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AI & The Future of Work

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Introduction

Big data and advances in computing power have triggered a technological revolution that have enormous bearing on the workplace and the labor market. Machines and robots are improving their capacities rapidly through artificial intelligence (AI) and innovations in design and structure. But how this digital revolution will affect firms, workers and their livelihoods is yet to be better understood.

Headline-grabbing assessments of the future of work predict polarizations and an increasing number of individuals in good and bad jobs, while hollowing out the middle class. Trends since the 1970s confirm this specter of polarization in the USA and the UK, but so far not in continental European countries. However, while the future transformation will be profound, it may be relatively slow, leaving time for many workers to adapt to the changes in the demand for labor. There is an inherent difficulty for established companies to truly unleash the full potential of AI as their core strategy. It may now be time for management to think beyond the process of innovation, and also consider alternative budgeting approaches and capital structures to fuel the critical work surrounding AI.

Platforms that facilitate the exchange of goods and services are fostering an ever-growing gig economy, an employment concept in which people are paid for each specific short-term task. The most important challenge is to ensure that incomes are predictable and high enough to ensure a reasonable quality of life. However, too much regulation of freelance work could result in the curtailing or even demise of the gig economy.

While AI promises substantial advances in productivity, it should not threaten or violate human dignity. Accordingly, the legal and ethical challenges of free entrepreneurship and the need to gather vast amounts of data to develop AI are discussed in the final section of this report.

We hope that our findings will prove valuable and I wish you a most insightful and enjoyable read.

Urs Rohner
Chairman of the Board of Directors
Credit Suisse Group AG

CREDIT SUISSE AG
Research Institute
Paradeplatz 8
CH-8070 Zurich
Switzerland
research.institute@credit-suisse.com
credit-suisse.com/researchinstitute

What technological change means for the future of work

Rafael Lalive and Daniel Oesch
University of Lausanne

Big data and advances in computing power have triggered a technological revolution that may have enormous bearing on the workplace and the labor market. Machines and robots are improving their capacities rapidly through artificial intelligence (AI) and innovations in design and structure. Digital assistants organize schedules, plan trips, and provide answers to many questions people have. Autonomous cars drive around on our streets and can bring customers from the pick-up point to any place they desire.

These developments in technology are exciting, and bring enormous improvements, especially for consumers and entrepreneurs, but they also fuel fears that expanding artificial intelligence and machine capabilities may make humans obsolete in the production process. Our objective is to discuss how and why these fears come about, whether they were true in the recent past, and to what extent they will apply in the near future. Specifically, we first sketch a framework that allows us to discuss the effects of machines on employment. This framework is an abstraction of the real world, but is useful to assess how machines affect employment. Second, we review how technology has affected employment in the recent past. Third, we discuss what the future of work could look like.

Analytical framework

We adopt a framework developed by Acemoglu and Autor (2011) on task allocation to discuss how technology affects employment. The framework starts with the premise that firms employ workers to fulfill tasks. A task is a unit of work that is directly needed in production. Tasks differ in terms of complexity. Workers supply effort to perform tasks and differ in terms of their skills, where "skill" refers to the capability to perform tasks. Simple tasks can be performed easily by skilled and unskilled workers, but complex tasks can only be performed easily by skilled workers. Workers earn wages that are in line with their skills. In this context, firms will allocate tasks in a very intuitive fashion. The low-skilled workers perform the least complex tasks because their comparative advantage, the ratio of output to cost, is highest in these tasks. The high-skilled workers will perform the most complex tasks, and intermediate-skilled workers perform the skills of intermediate complexity. Workers perform the tasks that correspond to their level of skill.

Technology in the form of machines, robots or digital assistants competes with humans for tasks. Machines in factories and computers in workplaces have taken on the repetitive, but cognitively demanding work of, for instance, office clerks (automatic teller machines). Fewer workers with intermediate skills are needed to execute tasks of intermediate complexity, and these workers then compete with both low-skilled and high-skilled workers for low- and high-complexity tasks. Intermediate-level jobs will fare less well, with lower employment and lower wages. According to this line of reasoning, technology has led to a hollowing out of the middle class, a phenomenon called polarization. However, technology may also have been used to replace workers of low complexity. In this case, employment in highly-paid jobs grows

strongest, and lower-paid jobs disappear, a phenomenon called educational upgrading. The framework identifies the primary drivers of the employment effects of technology, but only empirical analysis can tell which of the two scenarios, polarization or upgrading, is more relevant.

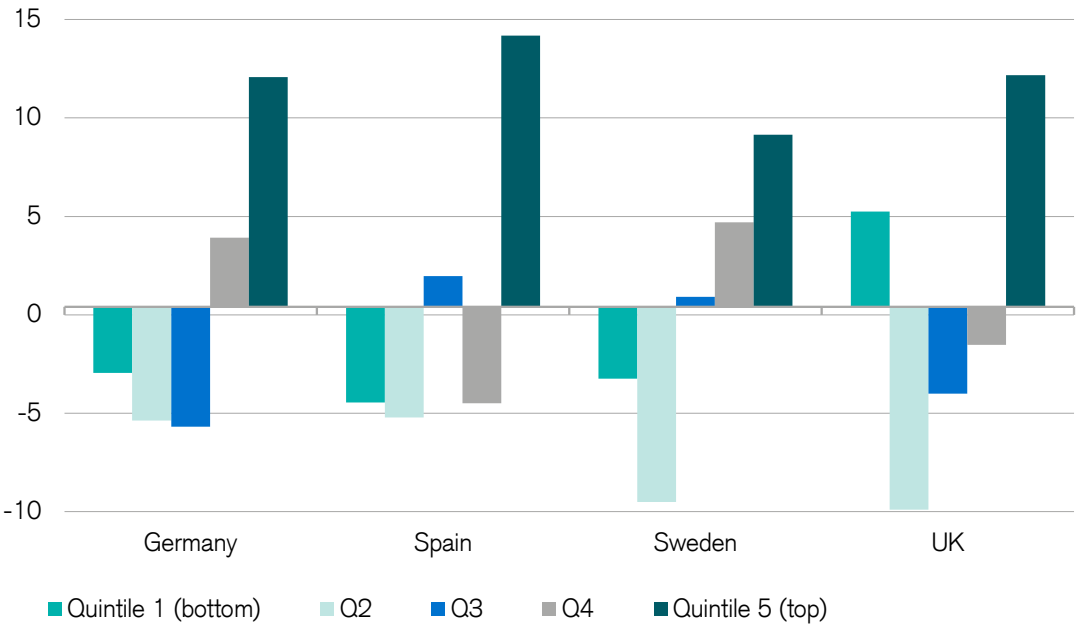
Machines and employment in the recent past

The view that the labor markets are polarizing has become widely accepted in economics (Autor and Dorn 2013, Goos et al. 2014). So far, the empirical evidence for job polarization is largely limited to the USA and the UK (Wright and Dwyer 2003, Goos and Manning 2007, Autor and Dorn 2013). In contrast, most studies for Western Europe point toward the upgrading of the occupational structure (Fernandez-Macias 2012, Oesch 2013, Fernandez-Macias and Hurley 2016), which is particularly true for Switzerland (Murphy and Oesch 2018).

We assess whether polarization or upgrading is relevant for four large European economies, Germany, Spain, Sweden and the UK. Changes in the employment structure can be empirically analyzed by adopting the analytical strategy of job-quality quintiles (Wright and Dwyer 2003). Its building blocks are occupations that are rank-ordered on the basis of their median earnings. These rank-ordered occupations are then grouped into five job-quality quintiles, with quintile 1 comprising the least-paid – and thus least-skilled – occupations and quintile 5 comprising the best-paid – and thus most advantageous – occupations. Each quintile comprised 20% of total employment at the beginning of the period under study, i.e. the early 1990s. This allows us to calculate occupational change up to 2015 by tracing employment changes in each of the five quintiles.

Figure 1 shows the pattern of occupational change for Germany, Spain, Sweden and the UK over the last two decades. In each one of these four European countries, employment expanded most strongly in the top quintile and either fell or stagnated in the three lowest job-quality quintiles. The pattern of occupational upgrading is clear-cut in Germany, Sweden and Spain, whereas it has a polarizing thrust in the UK, where employment also increased in the least-paid occupations.

Figure 1: Relative change in employment across job-quality quintiles 1992–2015
In percentage points



Data: EU-LFS (Labor Force Survey) 1992–2015 for Germany, Spain and the UK, 1997–2015 for Sweden.
Reading example: in Germany 1992–2015, the share of total employment set in the lowest-paid occupations of quintile 1 fell by 3.3 percentage points, whereas it increased by 11.7 percentage points in the highest-paid occupations of quintile 5.
Source: Oesch and Piccitto (forthcoming).

Over the last three decades, European economies have been most successful in the automation and offshoring of low-paid, low-skilled and low-status occupations such as farm workers and plant operators, data-entry clerks and sales assistants. In parallel, job expansion was most vigorous among higher-paid and better-skilled positions in management and the professions (Oesch 2013).

As a result, labor-market opportunities expanded for the salaried (upper) middle class, whereas the core of the traditional working class and subordinate white-collar employees lost ground. For the polarization thesis to hold, we should also have observed job growth in low-skilled services among interpersonal service workers. However, this mostly female class did not substantially increase its employment share in Western Europe (Oesch and Piccitto, forthcoming).

While the doom scenario of polarization and middle-class erosion may make newspaper headlines, it is not in line with the secular trends in Western Europe's employment structure. Given the extent of educational expansion over the last few decades, this is good news. As technical colleges and universities were sending out highly educated workers in greater numbers, the economy was also creating more jobs in occupations requiring higher education. However, it is an altogether different question whether upgrading trends from the past translate into the future.

Disruption versus continuous change

Adopting the framework we sketched out earlier, Frey and Osborne (2017) questioned a group of machine learning experts and examined job descriptions to identify computerization bottleneck tasks that would preclude an occupation from being computerized. They estimated the share of jobs that are exposed to automation to account for 47% of total employment in the USA.

However, other scholars present very different assessments of how technology will affect the labor market of the future. Two recent OECD studies expect that 9%–14% of all jobs could be easily automated in the near future (Arntz et al. 2016, Nedelkovska and Quintini 2018). Since the OECD studies focus on individual tasks rather than entire occupations, the estimates therefore diverge widely and are very sensitive to assumptions. They point to two very distinct future scenarios: a first scenario predicts a deep break with sudden and disruptive changes, while a second scenario holds continuous and progressive change as more likely.

Automation and employment: The scenario of disruptive change

According to the scenario of disruptive change, the next wave of automation should replace employment in a wide range of activities, including agriculture, industrial production and logistics (through robotization), ground transportation (through unmanned machinery), secretarial and administrative support (through new software and Big Data), sales (through self-checkout), cleaning (through robots) and even construction (through prefabrication).

Most studies suggest that the degree of automation is negatively correlated with the level of training in a given profession. Low-skilled occupations would therefore be more exposed to technological change than occupations requiring a high level of training. More specifically for Switzerland, a recent analysis suggests that vocational education and training (VET) graduates are more threatened by automation than university graduates. While 65% of the jobs held by the former would be threatened, this is only the case for 25% of the jobs held by academics.

The disruption scenario predicts de-industrialization and therefore a decreasing demand for production workers employed in manufacturing. Through its impact on the secretariat, payment management, IT maintenance and e-commerce, digitalization would also jeopardize the jobs of commercial employees, sales assistants and retail managers. More generally, structural changes in the labor market should mainly affect the weakest areas – both in terms of educational level and geographical setting, with the peripheral regions of countries being more affected than the service centers of large cities.

Automation and employment: The scenario of continuous change

The second scenario predicts a much more gradual change. Widespread automation will not take years, but decades in the second scenario – and will depend on various factors such as the feasibility and costs of new technological solutions as well as their legal, social and political acceptance. The technical feasibility of automating a process does not necessarily mean that an activity will be automated and employment will disappear any time soon. Moreover, workers continuously adapt to technological change and the multiple tasks that make up an occupation will constantly evolve over time.

Some tasks appear difficult to automate, especially if they involve social skills (negotiating, coordinating, teaching or care-giving) or creative skills (inventing new products and services, creating art and culture). Therefore, automation does not seem to threaten the bulk of employment in areas such as management,

engineering, science, education, medicine, culture or the police. New product innovation will create new tasks, and new tasks are typically given to workers who explore and develop them before they are encoded and entrusted to a machine.

New technologies will certainly lead to a decrease in jobs in some occupations and industries. Yet, at the same time, they will also generate many new jobs. By way of illustration, it can be noted that, despite strong technological progress, more than 860,000 net jobs have been created in Switzerland over the last two decades. The Federal Council (2017) therefore expects the adoption of digital technology, as with previous technological innovations, to contribute to job growth in Switzerland. While studies are abundant on jobs that are lost through automation, it is very difficult to estimate the number of new jobs that will be created as a result of the digital shift. Overall, this second scenario is therefore much more optimistic. However, it does not deny that there is a need to continually adapt the population's skills.

Which jobs in the future?

Using the second step-by-step scenario as a starting point, the employment evolution can be projected for different occupational groups using two sources. The US Bureau of Labor Statistics provides projections for employment trends between 2016 and 2026. These projections do not share the alarmism of the disruptive scenario. On the contrary, it forecasts an increase in total employment of 7% between 2016 and 2026. For five occupational groups, growth is expected to be much higher. The most spectacular surge is predicted for workers in health care (+24%) and personal services (+15%), particularly among home helpers, care givers and medical assistants. Two other major groups that are also expected to grow strongly are health specialists, including therapists and nurses (+15%) and computer and mathematical experts (+15%).

The largest decline is projected in the USA for production occupations (–4%), particularly among metal and mechanical engineering workers. Employment is expected to stagnate in the agricultural trades as well as in administrative support jobs, commonly associated with the back office (0%). A third intermediate group includes occupations that are expected to grow at the same rate as the overall labor market, such as jobs in construction, catering, management and education.

A plausibility test consists of comparing these projections with the indicators that assess the current employment demand for skilled labor in Switzerland (shortage indicators). As structural changes in the labor market are slow, these indicators should provide us with information on the evolution of the labor market in the coming years. Shortage indicators also suggest that labor demand will remain particularly vigorous in health, where many jobs have been created over the last fifteen years (State Secretariat for Economic Affairs [SECO] 2016). It is likely that demographic aging will continue to stimulate demand for manpower in an area where the potential for automation seems limited. In Switzerland, however, it is mainly the highly qualified professions – such as doctors or pharmacists – that are showing signs of shortage, while this is less the case for, say, dental assistants or pharmacy assistants. Switzerland also has a shortage in the so-called "MINT" professions (mathematics/information technology/natural sciences/technology) among engineers and computer scientists, as well as among specialists in management, law and education. Finally, there are no visible shortages in agriculture, the food industry, textiles, catering, commercial and administrative professions or cleaning. In general, occupations showing the most signs of shortages have training requirements that are significantly higher than average, while the opposite is true for occupations with no shortages (SECO 2016).

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New technologies will certainly lead to a decrease in jobs in some occupations and industries. Yet, at the same time, they will also generate many new jobs.

Technology will affect how firms recruit workers. In many markets, many workers want the same job, and many employers want the same worker. This situation generates the problem of congested labor markets. All workers apply to the same firm, all employers invite the same candidate, and both workers and firms need to wait until the market clears. Digital platforms can use information about the preferences of workers and firms, a bit like the online dating app Tinder does

in the context of matching partners. Additional information will help speed up the matching process, especially if the market provides workers and firms with information on the feasibility of matches. More information can also lead to more inequality because information helps workers and firms pair up exactly, while currently luck is an important element of forming an employment relationship.

Conclusion

Are we heading toward a future where computers, robots and AI replace human labor and lead to mass unemployment? Warnings about a future of widespread technological unemployment are as old as the industrial revolution. They have been periodically voiced, most prominently by Jeremy Rifkin in 1992 with his book "The End of Work." When Rifkin made his prophecy of a jobless future, the USA had a civilian labor force of 118 million people. In 2018, civilian employment increased to 155 million people – a figure that becomes truly astounding when compared to the 29 million gainfully employed workers in 1900 – among whom 40% were still employed in agriculture. Despite the huge labor-saving potential of combustion engines, assembly lines, nuclear power and micro-chips, many more people are working today in the USA than 120 years ago – and the USA is not alone. Between 1950 and 2015, the total volume of work performed in Switzerland grew from 5.5 billion to 7.8 billion working hours (Siegenthaler 2017).

How can labor-saving technology be introduced without leading to the end of work? Computers and robots will only be used where they lead to productivity gains and, consequently, additional income. These productivity gains can benefit three groups of stakeholders: (1) the workforce whose productivity has increased in the form of wage increases; (2) business owners who benefit from an increase in their profits; or (3) consumers who benefit from lower prices. In practice, productivity gains tend to benefit all three groups to some extent. These three groups will then use their increased income to acquire more goods and services, which should in turn lead to employment growth.

Hence our argument would be that there is no shortage of work to be done in contemporary economies. Rather, there is a lack of financial means to pay for all the work that would be socially desirable. It suffices to think of the development and maintenance of public infrastructure (public transport), healthcare (care of the elderly) or education (affordable quality pre-schools).

Rather than a jobless economy, the two great challenges in the labor market may then be massive dislocation on the one hand and the distribution of productivity gains on the other. While technological change will not lead to the end of work, it will certainly displace people from occupations and sectors. In this context, broad access to initial and further education will become increasingly important for people's life chances. Likewise, popular support for technological progress may grow weak and weaker if the resulting productivity gains continue to be pocketed by a small elite of winners – rather than be shared widely across the workforce as was the case during the post-war decades.

Western societies benefited in the post-war decades from an institutional framework that responded well to the technological challenge created by Fordist mass production: the Keynesian class compromised with full-employment policies, strong unions and the development of the welfare state. The democratic challenge of the next decades will be to develop a new institutional framework that allows modern societies to fully harness – and broadly share – the potential of the digital revolution.

How to make AI transformation more likely to succeed

Howard Yu and Jialu Shan
IMD

To get the most out of artificial intelligence (AI), companies need more than just data, infrastructure, and off the-shelf analytics; they need to redesign their investment processes. In this chapter, we examine the inherent difficulty for established companies to truly unleash the full potential of AI as their core strategy. We conclude that senior executives must think beyond the process of innovation as well as consider an alternative budgeting approach and capital structure to fuel the critical work surrounding AI.

What are we learning about artificial intelligence in financial services?" asked Ms. Lael Brainard, one of the seven members of the Board of Governors of the US Federal Reserve. "My focus today is the branch of artificial intelligence known as machine learning, which is the basis of many recent advances and commercial applications," the governor told her audience in Philadelphia, Pennsylvania. "Due to an early commitment to open-source principles, AI algorithms from some of the largest companies are available to even nascent start-ups... So it is no surprise that many financial services firms are devoting so much money, attention, and time to developing and using AI approaches."

JPMorgan Chase is reportedly devoting some USD 10.8 billion to its tech budget in 2018. Europe's largest bank, HSBC, is spending USD 15 billion on new technology. And the biggest spender of all, Bank of America, has set an annual global budget of nearly USD 16 billion for technology and operations. That figure is at least USD 3 billion more than Intel, Microsoft or Apple spent on research and development in 2018. As Andrew S. Grove, the long-time chief executive and chairman of Intel Corporation, told a Stanford researcher in 1991, "Don't ask managers, 'What is your strategy?' Look at what they do! Because people will pretend." Whether they are pretending or not, the resource allocation patterns suggest that banks are now effectively IT companies.

What Grove saw as the actual strategy of a firm is the cumulative effect of day-to-day prioritizations or decisions made by middle managers, engineers, salespeople, and financial staff – decisions that are made despite, or in the absence of, intentions. And that is where the problem lies. Money for new investments accounted for only 27% of bank spending on information technology in 2017. According to Celent, a research and consulting company based in Boston, the rest – close to 73% of spending – was allocated to system maintenance. Of the nearly USD 10 billion JPMorgan Chase spent on IT in 2016, only USD 600 million was in fact devoted to fintech solutions and projects for mobile or online banking, although CEO Jamie Dimon warned shareholders in his letter that "Silicon Valley is coming."

This knowing-doing gap is no simple pretension by senior leadership. Financial institutes we have spoken with have (1) all organized employee seminars inviting motivational speakers to talk about innovation; (2) established corporate venture funds to invest in innovative startups;

(3) practiced open innovation, posted challenges online, and run tournaments with external inventors; (4) organized "design thinking" workshops for employees to re-think customer solutions outside the mainstream; and (5) installed Lean Startup methodologies that allow employees to fail fast in order to succeed early. So widespread is the innovation process, and yet, managers continue to face unyielding organizations whose core business is being encroached on by Google and Amazon, if not Tencent or Alibaba or some other digital upstarts. "Tell me one thing that I should do but haven't done," hissed an executive the moment we mentioned Google Venture. It seems that no matter how hard these in-house innovation experts try, their companies simply will not budge. The ships are not just big; they cannot turn. Why?

> "Seizing a window of opportunity is not necessarily about being the first, but about getting it right first.

Too many innovation experts are focusing solely on the nuts and bolts of everyday implementation: gathering data, tweaking formulas, iterating algorithms in experiments and different combinations, prototyping products, and experimenting with business models. They often forget that the underlying technologies – AI in this case – never stay constant. Seizing a window of opportunity is not necessarily about being the first, but about getting it right first. In this instance, that means getting it right for banking clients. Doing so takes courage and determination, as well as vast resources and deep talent. But the banking industry is not where Silicon Valley comes first – the auto industry is.

How likely is it that your industry will be disrupted by the Valley?

No automaker today would speak to investors without mentioning "future mobility." BMW is "a supplier of individual premium mobility with innovative mobility services." General Motors aims to "deliver on its vision of an all-electric, emissions-free future." Toyota possesses the "passion to lead the way to the future of mobility and an enhanced, integrated lifestyle." And Daimler, maker of Mercedes, sees the future as "connected, autonomous, and smart." In contrast to the personally owned, gasoline-powered, human-driven vehicles that dominated the last century, automakers know they are transitioning to mobility services based on driverless electric vehicles paid for by the trip, by the mile, by monthly subscription, or a combination of all three. In the past, mobility was created by individual cars automakers sold; in the future, mobility will be produced by service companies operating various kinds of self-driving vehicles in fleets over time. At the BMW Museum, anyone can witness the gravity of this vision first-hand, articulated by its chairman of the board.

Walking up the spiral ramp of a rotunda inside the BMW Museum, one sees flashes of pictures about BMW history that display in variable sequences, slipping in and out of view like mirages. At the very top of the museum is a "themed area" of about 30 stations demonstrating an emissions-free, autonomously driven future. These are not only a vision, but a real project, begun in earnest in the autumn of 2007 by then-CEO Norbert Reithofer and his chief strategist Friedrich Eichiner. The two men tasked engineer Ulrich Kranz, who had revived the Mini brand in 2001, to "rethink mobility." The task force soon grew to 30 members and moved into a garage-like factory hall inside BMW's main complex.

"I had the freedom to assemble a team the way I wanted. The project was not tied to one of the company's brands, so it could tackle any problem," Kranz said in an interview with Automotive News Europe in 2013. "The job was to position BMW for the future—and that was in all fields: from materials to production, from technologies to new vehicle architectures." And so Kranz and his team decided to explore uncharted territory that included "the development of sustainable mobility concepts, new sales channels, and marketing concepts, along with acquiring new customers." The starting point for "Project i" was, in other words, a blank sheet of paper.

"We traveled to a total of 20 megacities, including Los Angeles, Mexico City, London, Tokyo, and Shanghai. We met people who live in metropolises and who indicated that they had a sustainable lifestyle. We lived with them, traveled with them to work, and asked questions," Kranz recalled. "We wanted to know the products that they would like from a car manufacturer, how their commute to work could be improved, and how they imagined their mobility in the future. As a second step, we asked the mayors and city planners in each metropolis about their infrastructure problems, the regulations for internal combustion engines, and the advantages of electric vehicles."

Once the findings came back, Kranz expanded his team by seeking out "the right employees both internally and externally." The result was BMW's gas-electric i8 sports coupe and all-electric i3 people mover, which shimmered under white lights at BMW World, where the company's top automotive offerings are showcased. The i3 had almost no hood, and the front grille was framed by plastic slits that looked like a pair of Ray-Bans. It came in a fun-looking burnt orange. The front seats were so vertically poised, with the dashboard stretching out, that they exuded a "loft on wheels" vibe. Like the interior, made of recycled carbon fiber and faux-wood paneling, the electric motor of the i3 was geared to urban dwellers in megacities who yearned for a calm, relaxing drive.

What made BMW all the more remarkable was its timing. Almost two years before Tesla's Model S was introduced, BMW had presented the battery-powered car as a revolutionary product, and committed to build it and deliver it to showrooms by 2013. When the BMW i3 went on sale, Tesla's Model S had spent just over a year on the US market. The 2014 i3 went on to win a World Green Car award, as did the 2015 model, the i8. In short, BMW was fast and early.

Then something terrible happened – or really nothing happened.

The i3 is now five years old, and the i8 is four. The BMW i brand includes the services DriveNow and ReachNow (car sharing), ParkNow (to find available parking), and ChargeNow (to find charging stations). But, besides being featured in occasional press releases, Project i has given way to other BMW sports cars in prime-time TV advertising spots. There is no news from Project i, except that project members are reportedly leaving. Ulrich Kranz, the former manager, joined former BMW CFO Stefan Krause at Faraday Future, and after a short stay, they started Evelozcity in California, where they recruited another i-model designer, Karl-Thomas Neuman. And Kranz is not alone. Carsten Breitfeld, former i8 development manager, is now CEO of Byton, where he also enlisted a marketing expert and a designer from the BMW team.

How much Project i has cost BMW, we will never know. But if, according to BMW figures, the carbon-fiber production and the autobody works for the i3 set the company back some half a billion euros, the entire project could easily have cost two to three billion – a sum that would have been enough for the development of two to three series of a conventional VW Golf or Mercedes S-Class. Two to three billion euros is also more than fifteen times the USD 150 million Apple spent to develop the first iPhone, which launched in 2007. With so much bleeding, the new CEO Harald Krüger talked of Project i 2.0, a plan to integrate the BMW i sub-brand back into the parent company, and refocus distribution efforts on "classic" products.

In 2018, BMW USA reported just 7% of its sales were cars with a plug, which included all its hybrid offerings. Meanwhile, Tesla reported booming sales of its Model 3, which has become one of the USA's top 20 most-sold vehicles in the third quarter of 2018. Tesla was ranked fourth in luxury car sales during the same quarter. At the time of writing, Tesla has surpassed BMW and Daimler to become the world's second most valuable automaker in terms of market capitalization, trailing only Toyota.

> "Then something terrible happened – or really nothing happened.

Did Tesla and other start-up companies steal BMW's idea and run with it? No, it is what is called the Zeitgeist, a German word meaning "spirit of the time." When the time is ripe, the ideas are "in the air." Competition invariably emerges, and companies have to improve their ideas to stay ahead. They need to come up with demonstrations that excite potential customers, potential investors and, more importantly, potential distributors.

BMW's shift in its distribution of the i sub-brand echoes what Kodak did. Kodak built the first digital camera back in 1975 and was the first to put out a competent product, but then ended up folding its consumer digital and professional divisions back into the legacy consumer film divisions in 2003. Meanwhile, Nikon, Sony, and Canon kept innovating in the subsequent decades, with features like face detection, smile detection, and in-camera red-eye fixes. We all know what eventually happened to Kodak.

How to become future-ready

BMW is by no means a laggard in innovation. At IMD business school in Switzerland, we track how likely a firm is to successfully leap toward a new form of knowledge. For automakers, it is the shift from mechanical engineering, with

combustion-engine experts, to electric and programming experts of the same kind as those who build computers, mobile games, and hand-held devices. For consumer banking, it is the shift from operating a traditional retail branch with knowledgeable staff who provide investment advice to running data analytics and interacting with consumers the same way an e-commerce retailer would. The pace of change may differ between industries, but the directional shift is undeniable.

The IMD ranking measures companies in each industry sector using hard market data that is publicly available and has objective rules, rather than relying on soft data such as polls or subjective judgments by raters. Polls suffer from the tyranny of hype. Names that get early recognition get greater visibility in the press, which accentuates their popularity, leading to a positive cascade in their favor. Rankings based on polls also overlook fundamental drivers that fuel innovation, such as the health of a company's current business, the diversity of its workforce, the governance structure of the firm, the amount it invests in outdoing competitors, the speed of product launches, and so on. According to an objective composite index like this one, BMW is among the best. **Table 1** shows the ranking of the top 55 automakers and component suppliers. The methodology of the ranking is described in the appendix.

But the index also points to the general conservatism of large companies. Most radical ideas fail, and large companies cannot tolerate failure. It does not matter whether you call BMW's strategy "throw everything at the wall and see what sticks" or a groundbreaking, iterative approach to mobility; if the only way to innovate is "to put a few bright people in a dark room, pour in some money, and hope that something wonderful will happen," Gary Hamel once wrote, "the value added by top management is low indeed."

But it is not just about cars. The dilemma experienced by German automakers is strikingly similar to the ones facing executives in banking and a host of other industries these days. Just as Detroit is confronted by Silicon Valley, Wall Street can see the future of banking everywhere it looks. Turning to China, it sees Alibaba, whose AliPay has become synonymous with mobile payment, and Ant Financial, Alibaba's finance subsidiary, which is now worth USD 150 billion – more than Goldman Sachs. Looking homeward, it sees that start-ups like Wealthfront, Personal Capital, and Betterment have all launched robo-advisors as industry disruptors. In retail checkout lanes, it sees Square or Clover or Paypal Here taking in credit card payments on behalf of millions of small-time merchants.
It sees that the future of banking is not only about Big Data analytics, but also about calling

Table 1: Top 55 automakers and component suppliers

Company	Score	Rank
Tesla Inc.	100	1
General Motors Company	98.357	2
Volkswagen A.G.	93.221	3
Ford Motor Co.	82.265	4
Toyota Motor Corporation	82.235	5
Nissan Motor Co., Ltd.	81.442	6
Bayerische Motoren Werke A.G.	71.473	7
Daimler A.G.	69.570	8
Peugeot S.A.	63.488	9
Visteon Corporation	59.146	10
Honda Motor	56.223	11
AB Volvo	53.885	12
Renault	47.907	13
Ferrari N.V.	47.710	14
Robert Bosch Gmbh	47.094	15
Fiat Chrysler Automobiles N.V.	43.215	16
Brilliance China Auto Holdings	42.935	17
Audi A.G.	42.428	18
Continental A.G.	41.911	19
Valeo S.A.	41.208	20
Denso Corporation	38.351	21
Cooper-Standard Holdings Inc.	36.989	22
Baic Motor Corporation Ltd.	35.015	23
Skoda Auto, A.S.	34.876	24
Guangzhou Automobile Group	33.444	25
Yamaha Motor Co., Ltd	32.383	26
Fuyao Glass Group Industries	31.058	27
Hyundai Motor Co., Ltd.	29.133	28
Jaguar Land Rover Ltd.	28.849	29
Aptiv Plc.	28.638	30
Suzuki Motor Corporation	27.926	31
Byd Company Ltd.	27.702	32
Geely Automobile Holdings Ltd.	27.568	33
Magna International Inc.	27.077	34
Mitsubishi Motors Corporation	24.689	35
Chaowei Power Holdings Ltd.	24.134	36
Mazda Motor Corporation	22.551	37
Subaru Corporation	22.213	38
Tata Motors Ltd.	21.093	39
Beiqi Foton Motor Co., Ltd.	20.672	40
Kia Motors Corporation	17.535	41
Isuzu Motors Ltd.	17.462	42
TS Tech Co., Ltd.	17.074	43
Haima Automobile Group Co.	13.603	44
Paccar Inc	11.671	45
Aisin Seiki Co., Ltd.	11.655	46
Saic Motor Corporation Limited	10.135	47
Mahindra & Mahindra Limited	8.539	48
Harley-Davidson, Inc.	7.375	49
China Faw Group Co., Ltd.	6.358	50
Anhui Jianghuai Auto Group	5.043	51
Jiangling Motors Corporation	4.127	52
Dongfeng Motor Group Co., Ltd.	2.925	53
Chongqing Changan Auto Co.	0.181	54
Great Wall Motor Co., Ltd.	0	55

Source: see Appendix

on and bundling a group of financial services that happen in real time and with little human interaction. A smart infrastructure that automatically interacts with customers, continuing to improve its algorithm and adjust its response without human supervision as it handles data gushing in from all around the world at millions of bytes per minute, is tantamount to one giant leap forward for every banking incumbent.

Deep-learning-based programs can already decipher human speech, translate documents, recognize images, predict consumer behavior, identify fraud, and help robots "see." Most computer experts would agree that the most direct application of this sort of machine intelligence is in areas like insurance and consumer lending, where relevant data about borrowers – credit score, income, credit card history – is abundant, and goals such as minimizing default rates can be narrowly defined. This explains why, today, no human eyes are needed to process any credit request below USD 50,000. For these businesses, the question of where and how to deploy AI is easy to answer: find out where a lot of routine decisions are made, and substitute algorithms for humans.

But data can be expensive to acquire, and investment conventionally involves a trade-off between the benefit of more data and the cost of acquiring it. For many traditional banking incumbents, the path to AI is anything but straightforward. Managers are often tasked with considering how many different types of data are needed. How many different sensors are required to collect data for training? How frequently does the data need to be collected? More types, more sensors, and more frequent collection mean higher costs along with the potentially higher benefit. In thinking through this decision, managers are asked to carefully determine what they want to predict, guided by the belief that this particular prediction exercise will tell them what they need to know. This thinking process is similar to the "re-engineering" movement of the 1990s, in which managers were told to step back from their processes and outline the objective they wanted to achieve before re-engineering began. It is a logical process, but it is the wrong one.

Consider the process of shopping at Amazon. Amazon's AI is already predicting your next purchase under "Inspired by your browsing history." Experts estimate the AI's success rate at about 5%, which is no small feat considering the millions of items on offer. Now imagine if the accuracy of Amazon's AI were to improve in the coming years. At some point, the prediction would be enough to justify Amazon pre-shipping items to your home, and you would simply return the things you did not want. That is, Amazon would move from a shopping-then-shipping model to shipping then shopping, sending items to customers in anticipation of their wants. The complication lies in when Amazon should introduce this AI-driven fulfillment service. With the underlying technology improving, Amazon might choose to launch such a service just a year ahead of the competition, when the AI prediction is not yet perfect, and suffer a hit on returns and a dip in profitability. Why? Because launching the service slightly sooner will give Amazon's AI more data sooner than the competition, which will mean its performance will improve slightly faster than that of others. Those slightly better predictions will in turn attract more shoppers, and more shoppers will generate more data to train the AI faster still, leading to a sort of virtuous cycle.[1]

In fact, this data intelligence is the only first-mover advantage that matters. It grows from a positive feedback loop. The more data that is used, the more valuable the business becomes, since getting relevant data in quantity is always difficult and expensive. This is why Google Maps becomes more accurate as more people use it: the underlying algorithms have more data to work with, so the apps become even more accurate. Google has made two decades' worth of investments to digitalize all aspects of its workflow, but not because it has a clear notion of what it wants to predict. It had done so before a clear notion of AI fully emerged. This is the groundwork that must be laid before a well-defined strategy for effective AI can be established, which means the conventional budget allocation will not work for banking incumbents seeking to scale their footprints in the age of AI. They have no choice but to follow a disruptive playbook, but with a twist.

How understanding disruption helps strategists

In the early 1990s, Professor Clayton Christensen of the Harvard Business School noticed an interesting pattern among companies facing the emergence of a new technology. When technological progress was incremental, even if the increments appeared in rapid succession, powerful incumbents always triumphed. Companies that were endowed with vast resources, extensive networks of suppliers, and a loyal customer base were able to command great advantages over their rivals, as would be expected. This is what made IBM a formidable player in the computing industry and General Motors a bellwether organization in the automotive industry.

1. For an excellent analysis of this thought experiment, please refer to Prediction Machines: The Simple Economics of Artificial Intelligence by Ajay Agrawal, Joshua Gans, and Avi Goldfarb. https://www.amazon.com/dp/B075GXJPFS.

And yet, there is a class of technological changes in which the new entrant – despite far fewer resources and no track record – almost always topples existing industry giants. This special class of technological changes, Christensen noted, does not have to be sophisticated or even radical.

Take transistor television as an example. When RCA first discovered transistor technology, the company was already the market leader in color televisions produced with vacuum tubes. It naturally saw little use for transistors beyond novelty, and decided to license the technology to a little-known Japanese firm called Sony. Sony, of course, could not build a TV out of transistors, but it did manage to produce the first transistor radio. The sound quality was awful, but the radio was affordable for teenagers who were delighted by the freedom to listen to rock music away from the complaints of their parents. Transistor radios took off. Still, the profit margins were so low that RCA had no reason to invest further. It was busy making serious money and investing every R&D dollar on improving vacuum tube color TV.

Sony, meanwhile, was looking for the next big thing. It launched a portable, low-end, black-and-white TV at a rock-bottom price, targeting low-income individuals. Called the "Tummy Television," it was tiny enough to perch on one's stomach – the antithesis of RCA's centerpiece of middle-class living rooms. Why would RCA invest in transistors to make an inferior television for a less-attractive market? It did not.

The real trouble began when Sony finally pushed the transistor's performance to produce color TVs based entirely on the new technology. Overnight, RCA found itself trying to catch up on a technology that it had ignored for the past three decades, which it had ironically pioneered and licensed out. Christensen called this type of technology – inferior at first but immensely useful later – disruptive, a term that has since been immortalized in the business lexicon of executives, consultants, and academics.

What we see today in the financial industry are new entrants leveraging digital interfaces and AI decision-making processes that involve minimal manual work to target an underserved market segment. Their technologies cannot satisfy high-end banking customers yet. But like the desktops that displaced minicomputers, or the angioplasty that displaced open-heart surgery, AI and digital automation will inevitably improve and, one day, these new solutions will be able to meet a substantial part of the need among big clients. The implication is that there will always be space for manual-intensive, human-centric operations, but that space will shrink substantially in the future.

One logical solution is for banking incumbents to create a separate unit and launch "speed boats" that adhere strictly to the playbook of digital disruptors. These will target an underserved market, and provide security services on a digital platform, with minimal human intervention. Initiatives like this are meant to develop a new set of capabilities – advanced analytics, dynamic product deployment, linking to third parties to fill a sudden surge in market demand – initially targeting a new segment that does not interfere with the mainstream business of the current banking operation. Over time, such new businesses will develop crucial capabilities that will mature enough to be transplanted back into the mainstream. This approach prevents the often-heard refrain of IT large-scale transformation: overtime, overbudget, and with underwhelming market results. In a way, it is RCA launching Sony's transistor radio, but keeping ownership of it to get future technologies ready.

And here is one last twist. Scaling up a disruptive business will always be costly. The company will suffer financial loss for years, if not decades, and in the foreseeable future, will be unlikely to achieve the level of profitability of the core business. BMW has been profitable for a very long time; Tesla is still operating at a loss today, as is Uber.

From Amazon to Square to Ant Financial, profitability is not the most important metric for managers; user base and market share are. This is why banking incumbents need to consider an alternate investment structure, allowing third parties, venture capitalists, and even competitors to take an equity stake. Such a structure seems controversial, but is not unprecedented. Alibaba does not own all of Ant Financial. After exiting China, Uber now owns a minority share of its Chinese rival Didi. This is also the new strategy of GM's CEO Mary Barra, and it paid off handsomely in May 2018 when SoftBank announced a USD 2.25 billion investment in Cruise Automation – the self-driving unit of General Motors, headquartered in San Francisco. The investment pushed Cruise, originally purchased by GM for USD 581 million, to USD 11.5 billion. It takes more than just vision, belief, passion and experimentation in AI to transform a company. It takes a pocket so deep that it requires other people's money to act on that aspiration. It is an unconventional approach taken during an unconventional time.

One last flashback…

Adjacent to the Mercedes-Benz museum in Stuttgart, Germany is one of the largest Mercedes dealerships in the world, which we also visited during the autumn of 2018. Its cavernous main hall is preceded by a restaurant, a café, and a shop hawking Mercedes-Benz merchandise. We saw a vertical banner stretching from the ceiling to the floor along the glass panels on one wall. "Ready to change," the banner cheered. "Electric intelligence by Mercedes Benz." It referred to Concept EQ, a brand of electric plug-in models first unveiled in Stockholm on 4 September 2018. There were three EQs on display next to an exhibition kiosk that did not work, but instead displayed an error alert and tangled cables spilling from the back that had come unglued.

Then, on the top floor, visitors were gawking at a Mercedes-AMG, known for its "pure performance and sublime sportiness." Here was a vision of a forward-looking sports car with all its driving pleasure fully realized. The risers and the wrap-around LCD walls only accentuated the carbon-fiber composite of the chassis, gleaming in matte black. But we also noticed that the CO2 emissions rating of this Mercedes AMG GT 63 S, with its 630 horse-power, was an F.

Appendix

This appendix presents a short description of the calculation behind the "Leap readiness index" for the automotive industry in 2018. This index includes the top 55 automakers and component suppliers by revenue by the end of 2017. The ranking measures four factors: (1) financial performance, (2) employee diversity, (3) research and development, and (4) early results of innovation efforts. These four main factors are tracked by 17 separate indicators that carry the same weight in the overall consolidated result.

All of our 17 indicators are hard data, i.e. they are publicly available from company websites, annual reports, press releases, news stories, or corporate responsibility reports. In order to calculate the "Leap readiness index," we first manually collected historical data for each individual company. We then performed calculations for each indicator (e.g. 3-year compound annual growth rate) before we normalized criteria data by scaling it between 0 and 1.

For "early results of innovation," we identified five key trending topics in the automobile industry. These were autonomous vehicles, electric vehicles (EVs), shared mobility, connected cars, and corporate venturing. We consulted Factiva – a global news database that covers all premium sources – and counted the number of press releases on each trending topic over the past three years (2016–18). We then conducted the same normalization for these five indicators. Finally, we aggregated indicators to build the overall ranking. For the purpose of comparison, we have ranked each company from 1 (best) to 55 (worst) on a scale of 0 to 100.

Financial performance	**Employee diversity**	**Research and development**	**Early results of innovation**
% of international sales last year	% of women employees	3Y CAGR	Press count on
3Y CAGR turnover	% of women management	R&D intensity	"autonomous vehicles"
3Y CAGR mkt cap	board members	3Y average R&D intensity	Press count on "EVs"
3Y average profit change	CEO demography	3Y CAGR	Press count on "connected cars"
P/E ratio last year	Headquarter competitiveness	R&D expenses	Press count on "sharing mobility"
			Press count on "corporate venturing"

Economic security in the gig economy

Giuliano Bonoli
University of Lausanne

One of the most disruptive ways in which technology is changing the world of work is without doubt the so-called "gig" economy, where unlike the traditional firm-based model, work is not performed by employees, but by freelancers (or "giggers") who are hired only for the time it takes to perform specific tasks (De Stefano 2016; Sutherland and Jarrahi 2018).

Thanks to internet-based platforms, gig economy companies connect sellers and buyers of almost any service. Uber was among the first companies to develop this model and is still the best-known gig economy giant. This business model has spread rapidly – first to other low-skill services such as domestic chores (TaskRabbit) or care needs (Care.com), and now to higher-skill jobs. Anyone can hire computer programmers, designers, ghostwriters or even business consultants on general web-based platforms such as upwork.com or dedicated platforms like 99designs.com for designers or 10eqs.com for business consultants. Since these jobs do not necessarily have to be performed locally, the high-skill segment of the market for freelancers is clearly international. In the gig economy, talent can be traded on a global scale.

What exactly do we mean by gig economy?

There are, at least, two different types of gig work. The best-known type is on-demand work, facilitated by internet-based apps and platforms that connect service sellers and buyers in local markets (e.g. Uber, TaskRabbit, Handy.com, Care.com and so forth). But there is also crowdwork, which can be performed by workers based anywhere in the world as long as they have access to a computer. They execute simple tasks for which they are paid usually small amounts, typically a few cents per task. One of the best-known crowdwork platforms is Amazon's Mechanical Turk.

The sort of tasks performed by crowdworkers are called "human intelligence tasks" and cannot be outsourced to machines, e.g. filling in psychology questionnaires or training machine learning algorithms in face recognition.[1]

How big is the gig economy now? This apparently simple question is in reality extremely complex (Abraham et al 2018). First, of course, there is the definitional issue. What precisely counts as a gig economy firm? The same applies to workers. Is it enough to drive for Uber once a month to qualify as a gig economy worker? Academic work has tended to use a definition implying that gigging is the main or sole source of income. Estimates using this definition give relatively low numbers, ranging from 0.5% to 3% of the workforce for the USA and Western Europe (e.g. see Katz and Krueger 2016; Huws and Joyce 2016; Eichhorst et al 2016). Broader definitions to include workers who supplement other sources of income are in the region of 10%–15%. The gig economy is still marginal, but is widely recognized for its enormous potential. It is easy to envision a

1. Face recognition software must be calibrated so that it identifies individual persons in pictures taken from different angles, lighting conditions, etc.. In order to do this, the software needs to be "trained" i.e. exposed to thousands of pictures of people and informed when recognition is successful. In this way, the software "learns" what precisely to look for to improve its face recognition performance. Taskers are simply asked to say if two pictures are of the same person or not.

future in which many firms will consist of a core of essential staff who buy talent when and where it is needed.

The gig economy as a gate to employment and income for everybody?

What are the consequences of such disruptive technological change for workers? The debate on the gig economy provides us with various scenarios. The true digital optimists believe that not only consumers, but also workers will benefit from the increased flexibility and empowerment that come with being self-employed, such as having greater control over work schedules, clients, jobs and projects. In fact, this vision is very far from reality for most gig workers. Take Uber drivers, for example, who in theory could benefit from all this. In reality, if they want to obtain a reasonable income, they have to drive around for several hours every day, often just waiting for a client to call. Things may of course be different for high-skill gig workers, such as business consultants or artificial intelligence specialists.

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Socially minded gig economy gurus and executives, above all in America, propagate the optimistic view of the gig economy. The narrative is often one of new forms of work providing a kind of last resort safety net for poor people – a safety net that the state is no longer capable or willing to guarantee. The internet is full of quotes from new economy big names who argue this. David Plouffe, who ran the 2008 presidential campaign for Barack Obama and is a now a strategic advisor to Uber, says: “we’re discovering that platforms like Uber are boosting the incomes of millions of American families. They’re helping people who are struggling to pay the bills, earn a little extra spending money, or transitioning between jobs.”[2] Stacy Brown-Philipot, the CEO of TaskRabbit who grew up in a disadvantaged Detroit neighborhood, sees the gig economy as an opportunity to “create everyday work for everyday people.”[3] Could the gig economy really be replacing the fading welfare state?

Then there are the pessimists who see the kind of work provided by internet-based platforms as insecure and alienating. In their eyes, gig work represents the ultimate stage in the casualization of work and the destruction of workers’ rights, where even the most basic rights such as health and safety may be at risk (Graben 2017). From this perspective, gig economy workers are like employees without workers’ rights. As a result, most of them should in fact be considered as employees and be entitled to the standard package of employee rights such as minimum hourly wages (where they exist), holidays, sick pay, unemployment insurance, and old age pensions. Moreover, gig economy workers do not benefit from the traditional instruments that democracies have developed to make sure that workers’ rights are respected, such as collective bargaining and trade union representation (Johnston and Land-Kazlauskas 2018).

As always, reality is in the middle. Platforms like Uber or TaskRabbit do provide access to income streams to people who would find it extremely difficult to compete in the regular labor market. This is above all the case for unskilled workers. Today, in most advanced economies, there is a huge surplus of unskilled labor. Companies are looking for talented employees with technical and people skills, and those people without specialist skills or training are having a hard time. The gig economy can help them in two ways. First, access to an income is relatively easy. Second, the services provided by gig economy freelancers are cheaper than those provided by traditional firms. Lower prices mean higher demand and hence more work to be shared by the large pool of unskilled workers.

But having access to an income stream is not enough. Freelancing of the kind that takes place through internet-based platforms has two main shortcomings. One is the lack of short-term income security. Revenues for giggers can be unpredictable. For those who perform simple tasks, revenues also tend to be low, so that it is

2. https://www.uber.com/newsroom/1776/

3. https://www.marketplace.org/2017/03/16/business/corner-office/taskrabbit-demand-chore-company-doubles-number-cities-it-operates

difficult for them to finance even short periods of inactivity with the income they generate while working. Hence, in order to keep afloat, giggers need to provide more than full-time availability to make sure that they do not miss earning opportunities. Uber drivers, for instance, complain that to earn a decent income they need to stay idle while waiting for clients to show up (Dudley 2017). Things may be easier for workers at the high end of the gig economy, where higher hourly earnings allow them to compensate for idle periods.

Some level of short-term economic security is essential to be able to lead a "normal" life, which by most definitions would include having a family, renting or buying accommodation, and planning for the future. It is doubtful that gigging alone can provide this.

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> Some level of short-term economic security is essential to be able to lead a "normal" life.

On top of the uncertainty regarding demand for services, there are obviously also issues with availability. Few people can be available all the time. Parents of small children must organize their time around the care needs of their offspring. In addition, people are sometimes ill, and the pressure to work when feeling unwell can be very strong. In the UK, there was an outcry when a delivery driver who suffered from diabetes passed away after he missed appointments at the hospital for fear of being penalized.[4] This is obviously an extreme and rare event, but clearly the situation of having to provide constant availability is incompatible with any notion of quality of life.

The second problem is income security in the long term, which is often problematic – not only for gig economy workers, but for the self-employed in general (Spasova et al 2017). For employees, this security is provided by social insurance. When working, employees and their employers pay social contributions that entitle workers to an income stream if they are unable to work due to social risks such as unemployment, disability or old age. Again, to some extent, access to long-term income security is a matter of earnings. High-skilled, high-earning freelancers can buy insurance cover on the market for all the social risks mentioned above. However, to be able to afford this, they need to be relatively successful. Given current trends in life expectancy, financing one's own retirement alone is a difficult task and requires the capacity to set aside a sizable proportion of income with a certain level of regularity.

Hence it is difficult for high-skilled professionals to buy insurance against social risks and virtually impossible for low-skilled workers. Drivers, taskers or carers who barely manage to earn a reasonable living now are unlikely to be able to save for their retirement or to insure themselves against risks such as illness or disability. Of course, some of them might transition to standard jobs. But this may not be the case for the majority, especially since the trend seems to be toward more gig work.

The gig economy, like most disruptive technological innovations, is both an opportunity and a threat for social cohesion and stability. It is an opportunity because it is inclusive by nature. There are very few obstacles for motivated individuals who want to participate in it. It is a threat because the rewards it offers for participation are very far away from what we consider as a socially acceptable way of living in advanced economies. Society, governments and firms still need to find a balance between flexibility and security around this disruptive but very efficient solution to create markets for talent.

What can be done?

Unsurprisingly, there is little consensus on how to provide a reasonable level of economic security to people working in the gig economy. Some argue that enforcing existing legislation would be enough, and giggers should simply be considered as employees and receive employee rights. This solution is often favored by the trade unions and governments. However, it is not applicable everywhere. First, some giggers are true freelancers who chose to be self-employed and who work for several clients, so that there is no legitimate reason for governments to reclassify them as employees. Second, forcing standard employee status on gig economy workers may destroy the business model, which is based on low-cost and low-priced services. This would mean denying access to work and income to those who are profiting from the opportunities provided by the gig economy.

Some argue in favor of adapting existing systems to the emergence of new forms of work. In the specialized literature, one can find several ideas such as creating new legal statuses

4. https://www.bbc.com/news/uk-england-dorset-42946855

(e.g. independent workers) or expanding the definition of employee to encompass the new forms of work (e.g. see Stewart and Stanford 2017). It may be the case that the traditional social insurance-based solutions are unsuitable to the very nature of the gig economy. What is certain is that current legal regulations are finding it hard to accommodate new forms of work such as gigging, as shown in Chapter 4 on legal and ethical challenges.

We may need more innovative solutions. In its recent report on the changing nature of work the World Bank argues that "traditional provisions of social protection based on steady wage employment, clear definitions of employers and employees, and a fixed point of retirement are becoming increasingly obsolete" (World Bank 2019: 14). Let us not forget that the social insurance systems in place today are a legacy of the early days of industrialization. Social insurance was invented in 19th century Germany by Otto von Bismarck and it is at least questionable whether this model is suitable to today's working world. Without a doubt, social insurance is still needed for the majority of workers who continue to fit in the standard pattern. But it needs to be complemented or supplemented by other forms of social protection.

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> The idea that social protection needs to be adapted to the changing nature of work is now firmly embedded in public debates.

The idea that social protection needs to be adapted to the changing nature of work is now firmly embedded in public debates. The most striking proof of this is the impressive return on the scene of an old idea: universal basic income (UBI) paid unconditionally to every citizen. The idea has gained renewed popularity precisely in relation to fears of robots taking over more and more jobs, and work becoming ever more precarious. Interest for UBI is strong in Finland, where an experiment has been set up to study how people's behavior changes if they receive money from the state with no conditions attached.[5] It is also strong in Switzerland, where proponents of basic income were able to benefit from this country's direct democratic institutions and to organize a referendum. The vote, which took place in 2016, saw a clear victory of the "No" camp (77% voted against the idea of a basic income6). Rather surprisingly, the World Bank also seems interested in basic income programs as a possible strategy to adapt social protection to changes in the way people work (World Bank 2019: 109–112).

Basic income is a very attractive proposition because of its simplicity and its capacity to solve several problems that plague current societies and social policy interventions (Van Parijs 1992). Since it is universal, people are not penalized if they work, which is what happens with most existing social welfare schemes where extra income results in benefit reductions. It provides help to everybody, so that there is no risk of leaving anyone behind. However, it has two downsides. First, there is nearly total uncertainty with regard to its economic impact and more precisely its impact on the labor market. There have been a few experiments, but it is very difficult to generalize the findings of time-limited experiments based on experimental samples to determine what will happen in the long run if a universal basic income were to be introduced. Potentially, such a program could radically reduce labor supply in ways that could affect the prosperity of modern economies and ultimately their ability to finance a basic income. The second problem is political feasibility. As shown by the Swiss vote of 2016, it is difficult to gather a majority around the idea of providing an unconditional income to people without any form of reciprocity.

In the end, a universal basic income may not be the panacea for today's problems, but the welfare state still needs to be adapted. Less ambitious programs such as in-work benefits or universal child allowances seem promising and considerably more feasible. In-work benefits are similar to a negative tax and are paid to workers (employees and self-employed) with earnings below a given threshold (OECD 2003). The benefit is generally calculated so that an extra unit of income reduces the benefit by a smaller amount, typically around 50%–60% of the increase in earnings. The result is that there is always an incentive to work more for those who

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5. See: https://www.kela.fi/web/en/basic-income-experiment-2017-2018

6. See: https://www.swissinfo.ch/eng/directdemocracy/vote-june-6_basic-income-plan-awaits-voters-verdict/42200378

receive this form of help. In-work benefits exist in most countries, but tend not to react to rapid income fluctuations. In today's hyper-connected world, it is not so difficult to imagine a system of income supplements that are adapted in real time to the changing income of gig economy workers. The welfare state should also exploit the advantages that new technologies can offer. In-work benefits exist and are a promising way to top up the incomes of workers with insecure earnings. They need to be adapted to today's working world in a way that preserves incentives to work.

> "The challenge before us is to preserve the high levels of social cohesion and economic security achieved in the past.

Another alternative would be to improve the financial support given to households with children. In fact, the uncertainty due to income fluctuations is especially a problem for families. Adult-only households are much more able to cope and adapt. Many OECD (Organisation for Economic Co-operation and Development) countries provide child allowances, i.e. benefits that are paid to households with dependent children. These could be strengthened and connected to the debate on basic income. Some have argued in favor of a "child basic income" (Atkinson and Marlier 2010). Relative to the general basic income, this option would be more affordable and at the same time more likely to provide support where it is most needed. A child basic income, independent from earnings, would also be favorable to work incentives.

These debates show that the disruptive technological change and the transformation of work are generating new ideas with regard to the reform of the social protection systems that we have inherited from the industrial economies of the postwar years. The challenge before us is to preserve the high levels of social cohesion and economic security achieved in the past in this newly emerging economic and technological world.

Obviously, the implications of this challenge go beyond the narrow field of social policy. Preserving some form of social cohesion is essential in modern democracies. Otherwise, those who feel left behind tend to turn to anti-system political parties with unpredictable consequences for the preservation of our prosperity and way of life. As shown in Chapter 1 on technical change, the occupational structure is changing and society needs to understand that, given the surplus of low-skilled labor in all advanced economies, a substantial effort will have to be made to support the living standards of those who cannot participate in mainstream wealth creation processes. This has to be done intelligently, i.e. in a way that preserves work incentives while at the same time protecting the weakest members of the workforce from poverty and exclusion. The technological transformations that we have witnessed in recent years have the potential to produce enormous gains in terms of quality of life. The dark side is polarization and a very real risk of exclusion for some workers. Public policy must make sure that society as a whole will profit from this tremendous opportunity and that it will do so in an inclusive way.

AI: Legal and ethical challenges

Bettina Hummer
University of Lausanne

As the preceding chapters have shown, artificial intelligence (AI) is modifying our society deeply. Sophisticated technologies diversify human activity, the internet encourages new forms of work, and businesses that would like to further develop artificial intelligence are facing serious innate challenges. Accordingly, labor markets are likely to undergo significant changes, along with employment laws, social welfare and public policy. How can we ensure that computer technology and artificial intelligence will improve the working world and benefit people in the end?

Some ethical and constitutional fundamentals

Modern data processing technologies enable us to define solutions that are based solely on numbers, mechanics and electronic equipment, without a human brain as a middleman. Hence, the use of these technologies may endanger an individual's rights if ethical, cultural or social values are left behind. Values are what humanity is all about and should protect us from scenarios where machines decide people's futures. They radiate into the field of work where employees, employers and other contracting partners must treat each other with fairness. The European Union's General Data Protection Regulation (GDPR) puts it in a nutshell by saying that "e-recruiting practices without any human intervention" cannot be conducted without the consent of the person affected. But e-recruiting is by far not the only technology that springs to mind when we talk about mutual respect in the working world. What if the computer evaluation of employees (e-rating or e-profiling) were to automatically lead to the exclusion or dismissal of employees without the employers' involvement, i.e. leaving machines to perform the unpleasant tasks in contractual relationships? These are just some examples of how important it is to consider measures protecting people against potentially life-changing automated decisions and their consequences.

Human dignity is a philosophical concept that is now anchored in many international treaties and national constitutions. In the workplace dignity requires human intervention. Putting a person's decision or a "wall" (Sève 2011) between the machine and the data subject becomes all the more important as computers might develop concepts they are not directly programmed for. The problem is not new; as Serge Gutwirth observed more than 20 years ago – technology "can program life up to a point by excluding certain behavioral alternatives" and promote "the use of statistic projection in the decision-making process" (Gutwirth 1997, p. 75). There is no doubt that data gathered by computers is an enormous resource and, if used properly, can have far-reaching benefits for the labor market. But, like any other methods or techniques, the use of information technology and AI needs to follow some basic ethical and legal guidelines.

Framing the use of AI

First, persons or employees affected by data processing must be able to respond and freely voice their opinions in surveys and other automated procedures, and choose whether to participate in e-managed programs and applications or not. For example, the EU's GDPR defines personality profiling as "evaluating the personal

aspects relating to a natural person, in particular to analyze or predict aspects concerning the data subject's performance at work" and individuals "should have the right not to be subject to a decision … which is based solely on automated processing" (recital 71 GDPR). Moreover, the related provision requires explicit consent from the data subject (Art. 21 GDPR).[1]

But even in countries where the GDPR is not directly applicable, such as Switzerland or countries outside the EU and the European Economic Area, the employee's veto right may derive from the right to data-related self-determination in contractual relationships. Article 8 of the European Convention on Human Rights (ECHR) includes the right of respect for privacy, including correspondence (e.g. letters, telephone calls and emails) and thus has a bearing on the interpretation of national labor law (Pärli 2015, p. 17). In many European countries, the employee's right to privacy cannot be readily waived by the labor contract2 and violation of this right may have significant consequences. In the 2017 "Keylogger" case in Germany, for example, the court ruled that the employer could not use computer-based evidence to justify the dismissal of a worker who frequently carried out private activities during working hours.

"There is no doubt that data gathered by computers is an enormous resource and, if used properly, can have far-reaching benefits for the labor market.

Besides the data-related right of self-determination, equality of treatment also plays a key role in preventing unfair decisions in the working world. Similar to data protection, equality is a fundamental right that protects workers from being subject to automated decision-making that would apply only to certain groups such as women, disabled persons or migrants. Scientific research, for example, has shown that intelligent software is able to perform facial recognition of persons and put them in categories according to their gender, age, or color of their skin (Wagner 2016). Such possibilities can lead to inequitable and discriminatory decisions if there is no human wall to prevent them. That said, societies must also recognize the tremendous potential offered by smart technologies, or, in the words of Andrus Ansip, Vice-President and Commissioner at the Digital Single Market at European Commission, "From better healthcare to safer transportation, the benefits of AI are many and Europe should grab them" (EU Commission June 2018).

Using AI for the benefit of coming generations

While research and free entrepreneurship are fundamental principles of open democratic systems and must be considered when regulating the commercial use of new technologies, national constitutions and international agreements are starting to impose obligations on states and organizations with respect to the next generations. Sustainability or the concept of intergenerational justice looks to the future, particularly by protecting the environment, but also by using new technologies in a mindful way and ensuring prosperity. A field where we can also find constitutional rules that are binding legislators is education and continued learning. In many countries, access to education is, if not an individual right, at least another constitutional aim that must be observed when preparing the society for new forms of work.

In Switzerland, for instance, the Confederation and the cantons must jointly ensure the high quality and accessibility of the "Swiss Education Area" (Art. 61a Swiss Federal Constitution) and the Confederation should "promote scientific research and innovation" (Art. 64 Swiss Federal Constitution). To make the digitalized world function successfully, societies will indeed have to invest money in education as well as research. In September 2018, the Council of the European Union created the European High Performance Computing Joint Undertaking (EuroHPC JU) public-private partnership to "pool European resources to develop top-of-the range exascale supercomputers for processing big data, based on competitive European technology."[3]

1. In the same manner, Art. 24 of Regulation (EU) 2018/1725 grants the right not to be subject to a decision based solely on automated processing when EU institutions or EU bodies are involved.

2. See or example Art. 328b CO and for further details Fanti 2017, p. 230 et seq.

3. The EU-Commission and its priorities: https://ec.europa.eu/digital-single-market/en/eurohpc-joint-undertaking.

The Council Regulation governing the EuroHPC JU expressly mentions artificial intelligence as a phenomenon that can underpin "personalized medicine, connected and automated driving or other lead markets," with the aim of promoting Europe's "wider competitiveness goals" and to leverage private investments and help tackle societal challenges.[4]

Besides financial input, the EU Commission is currently debating whether European legislation should not be more flexible in terms of data re-use and data sharing because "data is the raw material for most AI technologies" (EU-Commission April 2018). At the national level, Scandinavian countries are already on the way to reconciling artificial intelligence with the Nordic Welfare System. According to Asa Zetterberg, the Swedish government's Chief Digital Officer, for example, Sweden sees massive potential in using artificial intelligence for "competitiveness, jobs, welfare and sustainable development."[5]

> "But, like any other methods or techniques, the use of information technology and AI needs to follow some basic ethical and legal guidelines.

The opportunities of enhancing economic growth by using and developing artificial intelligence are indeed many. Researchers predict a shift to more skilled work that will affect many professions along with momentary shortages in workforce because artificial intelligence needs a tremendous amount of know-how (Schieferdecker 2017, p. 67, Worbel 2017). Even industries that are not directly involved in computer technology, such as healthcare, retailing, manufacturing, construction and insurance (Brulhart 2018, p. 51), to name a few, should see their business potential increase. In short, one does not need to be a programmer, an engineer or a mechanic to find work in the digitalized world. People with language proficiency, medical and biological knowledge, as well as business acumen and many other professional skills will be necessary to develop, support and commercialize artificial intelligence in all branches of the economy and businesses of all sizes.

Shaping work relations and social welfare on the threshold of the Digital Revolution

Today's working world is ruled by social standards such as employment law, social security and welfare. With the age of digitalization, these rules are being challenged in many ways, ranging from computers and robots threatening job security (Wildhaber 2018) to sufficiently providing for independent contractors and "gig" workers (Witzig 2016). How do we adapt social protection to the digitalized working world?

With respect to AI, employers and employees need to know what happens when a computer does something it was not supposed to do, i.e. comes up with automated solutions it had not been programmed for. This could happen by mistake, e.g. because data the computer has been fed with was fallible, or as a result of the intelligent data processing that makes the computer learn and infer things by itself. Torts caused by automated machines and self-driving cars might be the first cases that spring to mind (Werro and Lubian 2018, p. 69). Although workers' compensation schemes, like mandatory accident insurances and pensions, will often absorb damages, the conditions of liability must be clearly defined.

AI is a technology that may involve unpredictable consequences and should trigger liability based on risk that is independent from fault (like liability for motor vehicles, aircrafts or animals). Besides tort law, contracts must fit to new working conditions. What if the e-recruiting system used by a company makes a release that could be considered as discriminatory, towards a female applicant for example. According to existing laws, such statements can be directly imputable to the person controlling the system, the hiring company for instance.[6] In order to protect workers and candidates efficiently, contract law should ensure compensation in case of violation. It should also state that chatbots or other communication devices may generate legal consequences for the person behind the machine. For the working world,

4. see https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32018R1488

5. https://www.government.se/articles/2018/03/artificial-intelligence-will-strengthen-swedens-welfare-and-competitiveness/ 2018

6. For more details see Grapentin 2018.

it might therefore be wise to start introducing laws to govern these issues possibly along the following lines:

- The person controlling an automated computerized system is liable for damage caused by the system unless he/she proves that he/she took all due care to avoid damage or that damage would have occurred even if all due care had been taken. Liability also extends to infringements of personality rights.

- Statements that such systems address to third parties are binding for the person controlling the system.

A contribution-based pension scheme for retirement or occupational disability and unemployment regardless of formal employment status could be an effective way to collect social contributions and inject them into the various social protection schemes (old age, healthcare, work accidents, unemployment and so on). It would require adjustments to the traditional social security systems that still rely on the idea of a continuous full-time employment relationship between workers and their employers. In addition, our focus should not be restricted to the national job markets and social security systems because digitalization goes hand in hand with globalization. Crowdworking is a good example since it connects people from all over the world via the internet to carry out some gainful activity (European Parliament 2016, p. 1). Therefore, at least European countries should aim at finding a pan-European solution such as specifying a common contribution rate levied on gains earned through crowdworking and crowdsourcing. These contributions would flow into the national social security systems to help absorb undesirable consequences of transitions in the job markets (Kahil-Wolff Hummer 2018).

It should be noted, however, that information technology, and artificial intelligence in particular, can also be used to enhance social protection and should not be reduced to the "we will all lose our jobs" factor. In the past, repetitive and dangerous jobs have been known to result in costs and personal hardships that intelligent technology may help to avoid. Safety is an integral part of IT engineering with the idea that robotics do not create new risks for workers and citizens. Artificial intelligence may also foster professional activities suited to persons with health issues or disabilities that help working parents reconcile family with work, or that protect workplaces from hacking and other types of criminality. And, finally, artificial intelligence may help accelerate social security administration, which has often challenged the effectiveness of social security schemes and can put individual rights at risk. The European Union has now initiated the use of electronic data exchange in all EU member states, the European economic area and in Switzerland – the so-called EESSI (Electronic Exchange of Social Security Information[7]) system, which replaces traditional paper forms, allows cross-border data exchange and – notwithstanding European data protection rules – may become part of IT-assisted public management in the field of social security. There will nevertheless be a need to set up a framework of rules that balance the amount of data required by AI-managed administration and the protection of sensitive personal information.[8]

Conclusion

While inventions have always pushed human activity toward new eras, mankind is not just "pushed." We make decisions – democratically legitimate decisions that organize life and work in order to grant freedom, security and welfare to society. How can we ensure that modern computer technology will improve the working world and ultimately benefit people future generations? Legislators must be aware of the complexities surrounding information technology and artificial intelligence and try to gauge their very "nature" in order to define the aims that regulation should pursue.

7. For more details see Spiegel 2017.

8. The Swiss legislator is about to introduce a rule that allows using smart navigation systems in order to watch insured persons.

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About the authors

Rafael Lalive is a professor in economics at University of Lausanne and a member of several professional networks (CEPR, CESifo, IFAU, IfW, and IZA). He holds a PhD in Labor Economics from the University of Zurich. His key interests include the effects of robots on employment, placing job seekers into technology-resilient jobs and the economic effects of reforms on public policy. His research has been published by various major economics journals and science journals.

Daniel Oesch is a professor of sociology at the University of Lausanne. He is the author of two books “Occupational Change in Europe” (2013, Oxford University Press) and “Redrawing the Class Map” (2006, Palgrave Macmillan) and over 20 articles on social stratification and the labor market. He learnt his trade as secretary of the Swiss Federation of Trade Unions and earned his PhD from the University of Zurich.

Howard Yu is the author of LEAP: How to Thrive in a World Where Everything Can Be Copied (PublicAffairs, 2018), LEGO professor of management and innovation at the IMD Business School in Switzerland, and director of IMD’s signature Advanced Management Program (AMP). A native of Hong Kong, he earned his doctoral degree from Harvard Business School.

Jialu Shan is a Research Associate at The Global Center for Digital Business Transformation – An IMD and Cisco Initiative. She holds a PhD in Economics (management) from the Faculty of Business and Economics at the University of Lausanne (HEC). Her primary areas of interest are digital transformation and digital business models, as well as technological innovation, with a particular focus on Asian market.

Giuliano Bonoli is Professor of social policy at the Swiss graduate school for public administration at the University of Lausanne. He holds a PhD from the University of Kent at Canterbury and previously worked at the Universities of Bath (UK), Bern and Fribourg (Switzerland). His main research topic is the transformation and adaptation of European welfare states. Recently his work has focused on the challenges posed by migration and digitalization to social cohesion. He has published some forty articles in international journals and a number of books.

Bettina Hummer teaches Social Law and Legal German at the University of Lausanne, where she was Dean of the Faculty of Law, Criminal Justice and Public Administration from August 2011 to July 2015. She has been Director of the Institute for Labor and Insurance Law in Lausanne since 2002. Professor Hummer's research is focused mainly on Social Security Law and Free Movement of Persons within the EU. Her last book about Social law of the European Union and associated countries was published in 2017. Since May 2018, she has been a member of the Board of Governors of the International Association of Law Schools (IALS).

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