9. Automation Transforming the Economy

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Technological developments are changing the world and the way we work – on both sides of the Atlantic. New technologies such as self-driving vehicles, 3D printers and artificial intelligence are providing new business opportunities, are transforming whole business sectors and are raising concerns that jobs will be replaced with automated processes. But how justified are these concerns?

Automation and Employment

In general, the impact of automation on employment can be divided into two main types: substitution effects and complementary effects. Substitution occurs where a machine replaces human labor. Based on research by the University of Oxford[1], a Deloitte study focuses on this substitution effect, showing that 48% of all Swiss jobs could be automated[2]. In principle this study demonstrates the scale on which jobs could be taken over by machines because of their profile. Similar numbers have been calculated for other advanced economies, such as 47% for the US. For less advanced economies the number tends to be higher (for example India 69% or China 77%)[3], since a higher proportion of employment in less advanced economies tend to be structured, repetitive occupations, which can be easier to automate.

However, the substitution effect considers only the potential for job losses rather than the impact on total employment. Automation can also have a complementary effect – that is, it can create jobs. Greater automation drives down the cost of producing goods. The interaction between man and machine also increases employee productivity: for example, computers make office staff more productive rather than redundant. Increasing labor productivity leads to higher wages. Falling prices and rising wages improve the purchasing power of consumers, driving up the overall demand for goods and services and creating more jobs. The production and maintenance of digital technology – machines and software – also creates jobs. For this reason, the number of people employed in the ICT (Information and Communication Technology) sector has risen substantially over the years.

In the past, the complementary effects of new technology have outweighed the substitution effects: Automation has created more jobs than it has made obsolete. In Switzerland, for example, a Deloitte study[4] estimates that about twice as many jobs were created between 1999 and 2010 as a result of automation than were lost – about a quarter of Swiss employment growth in that period can be attributed to automation.

Is this Time Really Different?

While there are arguments that “this time really is different” and that therefore in the future automation will lead to higher job losses, there are also a number of arguments that this is not likely.

First, a wide range of occupations are still incapable of being carried out – or carried out efficiently – by machines. These include jobs involving intellectual activities, often in the service sector, and some manual occupations. The scope for automating manual jobs can be overestimated: Machines often require a tailored environment, outside which they cannot function[5]. An example of this concept is the automobile, which functions efficiently only in a dedicated environment – on roads. It is not always possible to adapt a working environment to the needs of machines; one of the greatest human strengths – flexibility – is also one of the biggest limitations of machines. Machines are most efficient when carrying out specialized processes repeatedly. The complementary use of machines and humans – combining human and technological strengths – is particularly productive.

Another counter-argument is that in many cases, automation does not reduce human employability but rather increases it as a result of the complementary effect. As stated above, support from machines increases human productivity. The so-called O-ring principle[6] (derived from the Challenger Shuttle accident, which was caused by a defective O-ring) stipulates that the stability of a system as a whole is only as good as the strength and stability of its weakest element. If this element fails, the entire system fails. Accordingly, automating the weakest element of a human work process – the least productive stage – does not weaken overall performance, but in fact strengthens the process because all activities become more productive.

A third argument is that the extent to which machine learning equals or outpaces human ingenuity is questionable. It is extremely difficult to teach machines to carry out processes that lack clear rules. Although impressive progress has been made in this area, it is based not on genuine artificial intelligence – real understanding – but on a ‘brute force’ approach, the large-scale blind application of the ‘trial and error’ principle. It is possible that as computing performance improves, and with specialist software, self-writing and self-learning algorithms, genuine artificial intelligence will be achieved. However, computers have a long way to go before they can match human intelligence.

Machines are therefore unlikely to displace human employment in the foreseeable future. However, they will continue to transform established sectors, occupations and activities[7]. This has consequences for employees, who will have to undergo training if they are to adapt their competencies in response to the changes. It also has an impact on employers, who will need to consider their future requirements for competencies and expertise. The key question is which competencies and expertise will be needed in the future.

Competencies for the Future

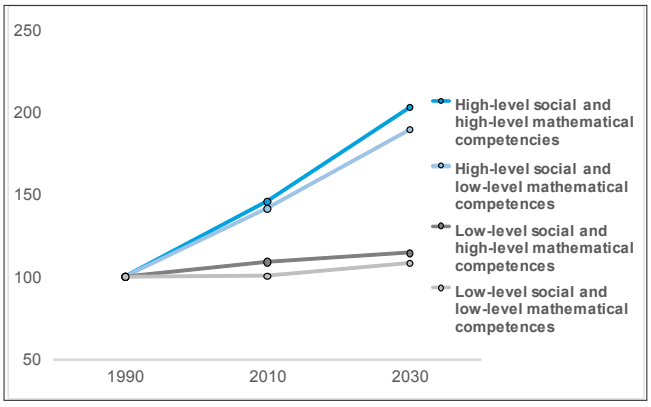
As a Deloitte study demonstrates, there has been a significant increase in the number of jobs in recent years where cognitive abilities and customer service are more important. This reflects the growing importance of a more service-oriented economy. Advanced levels of training and complex problem-solving skills have also become more important for employees.

Creativity and social intelligence in particular are likely to be essential competencies for most new jobs created in the

future. Because these competencies give humans a clear advantage over machines and software, they also offer protection against developments in automation, making jobs 'future-proof'. In the future there will also be greater demand for individuals with excellent mathematical skills and expertise in ICT. Job prospects and protection against automation will be improved for individuals who can combine mathematical and technological competencies with creativity and/or social intelligence, as studies for both the US and Switzerland confirm.

A study by Harvard University[8)] shows that employment and pay levels in the US have dropped or stagnated since 1980 in occupations that require high levels of mathematics with low levels of social competencies. The opposite is true when a high level of both mathematical and social competencies is required. In other words, mathematical competencies are important but confer far greater advantage on the labor market when they are combined with other competencies. In contrast, social competencies appear to be in particularly high demand both alone and in combination with mathematical competencies. The main reason for this is that employees with high levels of social competencies work mainly in non-routine activities that are more difficult to automate and, because of digitalization, increasingly form part of flexible organizational structures and working practices, which require high levels of communication and organizational competency. As the Figure shows, this is the case in Switzerland as well.

Growth in Swiss jobs requiring social and mathematical competencies



Base: 1990=100, 2030 figure estimate

*Source: Federal Statistical Office, O*NET, Deloitte Research*

Humans have an advantage over machines not only for their creativity and social intelligence but also because they can demonstrate versatility and situational adaptability. The latter competencies are important for lower-skilled occupations, where 'craft' and 'psychomotor abilities' are needed, such as cooking and hairdressing.

Implications for Companies

Companies, as well as employees and training institutions, face major challenges in tackling the changes brought about by automation and digitalization. Businesses need to be equipped to find the staff they need and, where possible, have future-proof competencies.

To do this, they need efficient talent management. Talent management that focuses on the needs of individuals and enhances their employability can increase employee motivation and productivity, and improve the attractiveness of companies as employers –issues that are particularly significant in the digital age for recruiting and retaining staff. Digital technologies can be used to facilitate recruitment of new staff. The use and evaluation of social media and mobile phone data in staff recruitment would increase the amount and detail of available information, and improve the accuracy of evaluation. Digital technology can also be used to establish direct contact with job applicants and support the recruitment process, for example through online behavioral tests and video interviews.

Companies also need to invest in their current workforce and provide continuing training so that employees can develop and expand their skills and knowledge. Companies should embed an awareness of further, relevant training within their corporate culture. They should also make use of digital technologies to enhance training provision and opportunities. These include for example social learning and internal forums, enabling employees to help and learn from each other. Further opportunities might exist from setting up an internal video channel or gamification of the learning environment, offering employees incentives for improving their performance by monitoring their own progress or by comparing themselves with others. Depending on the job in question, learning can also take place through virtual reality or simulations. Situation-based learning is often more effective than training based solely on theory, and data analysis can be used for ongoing evaluation and improvement of the effectiveness of different methods, at both individual and company level.

New technologies are therefore not only a challenge; they also provide a major opportunity (1) for countries as an alternative to offshoring to keep employment onshore, (2) for employees seeking higher value-adding jobs, and (3) for companies offering higher productivity and new opportunities to recruit and retain high potential talent.

For more information, please see in particular footnote 4.

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2) Deloitte (2015): Man and machine: robots on the rise? The impact of automation on the Swiss job market.
3) Citigroup (2016), Technology at work v2.0. The Future Is Not What It Used to Be.
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6) Kremer, Michael (1993), The O-ring theory of economic development
7) OECD (2013): OECD Skills Outlook 2013. First results from the survey of adult skills.
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