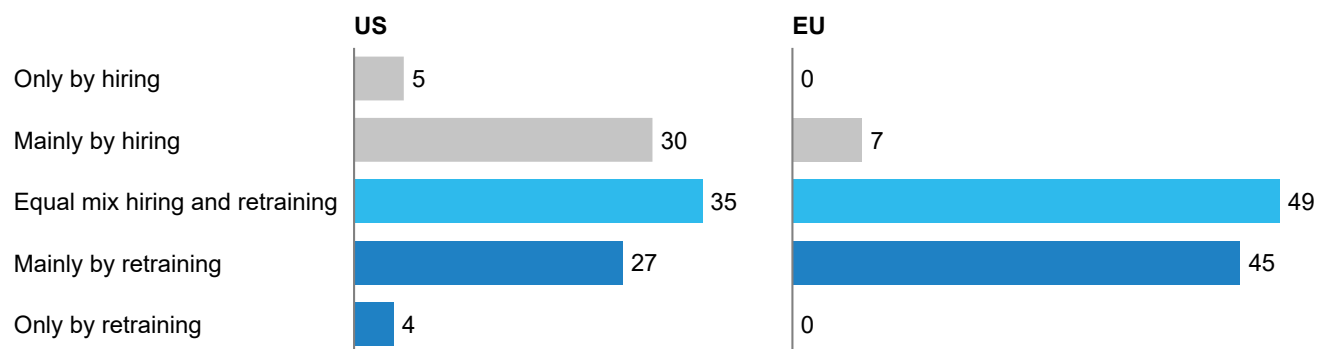### How companies are adapting their workforces to the automation era

European companies appear to be ahead of their global peers in willingness to train their workforce for the skill shifts required by automation and AI. A quarterly McKinsey survey of more than 1,500 executives conducted in November 2017 revealed that only one-third of US respondents expect to close skills gaps mainly or exclusively through training, but this view was taken by almost half of European respondents (Exhibit 28).[116] Interviews with Swiss executives undertaken as part of this research suggest that Swiss companies are stepping up their efforts. One example is AXA Switzerland that, as part of its digitization program, will initially train 1,000 employees—managers and experts—in agile working methods. The company's aim is to increase the proportion of agile work from currently 10 percent to up to one-third of employees in the medium term.[117]

Exhibit 28

Survey: more European than US companies say they intend to retrain existing workers as well as hire new ones.

"How can your organization best resolve its potential skills gaps related to automation and/or digitization over the next 5 years?"
Percentage of private-sector organizations with USD >100mn annual revenue that views skills gaps as a top-10 priority

	US	EU
Only by hiring	5	0
Mainly by hiring	30	7
Equal mix hiring and retraining	35	49
Mainly by retraining	27	45
Only by retraining	4	0

SOURCE: McKinsey & Company Quarterly Panel Survey, November 2017 (n = 1,549); McKinsey Global Institute analysis

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[114] McKinsey Global Institute workforce skills executive survey, March 2018. See *Skill shift: automation and the future of the workforce*, McKinsey Global Institute, May 2018.

[115] T. Adler and M. Salvi, *Wenn die Roboter kommen – Den Arbeitsmarkt für die Digitalisierung vorbereiten (When the robots come – Preparing the job market for digitization)*, Avenir Suisse, October 2017.

[116] McKinsey & Company Quarterly Panel Survey, November 2017, (n = 1,549). See *Skill shift: automation and the future of the workforce*, McKinsey Global Institute, May 2018.

[117] "Agilität ist viel mehr als eine Arbeitsmethode" ("Agile is more than just a work method"), *Das Magazin für Führungskräfte*, December 2017 (https://sko-leader.ch/de/article/2810131).

19%

of McKinsey survey respondents said executives lack sufficient technological understanding to lead organization's automation and AI adoption

50–60%

greater demand for than supply of big data talent

Building an organization that can consistently identify and close skills gaps requires fundamental shifts in five areas:

Leadership understanding and mindsets

Top executives need to develop a deeper understanding of technology. In the 2017 McKinsey survey, 19 percent of respondents said that their top executives lacked sufficient understanding of technologies to lead the organization through the adoption of automation and AI. This was the second-highest rated barrier to automation and AI adoption. An executive team that does not understand the technology sufficiently to spot all the potential opportunities cannot make the necessary changes. While CEOs and their teams do not need to become AI experts, they do need a basic understanding of the different types of AI and how they can be applied in a business setting. On top of understanding these technologies, leaders need to shift their mindsets and change their approaches if they are to facilitate transformational change in their organizations, including the redesign of business processes.

War for talent

Over the next five years, demand for talent to deliver new digital capabilities will significantly outstrip supply. In the case of agile skills, for instance, demand could quadruple supply. In the case of big data talent, demand could be 50 to 60 percent greater than supply.[118] To win the war for scarce talent, companies need to develop a solid understanding of existing skills gaps, sources of talent (including nontraditional sources), and factors likely to attract highly qualified employees (including an appealing culture and benefits).

Whether a company is looking to hire from traditional or nontraditional sources, there are digital tools that can vastly improve its ability to source, assess, and recruit new talent. By using a variety of data sources, such as social media profiles, online reputational signals, and gamified tests for job candidates, companies can obtain rich and detailed insights into the skills, working styles, and attributes of potential hires. This leads to better matching of workers with jobs, which raises employee productivity. Similar tools can streamline the process of interviewing and onboarding candidates, too, freeing up valuable time for the employees who previously undertook those tasks.

Finally, the search for talent does not have to be restricted to fixed-term employment. A recent McKinsey study that explored independent employment shows the rising importance of this way of working. Driven by diverse factors such as the availability of digital platforms creating large-scale, efficient marketplaces where workers connect with buyers of services, rising aspiration for higher independence and self-determination, and increased demand for independent services from both consumers and organizations, independent work is growing in importance. According to the study's estimates, 20 to 30 percent of the working-age population in the United States and EU-15 are engaged in independent work as freelancers and contractors, and so on.[119] Working with freelancers may allow companies to acquire the skills they need (if such talent is available) rapidly. Moreover, as organizations become more agile and work is undertaken in team-based settings, integrating contract workers into the organization becomes more seamless. However, this approach may also lead to a loss of proprietary knowledge and intellectual property, and could be a poor fit with the company culture.

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[118] Digital McKinsey.

[119] *Independent work: choice, necessity, and the gig economy*, McKinsey Global Institute, October 2016.

20-30%
of working-age
population in
EU-15 works
independently

Reskilling at scale

A comprehensive reskilling strategy enables a company to build on the existing skills of its workforce, with the advantage that established employees are already familiar with its processes and culture. At the same time, training and investment in human capital are shown to have a positive effect on workers' motivation and loyalty, which are, in turn, linked to a decrease in turnover and an increase in employee support toward digital corporate transformations.

Typically, reskilling includes three distinct types of measure: (1) raising the skills capacity of current employees by teaching them skills that are new or qualitatively different; (2) raising the existing skills of an employee to a higher level or to keep pace with technological change; and (3) hiring entry-level employees with the goal of training them in the new skills needed. A key choice for companies will be whether to use in-house training resources and programs tailored to the company, or to partner with an educational institution to provide external learning opportunities for employees. The executive survey shows that companies plan to focus retraining efforts on skills that are deemed of strategic importance to the company, such as advanced IT skills and programming, advanced literacy skills, critical thinking, and problem solving. In contrast, they are more likely to hire from outside for less complex skills.

In some cases, an alternative option can be to redeploy workers with specific skills within the firm. This can be achieved by unbundling the tasks within a job and rebundling them in different ways; by shifting employees to tasks that are of higher importance or to other entities; or by redesigning work processes where possible. While redeployment ensures that skills are used where they are needed, this approach does not increase the overall capacity of skills within the workforce.

Two rather different approaches to the same challenge were taken by SAP, a Germany-based international software company in the throes of expanding its Industry 4.0 business, and AT&T, a telephone company turned data-powered entertainment and business solution company (see Box 5, "A tale of two companies: Different approaches to the retraining challenge"). After an initial assessment of its skills needs and gap, SAP defined "learning journeys" for employees with a blend of classroom and on-the-job training alongside coaches. AT&T, on the other hand, focused on external partnerships—with universities for instance—to offer tailored education programs. In Switzerland, a number of companies have embarked on both types of retraining strategy, but many of these efforts appear to be at a relatively early stage.

Changing role of human resources

Human resources (HR) will need to adapt to how technology alters the way organizations work as well as the size and nature of the workforce. In the MGI workforce skills executive survey, 88 percent of business leaders surveyed said they believed HR functions would need to adapt at least moderately.[120] Across industries, leading companies are promoting the role of chief human resources officer (CHRO) to join the chief financial officer and chief executive officer at the core of leadership. By linking talent and financing, these three executives will work together to ensure that both talent and finance are appropriately linked in all mission-critical decisions, operations, and planning. Furthermore, talent allocation is becoming as important as financial allocation. Questions such as, "Do we have the right talent in place?" and "How should we think about talent development?" will be key agenda points in meetings of these top executives. For the CHRO to play this strategic role, knowledge of business operations is essential. This is why many companies are developing business unit executives rather than HR experts for the CHRO role. These CHROs delegate the more administrative aspects of the job to others and focus on the strategic and operational issues that come with building the workforce of the future.

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[120] McKinsey Global Institute workforce skills executive survey, March 2018.

Box 5: A tale of two companies: Different approaches to the retraining challenge[1]

Irrespective of their expected level of automation adoption, most companies we surveyed see a significant need for their workforce to upgrade their skills and continue to learn and adapt throughout their working lives.

Two companies, from either side of the Atlantic, provide a contrast in approaches to retraining: SAP and AT&T.[2] Both firms are incumbents in the technology and telecom industries with business models that are undergoing rapid change. AT&T has moved from being a telephone company to a data-powered entertainment and business solution company that requires advanced technical skills, including coding and data science. SAP, a software company, is adopting an Industry 4.0 growth strategy that involves disrupting its existing value chains and product portfolios and moving toward offering more advanced solutions such as public cloud and machine learning.

Each company is starting with a relatively educated workforce that nevertheless lacks the cutting-edge skills needed. Both plan to retrain up to half their current workforce. SAP has taken an in-house approach. The company first undertook an action-oriented analysis of the current supply of skills relative to future demand based on its future product portfolio derived from its strategic business priorities. This led to the quantification of a skills gap—and the definition of action areas to address it—both for the existing workforce and for external resources. To source the necessary external talent, contracting and strategic hiring were considered. For the current employee base, retraining was designed to address the largest portion of workers, while redeployment in the form of physical relocations accounted for a minor fraction. To fill its future skills needs, SAP mapped comprehensive end-to-end "learning journeys" for thousands of employees to help them transition into new roles or content areas. These learning journeys are based on a blended approach that relies on a sequence of classroom training courses provided in-house, followed by several weeks of on-the-job practice in the new roles or content areas, underpinned by coaching. Overall learning journeys may take between 6 and 18 months to complete. Shorter-term learning modules were also developed to close specific skills gaps.

AT&T's approach focuses on external partnerships with educators to develop an offer for employees. Like SAP, it began by mapping out how its workforce's skills will change in coming years and posting the roles that it believes will decline or grow.[3] An online portal enables employees to see which jobs are available, the credentials and skills required, and whether the role is projected to grow or decline. As part of the transition, AT&T has also radically simplified role profiles, consolidating 250 roles into only 80. To enable its workforce to gain the skills needed, AT&T developed a broad set of partnerships with 32 universities and multiple online education platforms to enable employees to earn the credentials needed for the new digital roles. With the Georgia Institute of Technology, for instance, AT&T created an online master's degree in programming. It has also created "nanodegree" programs with the online platform Udacity that enables employees to learn specific skills in less time. AT&T covers the tuition for these training programs, and individuals pursue them on their own time. So far, the company has spent more than $ 250 million on training and tuition aid for employees since 2013. The results are starting to show. As of March 2018, more than half of its employees had completed at least one of 2.7 million online courses in areas such as data science, cybersecurity, agile project management, and computer science. The company has awarded 177,000 virtual badges to about 57,000 employees on their internal career profile pages, indicating that they have completed the coursework. According to the company, employees who are currently retraining are twice as likely to be hired for one of these newer, mission-critical jobs, and four times more likely to advance their careers.[4]

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[1]   A version of this box was first published in *Skill shift: automation and the future of the workforce*, McKinsey Global Institute, May 2018.
[2]   *Work in progress: How CEOs are helping close America's skills gap*, Business Roundtable, June 2017.
[3]   John Donovan and Cathy Benko, "Inside AT&T's radical talent overhaul," *Harvard Business Review*, October 2016.
[4]   Susan Caminiti, *AT&T's $1 billion gamble: Retraining nearly half its workforce for jobs of the future*, CNBC, March 13, 2018.

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Cultural shift

To be successful, the shifts in approach that we have discussed need to be part of a culture that fosters innovation and encourages adaptability. In the face of disruptive changes, such as automation and the adoption of AI, the rise of new competitors or a broad increase in competitive pressure, organizations need to be able to quickly identify (external and internal) innovations, and to make the necessary changes to ensure that they adopt them. Not surprisingly, our findings show that many companies are planning on increasing organizational agility—defined as the ability of an organization to renew itself, adapt, change quickly, and succeed in a rapidly changing, ambiguous, and sometimes turbulent environment.[121] There is a strong tendency toward cross-functional and team-based work with more agile, less hierarchical ways of working, as companies have sought to shift from "mechanical" to "organic" organizations. Unlike traditional hierarchies, which are designed mainly for stability, agile organizations are designed for both stability and dynamism. They typically consist of a network of teams and are notable for rapid learning and fast decision-making cycles. Companies that move to more fluid team-based working environments experience a boost in productivity within their workforces resulting from better matching of employees to tasks and from higher employee engagement.

Switzerland may need to rethink its educational system

Private-sector organizations showing initiative in building the skills relevant to their (future) needs is crucial to closing the skills gap, but alongside their efforts there will need to be changes to the way education is provided both in terms of content and delivery.

In Switzerland, efforts to change the way education is provided can build on an exceptionally strong foundation. According to the IMD business school, the country has the best apprenticeship program in the world.[122] Companies perceive the Swiss workforce as having the best on-the-job training. The World Economic Forum's Global Human Capital Report 2017 ranked Switzerland third in the world for education and training of its population.[123] Switzerland is one of very few countries that has increased the GDP share of total public spending devoted to worker training from 1993 to 2015.

Building on this strong starting point, there are three areas to address. First, the system should consider further emphasizing the skills required for digitization, including not only advanced technological skills, but also social and emotional skills as well as meta skills. Second, there will likely be an increased demand for lifelong learning and reskilling options. Third, there are different ways for the private and public sector to collaborate in providing education and training. Many of these points have already been applied in Switzerland, while others may be worth exploring further.

4.7%

of 2016 Swiss
workforce were ICT
specialists vs.
6.6% in Finland

- **New skill sets.** The Swiss education system is known for creating world-class engineers and professionals. However, it does not create enough of them. For example, ICT specialists made up only 4.7 percent of the Swiss workforce in 2016 (this compares with 3.7 percent in Germany and 6.6 percent in Finland).[124] From 1998 to 2008, the number of university diplomas awarded in Switzerland grew by 30 percent to around 11,500 per year, but technology-related studies grew by only approximately 11 percent, showing a relatively small share of these studies in overall university degrees.[125] The need to change this situation has been recognized, and the Swiss public school system has embarked on an ambitious plan to introduce digital into its curriculum with the project

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[121] *Skill shift: Automation and the future of the workforce*, McKinsey Global Institute, May 2018.

[122] IMD World Talent Ranking 2017, IMD World Competitiveness Center, November 2017.

[123] *These are the 10 best countries for skills and education*, World Economic Forum, September 2017.

[124] ICT specialists in employment, *Eurostat*, December 2017.

[125] *Mangel an MINT-Fachkräften in der Schweiz: Ausmass und Ursachen des Fachkräftemangels in MINT (Shortage of STEM specialists in Switzerland: Extent and causes of the shortage of specialists in STEM)*, Bericht des Bundesrates, August 2010.

"Lehrplan 21." In addition to technical capabilities, social and entrepreneurial skills may need to be more strongly integrated into school curricula. Among the skills that will be difficult to automate—there will be more jobs requiring these skills as machines take over more routine tasks—are customer interaction, initiative taking, and team leading. As technology-enabled new ways of working increase—consider the rise of the digital nomad—skills will need to be developed for a future entrepreneurial workforce.[126] Finally, as employees face significant changes in their work environments, developing confidence and the tools necessary to constantly reassess and build their own skills will be key. For this, meta skills, including, for example, lifelong learning, a personal growth mindset, self-direction, and flexibility with change are just as critical as technical, social, or entrepreneurial skills.

- **Lifelong learning.** Labor market shifts are likely to be rapid as technological advances spread, which calls for even more emphasis on lifelong learning. A one-shot education in childhood is no longer likely to be sufficient to equip people with the ever-changing skills they will need to have an attractive profile to employers and maintain it. Switzerland is already well positioned on adult training. In 2015, 89 percent of the companies in Switzerland supported further training courses and 44 percent of all employees in companies with at least ten employees took part in training courses.[127] From 2005 to 2013, the number of advanced training certificates granted grew from around 3,000 to about 4,500 a year.[128] Further developing lifelong learning opportunities can (and should) be an endeavor shared by the public and private sectors. The education system can find ways to reflect the growing need for adult training, offering part-time courses. The public sector could also consider a "universal learning right" currently being discussed in the EU where citizens receive annual credits (or digital tokens) to use for learning within companies or in educational institutions.[129] On their part, companies can support their employees through financial and other support mechanisms, such as time off or tailored training.

- **Collaboration on building the workforce of the future.** Close collaboration between companies and public stakeholders, such as educational institutions, industry associations, labor agencies, and policy makers, as well as nonprofit organizations, for instance, foundations, can be extremely effective in accelerating the reskilling of the workforce. Switzerland already has advanced collaboration, especially between companies and industry associations as well as between its department of labor and companies. This collaboration allows for tailored apprenticeships to be offered and for quick alignment of training content with the skills that employers need. It is important that policy makers continue supporting workers while transitioning and make efforts to improve their mobility. Facilitating cross-sector mobility by helping individuals use their skills in new occupations and sectors is an area on which Switzerland could focus, particularly in close collaboration with the private sector to ensure that reskilling programs have the right priorities. Switzerland could also explore expanded ways to use data to enhance educational provision (see Box 6, "Using data to provide individuals with better employment opportunities.")

[126] Over the past decade, the number of people in Europe and the United States working independently as freelancers, contractors, self-employed, and "gig" workers increased to an estimated 162 million. See *Independent work: Choice, necessity and the gig economy*, McKinsey Global Institute, October 2016.

[127] *Weiterbildung in Unternehmen im Jahr 2015 (Further training in companies in 2015)*, Bundesamt für Statistik, October 2018.

[128] This includes universities, technical colleges, and universities of education. See *Bildungsabschlüsse (Educational qualifications)*. 2014, Bundesamt für Statistik.

[129] *Renew Europe*, World Economic Forum in collaboration with McKinsey & Company, January 2017.

30%
of 2016 Swiss population born elsewhere

Switzerland will likely continue to need immigration to meet its need for skilled workers

Switzerland has long relied on immigrants to supplement local skills. In 2016, the share of the population born elsewhere was about 30 percent, and around 83.4 percent of them were employed in 2016. These shares each rank in the top three of OECD countries, indicating the importance of immigrants to the Swiss economy.[130]

Immigrants' skills have complemented those of the native population to a significant degree, filling gaps at the top and, partially, at the bottom (Exhibit 29).[131] There is a positive correlation between the share of immigrants by occupation and the composite need for workers, indicating how much a worker was needed for a given occupation.[132] A SECO report finds that the earnings of immigrants across all qualification levels are in the same range of their respective Swiss peers; therefore, immigrants are not underbidding Swiss salaries.[133]

While immigration has slowed down in recent years, our model suggests that demand for highly skilled workers will rise steeply over the coming decades, suggesting that immigration will need to continue to play a part.[134] This is in line with findings from research conducted at the University of Basel, which finds that, without immigration, the Swiss economy would be facing a skills gap of 0.8 million to 1.4 million workers in 2060, assuming 2 percent growth per annum. The largest gaps, according to the report, would exist in healthcare, marketing and tourism, and engineering.[135]

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[130] *Foreign-born employment*, OECD.

[131] The so-called "dual model" in Switzerland distinguishes between immigrants from EU/EFTA countries and those coming from "third countries." Foreign workers from EU and EFTA countries are granted easy access to the Swiss labor market, regardless of their level of qualification. Third-country nationals are only admitted to a limited extent if they are qualified. For both EU and third-country immigrants, the share of highly skilled labor and of very low-skilled labor has been higher than that of Swiss passport holders.

[132] The composite index of the need for workers considers the share of unemployment, the share of open positions, immigration, employment growth, demographics, qualification requirements, the overarching index of demand for skilled workers, and labor participation and the volume of work in a sector. See *Fachkräftemangel in der Schweiz (Shortage of skilled workers in Switzerland)*, SECO, September 2016.

[133] Low- and medium-skill workers have slightly lower salaries (presumably many people with nonnative language skills inducing a discount on the wage) while highly skilled workers have slightly higher salaries than Swiss passport holders.

[134] According to the latest observation report on the Agreement on the Free Movement of Persons from SECO, the main reason for the low level of immigration are slow economic development in Switzerland and the relatively healthy economic situation in the EU.

[135] *Arbeits- und Fachkräftebedarf der Schweiz bis 2060 (Labor and skills demand in Switzerland until 2016)*, Conny Wunsch, Labor Economics, Faculty of Business and Economics, University of Basel, October 2014.

Box 6: Using data to provide individuals with better employment opportunities

Several initiatives around Europe are using digital data gathering and dissemination to help individuals improve their employability and obtain employment, as well as to aid private and public bodies in making informed decisions on which types of education and training they should offer.

One example is the EU's Skills Panorama, a website containing a large amount of data on how demand for skills is developing and therefore helps users to choose to pursue courses in skills that are likely to give them a good chance of employment.[1] Denmark takes an innovative approach by allowing users to contribute skills forecasts (in public-sector assessments drawing on regional employer surveys). Social partners at the local level and up ensure that there is a bottom-up view, that all data are publicly available, and that training courses and content are available to everyone. Another example is the tool introduced by the European Centre for the Development of Vocational Training (Cedefop) that collates information from a range of national sources and job portals to provide more comprehensive and detailed information on the qualifications required for certain jobs at the local, national, and regional levels.[2] Although online job offers do not accurately reflect the relative demand in all occupations, this is the first instance of information being gathered in one place. This database is planned to be fully functional by 2020.
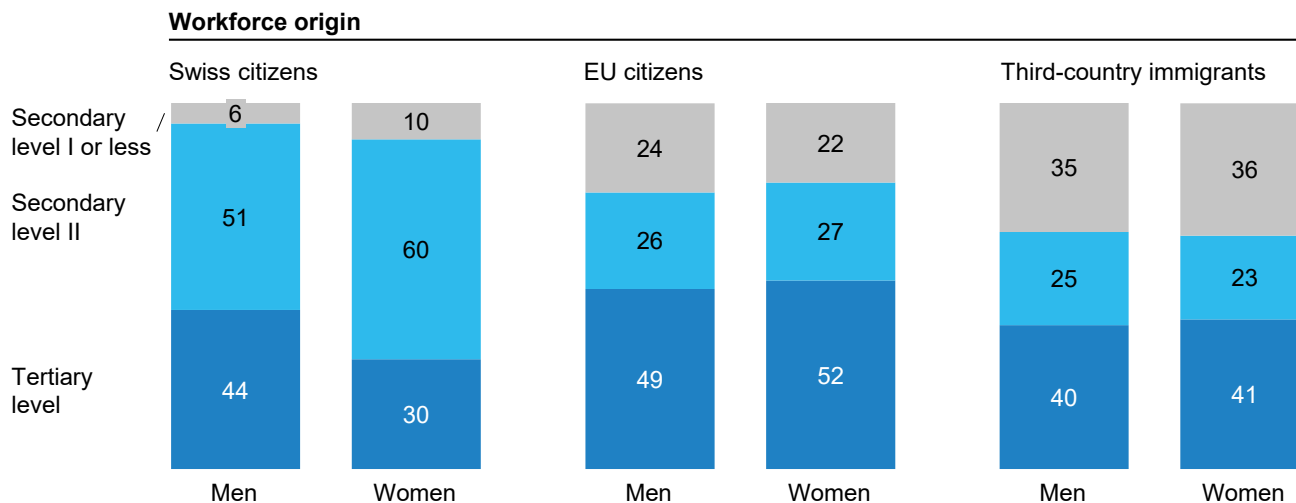
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[1] Skills Panorama website.

[2] *Accelerating workforce reskilling for the Fourth Industrial Revolution*, World Economic Forum, July 2017.

Exhibit 29

Most immigrants to Switzerland are either highly qualified (at the tertiary level) or have rather low qualifications.

Education level of immigrants in Switzerland
Percent, rounded

Workforce origin

	Swiss citizens		EU citizens		Third-country immigrants	
	Men	Women	Men	Women	Men	Women

Secondary level I or less / Secondary level II / Tertiary level

Swiss citizens — Men: 6, 51, 44 | Women: 10, 60, 30
EU citizens — Men: 24, 26, 49 | Women: 22, 27, 52
Third-country immigrants — Men: 35, 25, 40 | Women: 36, 23, 41

SOURCE: SECO, 2017; McKinsey Global Institute analysis

Consider the case of a data scientist—the current need cannot be satisfied by graduates alone. In mid-July 2018, jobs.ch, one of the largest job platforms in Switzerland, listed more than 400 vacancies under the keyword "data scientist," while other estimates have put the number of vacancies in the thousands.[136] However, all Swiss universities and universities of applied sciences together train roughly 200 to 300 students per year in this field.[137] Considering that more than half of all net ads of academic jobs in 2016 were filled by first-generation immigrants, this illustrates the high skills gap Switzerland faces even today.[138]

•••

Digitization, automation, and AI offer considerable advantages for Swiss businesses and citizens as well as new sources of growth. Fears of large-scale job losses appear unfounded, but there will undoubtedly be major disruption to people's careers that will need to be managed. Switzerland has a strong starting position for capturing these opportunities, but no room to be complacent. The country needs to accelerate its digital transformation and prepare for a skill shift at a speed and scale not seen in recent history in order to maintain and increase its competitiveness.

[136] The number of vacancies metric only reflects those that are advertised, and therefore typically underestimates demand for workers. Other estimates: In Germany 57 percent of all companies with more than 3 employees that have an open position for an IT developer search for a software developer to solve questions around big data (resulting in a need of 70-80'000 jobs needed). Scaling this for Switzerland, several thousand people would be needed. See Achim Berg, *Der Arbeitsmarkt für IT-Fachkräfte (The job market for IT professionals)*, presentation, November 2017.

[137] There are 16 study programs in data science in Switzerland. Assuming 15 graduates per year and program, there are around 200 to 300 graduates per year.

[138] *Berufshauptgruppen der Erwerbstätigen nach Migrationsstatus, Geschlecht und Staatsangehörigkeit (Main occupational groups of employed persons by migration status, gender and nationality)*, Bundesamt für Statistik, 2016.

Engineer using 3D printer
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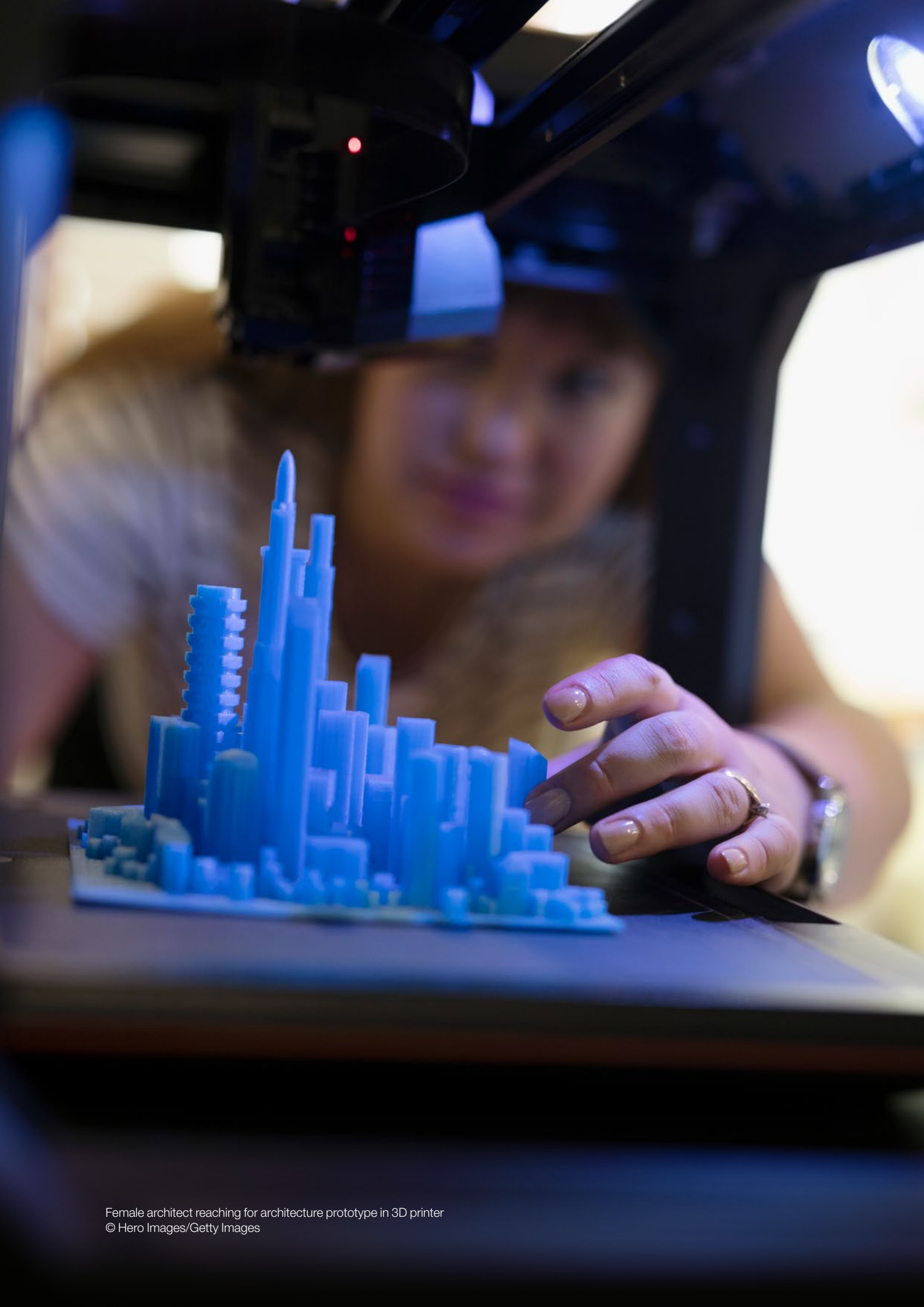
Female architect reaching for architecture prototype in 3D printer
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METHODOLOGY

Employment by sector for Switzerland
From MGI global model/IHS Global Insight.

Activities by occupation
Global benchmark, mostly estimated based on US data from BLS O*NET, 2014.

Skills per activity
Global mapping based on expert input, predominant skill per activity applied.

Technical automation potential per activity
Review of technological readiness per activity based on technology availability for 18 capabilities and percent of human-equivalent capability required per activity.

Adoption curve
Based on technology progression timeline, solution development timeline, economic feasibility which comprises of solution development cost and wage evolution, regulatory and social acceptance barriers.

Jobs lost
Calculating adoption rate * percent of time spent in each activity * projected employment in 2030 (assuming ceteris paribus, i.e., no shift in activity mix).

Interviews
Corroborated findings in executive and sector expert interviews and applied manual adjustments as needed.

Jobs gained
Rising incomes
- GDP/capita growth projections as per Oxford Economics/McKinsey Global Growth model.

- Univariate linear regression of consumer spend to GDP/capita in automotive, leisure, food, household goods, financial services, clothing, accommodation and food services.

- Application of 2014 export market shares for global sectors like automotive to calculate national level demand increase.

- Translation to 2014 and 2030 jobs with 2014 and projected 2030 direct and indirect jobs multipliers based on WIOD (extrapolated with typical historic sector productivity growth rates and adjusted for automation).

Healthcare
Bivariate linear regression of healthcare professionals vs. GDP/capita and share of population over 65.

New technology
Univariate linear regression of enterprise and consumer spend on hardware, software, and IT services with GDP/capita; translated into jobs via multiplier as above.

Infrastructure and energy
Used separate analysis done with Swiss Bundesamt für Energie.

Monetization of unpaid work
Time spent on unpaid household work benchmarked between countries and assumption on moving toward benchmark.

Other new jobs
Not quantified, but range provided based on research based benchmark (in the U.S.) of 0.5% of entirely new jobs annually.

Export competitiveness
Not quantified, but range provided based on scenario of 5% of GDP exports growth translating into new jobs via current multipliers (and assuming productivity growth is implicitly compensated via GDP growth – we use 2016 WIOD).

Skill mix shift
Mix today
As per calculation of activities described above.

Mix in future
As per calculation in jobs-lost-jobs-gained based on automation of and gains of jobs by occupations (assuming jobs gained translate into current activity mix per occupation).

Additional/more aggressive scenario
Overlaying the above calculation with

- Additional baseline productivity growth regardless of automation that reduces current activities/skills.

- Additional growth in technology-related activities assuming a share of the job gains per sector have an occupational mix in line with the ICT sector rather than current sector employment.

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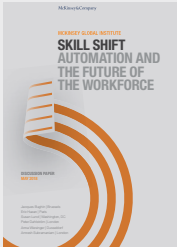
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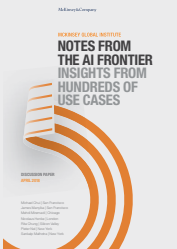
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