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What key competencies are needed in the digital age?

The impact of automation on employees, companies and education

Acknowledgements
Deloitte would like to thank all the executives and experts we interviewed for this study for their valuable input.

Contents

1. Key findings

Labour market

Automation generates employment growth
Over recent years, automation has created more jobs than it has destroyed. Of the 800,000 or so new jobs created between 1990 and 2013, some 200,000 can be attributed solely to automation. And in future years, automation is likely to continue to create more jobs than it destroys. It also looks likely that transformation in occupational roles and the shifting of jobs both within and between sectors will accelerate.

Competencies

Increase in knowledge and training intensity
In recent years, there has been a significant increase in the number of jobs where cognitive abilities and customer service have become more important. This reflects Switzerland's move towards a more service-oriented economy. Advanced levels of training and complex problem-solving skills have also become more important for employees.

Creativity, social intelligence and ICT expertise as the competencies of the future
Creativity and social intelligence in particular are likely to be essential skills for most new jobs created between now and 2030. Because these skills give humans a clear advantage over machines and software, they also offer protection against developments in automation, making jobs 'future-proof'. In future, there will also be greater demand for individuals with excellent mathematical competencies and expertise in ICT. Job prospects and protection against automation will be even better for individuals who can combine mathematical and technological competencies with creativity and/or social intelligence.

Niche opportunities: education and training, health, and communications
Some new jobs will be created in areas where total job numbers are relatively low, but where particular competencies will be required. The future will provide good employments prospects for employees with excellent knowledge in the areas of education and training, health, and communications. Although this knowledge may not be crucial to most newly-created jobs in future, it nevertheless offers protection against automation in these 'niche occupations'.

Prospects for lower skilled individuals thanks to flexibility and situational adaptability
Humans have an advantage over machines not only for their creativity and social intelligence but also because they can demonstrate versatility and situational adaptability. These skills are important for occupations requiring fewer or lower qualifications, but where craft competencies and psychomotor competencies are needed, such as cooking and hairdressing.

Education/training system

A well-positioned education and training system with potential for improvement
The permeability and practical orientation of the education and training system and high levels of qualification among employees give Switzerland an advantage in labour market terms. However, the training system must adapt to the challenges of automation and digitalisation. This includes accelerating changes in vocational training, so that it is able to respond rapidly to evolving occupational profiles and skills requirements, and focusing more on basic education in ICT competencies and social intelligence.

Lifelong learning and further training
In addition to the provision of initial (basic) training, further training and retraining will also be important. Employees will have to engage in lifelong learning through further training if they are to be capable of responding as rapidly as possible to changes in skills requirements triggered by automation and digitalisation. However, lower-skilled employees in particular are often less willing to undergo further training. This reluctance could be tackled by measures by the state and employers to raise awareness of its importance.

Companies

Motivating employees through further training
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. This also applies to further training: companies should embed an awareness of the need for relevant further training within their corporate culture. They should also make use of digital technologies to enhance training provision and opportunities.

Greater use of digital technologies improves employee recruitment
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 behavioural tests and video interviews.

2. Introduction: are we running out of work?

Technological change over recent years has been impressive. One example is the development of the mobile phone. Just ten years ago, most people used their mobile phones solely to make calls and send text messages. When the first iPhone was launched in 2007, things changed quickly. Mobile phones are now hi-tech devices equipped with GPS, and internet access, shaping people's everyday lives. The world of work also changed substantially. Using digital devices in general is now an integral part of many occupations, enabling employees to do their job. The ongoing development of digital technology has resulted in the creation of new occupations but also in the disappearance of some existing occupations.

Over the coming years, technological developments such as big data, cloud computing, the internet of things, robotics, artificial intelligence and immersive communications are likely to have a significant impact on the world of work and employment and to trigger far-reaching changes.[1] It is not surprising that this is has raised fears among many employees that there may not be enough work for them in the future. Such concerns are not new: they existed at the time of the industrial revolution in the late 18th and early 19th centuries. And they have never gone away: for example, in 1978 a report in the German news magazine Der Spiegel predicted that the widespread introduction of computers into the workplace would make office staff surplus to requirements.

> "Automated processes in logistics and at distribution centres enable Swiss Post to handle 19 million packets a day promptly and efficiently. Swiss Post is also using drones and delivery robots, and running automation projects in niche areas of the business where we need a greater focus on meeting specific customer needs."
>
> **Claudia Pletscher, Head of Development Programmes and Innovation Management, Swiss Post**

The impact of automation on the labour market

So far, such fears have proved unfounded. Since the first industrial revolution and the first major advances in technology, employment in industrialised nations has risen substantially over the medium-to-long term. Despite the greater deployment of new technology in many sectors of the economy, the number of jobs has actually gone up. Economists have been grappling with this seeming paradox for some time. Most economists considering the impact of automation on employment have taken 'automation' to mean the full range of technological innovations that replace individual work processes formerly carried out manually. Nowadays, though, 'automation' mostly means 'digitalisation' – the transformation of business activities through the introduction and use of information technology.

The explanation for the paradox lies in the diverse effects produced by automation. On one hand, the use of new technologies can result in job losses – a phenomenon referred to as the 'substitution effect' of automation. On the other hand, it can also have a 'complementary effect' – that is, it can actually create jobs. Greater automation drives down the cost of making goods making prices cheaper. The interaction between man and machine also increases employee productivity: for example, computers make office staff more productive rather than making them redundant. Increasing labour 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 so 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 sector has risen substantially over the years.

In the past, the complementary effects of new technology have outweighed the substitution effects: in other words, automation has created more jobs than it has destroyed.[2]

Growth in employment in Switzerland as a result of automation

As a previous Deloitte study has shown, these general findings have also applied to the labour market in Switzerland.[3] For example, between 1990 and 2013 there was little, if any, growth – and, in some cases, there were job losses – in occupations that are relatively easy to automate (that is, those with a high automation probability). In contrast, occupations with a low automation probability were more likely to grow in terms of total job numbers. Overall during this period, there was a net increase of around 800,000 in the total number of jobs. However, since other factors, such as demographic change and globalisation, also influenced this increase in job numbers, the study did not reach a conclusion about how many of the 800,000 new jobs could be attributed directly to automation.

A recent study by the Centre for European Economic Research now enables the direct impact of automation on employment in Switzerland to be calculated accurately for the first time.[4] This research shows that between 1999 and 2010, 103,000 jobs were lost to substitution effects and 234,000 jobs were created as a result of complementary effects (see Figure 1).

Automation therefore created a net total of 131,000 new jobs, which is about one quarter of the total number of jobs created across Switzerland during this time.[5] Applying this same proportion to the years 1990-2013, this would mean that about 200,000 of the 800,000 new jobs created during this period can be attributed directly to automation.

Transformation, not mass unemployment

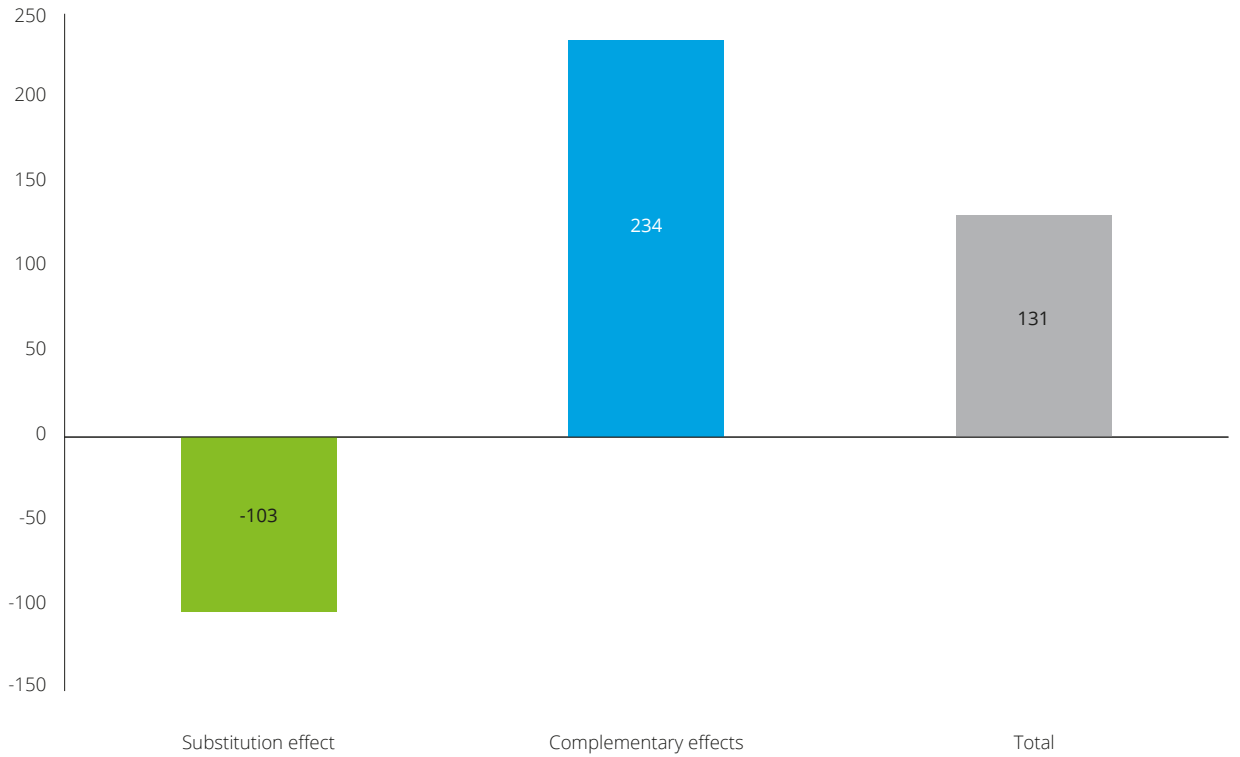
So can we assume that past trends will continue and that job creation will go on exceeding job losses in future? Some economists and forecasters have expressed doubts about to whether this will be the case.[6] One of their arguments is that technological innovation will result directly in fewer new jobs in production and technological maintenance than has so far been the case, and that the complementary effect has therefore lost some of its momentum. For example, in 1990, more than 8% of all employees in the US were employed in occupations created by new technology; a decade later, by 2000, this had fallen to 4%; and since then it has fallen further, to below 1%.[7]

However, the creation of new jobs in the ICT sector has had significant spill-over effects in other sectors of the economy. Calculations by Enrico Moretti, a professor at UCA Berkeley, show that every job created in the hi-tech industry results indirectly in up to five further jobs in the local economy, such as jobs for lawyers and waiters.[8] In other words, although digitalisation now creates relatively few new jobs directly, it has created many indirectly in other industries and sectors, such as consultancy, education and training, and health.

A second argument for the theory that automation will in future produce a net loss of jobs is that technological innovation is now so wide-ranging– for example, in areas such as driverless cars and image and speech recognition – that many jobs can already be done by machines and there is little residual space for human labour.

However, there are a number of counter-arguments to this view. 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.

Figure 1. The impact of automation on job numbers in Switzerland, 1999-2010 (in 1,000)



Sources: Gregory et al. 2016, Deloitte Research

> “The complementary relationship between man and machine is often underestimated. In the past, technological progress has always increased employment in the medium term, though it has also transformed jobs and activities.”
>
> **Dr. Eric Scheidegger, Deputy Director SECO**

The scope for automating manual jobs can be overestimated: machines often require a tailored environment, outside which they cannot function. An example of this concept, which David Autor calls ‘environmental control’[9], is the motor car, which functions efficiently only in a dedicated environment – on roads. A car’s performance will deteriorate in an environment (‘off road’) for which it is not properly equipped. 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 at their best when carrying out extremely specialised processes very efficiently, and the complementary use of machines and humans – combining human and technological strengths – is particularly productive.

A second 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. David Autor calls this the 'O-ring principle'[2], basing his argument on the work of Michael Kremer (1993), who described the principle with reference to the Challenger space shuttle disaster. The disaster was caused by a defective O-ring.[10] The O-ring principle 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 and the remaining human stages, but in fact strengthens them, 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 or unambiguous descriptions something known as 'Polanyi's paradox'). This is a major obstacle to machine learning,[9] and 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. Combining enormous databases, software and immense computing capacity enables computers to outperform human intelligence in controlled comparisons, such as in games of chess. However, the computers lack understanding and show low levels of flexibility and precision. It is possible that as computing performance improves, and with specialist software and self-writing and self-learning algorithms, genuine artificial intelligence may be developed in future. However computers have a long way to go before they can match human intelligence.

Machines are therefore unlikely to take employment away from human beings in the foreseeable future. However they will continue to transform established sectors, occupations and activities. Across the OECD, on average more than 40% of all employees work in companies that, over the past three years, have introduced new technology involving changes to employee activities and competencies.[11]

> "Future automation will not necessarily affect manual jobs more than others. Using robots outside well-defined production facilities is a challenge. In contrast, automation of structured office jobs has advanced rapidly, and greater use of automation and software is more a question of cost than of the technology."
>
> **Volker Stephan, Head of HR, ABB Switzerland**

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 from employees in the future. The following sections of this study explore this question in more detail, and show how competency requirements have changed over the past 25 years and how they are likely to change in future.

3. How did the competencies required by the labour market change between 1990 and 2013?

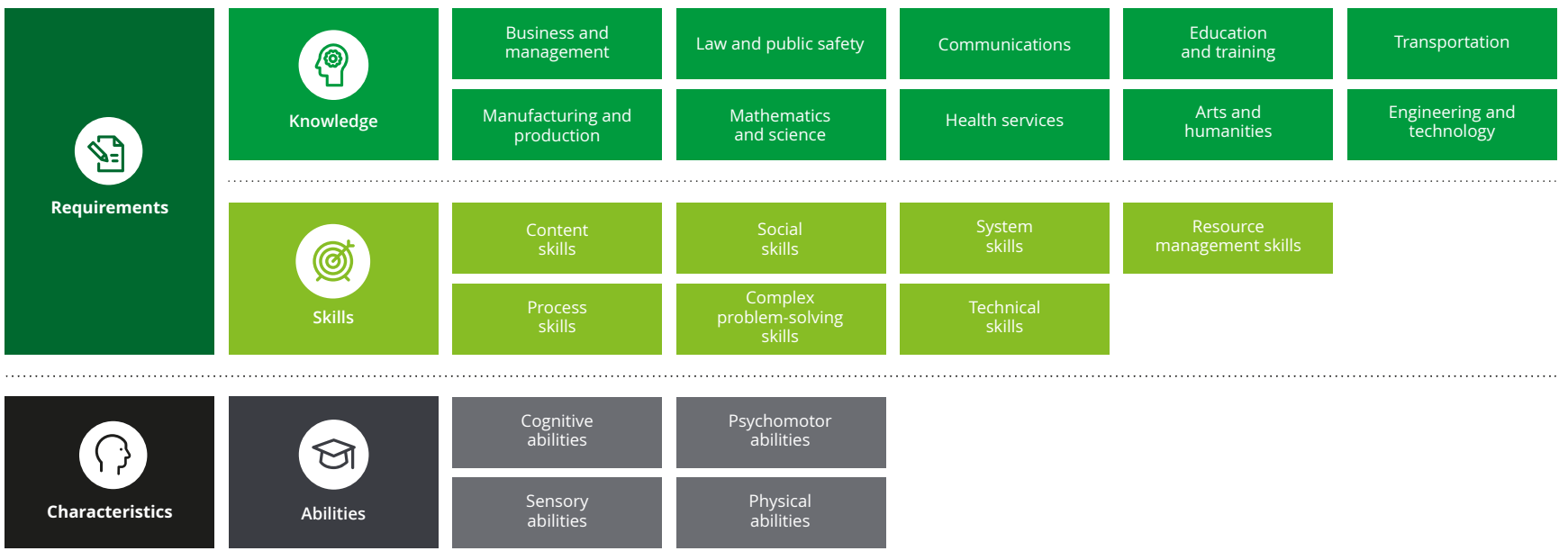
Automation and the global distribution of labour have fundamentally transformed the structure of Swiss employment. In 1800, almost 70% of all employees worked in agriculture and just 8% were employed in the service sector.[12] Those figures are now reversed, with 75% of all employees working in the service sector and just 3% in agriculture. This transformation has had enormous impact on the competencies required from employees. Physical abilities that were formerly required for working on the land, such as manual strength and stamina, have taken second place to verbal and communication skills. As this has happened, employees have had to retrain and acquire new competencies.

Categorising competencies

The US O*NET database classifies the types of competency that employees now need for specific occupations. On the basis of surveys, and using a scale from 1 (unimportant) to 5 (extremely important), O*NET has classified the importance of 120 individual competencies for a total of 900 individual occupations.

These individual skills can be divided into categories and sub-categories (see Figure 2). There are three categories of competency: knowledge, skills and abilities. 'Knowledge' and 'skills' are competencies that employees can acquire through training and/or experience. 'Knowledge' includes both theoretical and practical knowledge of general areas. 'Skills' relate to attributes that promote the acquisition of knowledge and that can be acquired through training. 'Abilities' are attributes that are often innate and that cannot therefore be learned; but they can be developed and refined. 'Abilities' also affect the ability of individuals to acquire knowledge and skills, and so influence performance in their occupation. These three categories of competency are broken down into 21 sub-categories: ten for 'knowledge', seven for 'skills' and four for 'abilities'.

Figure 2. Division of the 120 individual competencies into categories and sub-categories



Source: O*NET

Overview of competency requirements for Swiss employees

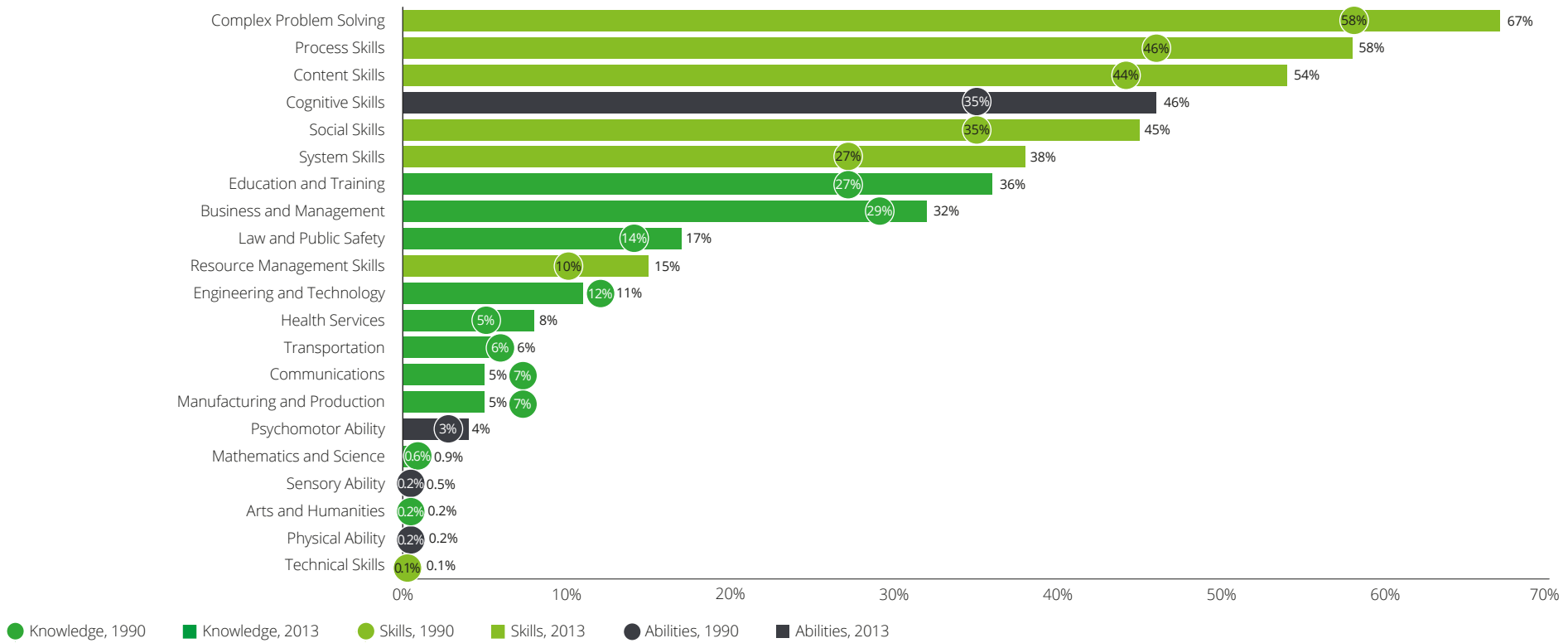
Combining O*NET data with employment data from the Structural Survey carried out by the Swiss Federal Statistical Office (BFS) enables us to identify the competencies required for more than 350 separate occupations in Switzerland.[13] This analysis assumes that the competencies required for an occupation in Switzerland are the same as in the US. Although this assumption may not always be valid with respect to individual occupations, it can be assumed that the majority of Swiss occupations require the same skills as those in equivalent US occupations. The most recent available statistics for Switzerland are for 2013.

Figure 3 shows the proportion of the 350 occupations for which each competency is at least "important' – rated 3 or higher on the scale of 1 to 5. The competency in the 'skills' sub-category that is important for the largest percentage of occupations in Switzerland is complex problem-solving, up from 58% in 1990 to 67% in 2013.Process and content skills and social skills also became more important in occupations over the same period.

Among the 'abilities' sub-category, cognitive abilities are important in the largest percentage of occupations: this indicates that competencies which are important for occupations both in the service sector and for the most highly-qualified occupations have become much more significant since 1990. In contrast, the importance of physical and psychomotor abilities and specialist knowledge in manufacturing remains unchanged or has actually decreased.

Figure 3 provides only a partial picture, however. One reason for this is the way in which skills are classified: the high value attached to complex problem-solving skills is the result not least of the fact that this category represents a single skill. By contrast, the second- and third-placed skills – process skills and content skills – comprise a range of individual competencies. A clearer and more detailed picture emerges from an overview of all 120 individual competencies.

Figure 3. The relative importance of competencies for Swiss employees, by sub-category



Note: The percentage figures illustrate the proportion of employees for whom that particular competency is at least 'important' to the exercise of their occupation, i.e. ranks ≥ 3 on a scale of 1 to 5. Sources: Federal Statistical Office, O*NET, Deloitte Research

Trends in requirements for 'knowledge'

The competencies in the 'knowledge' sub-category are evidence of Switzerland's move towards a service economy. Figure 4 shows, for the period 1990–2013, the proportion of occupations in Switzerland for which each competency in the 'knowledge' sub-category is in the range 'important' to 'extremely important'. Knowledge of customers and personal service is important in the largest percentage of occupations, up from 86% in 1990 to 90% in 2013. Language skills are equally important. Knowledge of mathematics is important for the majority of occupations, up slightly since 1990. The growing importance of computers and electronics since 1990 is unsurprising, given the increasing level of digitalisation in the workplace.

Education and training is another key knowledge area: it is important for managers, supervisors and teachers/trainer – occupational groups containing a relatively large number of employees. It also emphasises the growing importance of education and training to the Swiss economy: the more important education and training become, the more important knowledge of their delivery also become. In many occupational groups for which education and training is a vital competency, there was a substantial increase between 1990 and 2013, both in absolute terms (the number of new jobs) and in relative terms.

> "There will continue to be a need for specialised mechanics, for example to install and maintain machinery."
>
> **Jonas Lang, Responsible for Young Talent, Swissmem**

The total number of teachers in primary, secondary and tertiary education grew by 14,023, 19,812 and 12,171 respectively. There was also high relative growth: for example the numbers involved in employee training and development went up by 284%. There was a fall in employment numbers in only one category of occupation where knowledge of education and training is important: this was in the category of driving instructors where, the relative decline was just 3% and the absolute decline a fairly modest 54 jobs.

Specialist mechanical knowledge, a sub-set of engineering knowledge, also declined slightly in importance. This can be attributed to a fall in the number of occupations with lower value-added, such as metalworkers and machine fitters. At the same time, there was an increase in the number of jobs requiring mechanical knowledge, such as for industrial, production and chemical engineers. There was also growth in non-graduate occupations, such as air conditioning engineers and industrial machinery mechanics. Another sub-set of engineering that increased in importance over the period was knowledge of computers and electronics.

Figure 4. Importance of knowledge to Swiss employees: top 10

Competency	Category	1990	2013	
Customer and personal service	Business and management	86%	90%	↑
Languages	Arts and humanities	88%	90%	↑
Mathematics	Mathematics and science	55%	59%	↑
Administration and management	Business and management	46%	51%	↑
Computers and electronics	Engineering and technology	42%	48%	↑
Education and training	Education and training	27%	36%	↑
Clerical/processing	Business and management	33%	35%	↑
Law and public safety	Law and public safety	27%	26%	↓
Sales and marketing	Sales and marketing	18%	18%	→
Mechanical knowledge	Engineering and technology	23%	18%	↓

Note: The percentage figure illustrates the proportion of employees for whom a particular knowledge area is at least 'important' to the exercise of their occupation, i.e. ranks ≥ 3 on a scale of 1 to 5.
Sources: Federal Statistical Office, O*NET, Deloitte Research

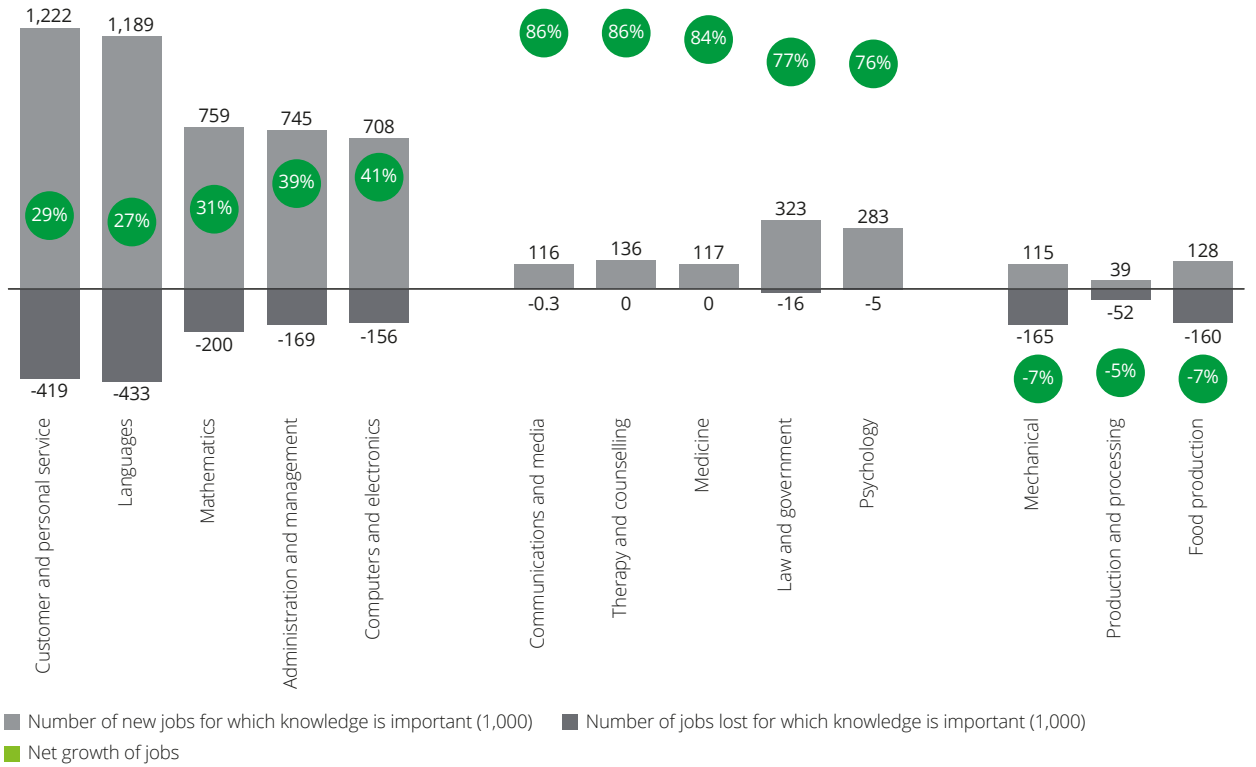
Differences in the relative importance of competencies become clearer if total employment data are analyse the new jobs created between 1990 and 2013. Some occupations – particularly those with a high proportion of routine manual activities – saw a fall in overall employee numbers.[14] Across all occupations, the total loss of jobs was about 500,000. However over the same period, almost 1.3 million new jobs were created and the net increase in jobs was therefore around 800,000.

For a large proportion of the 1.3 million new jobs, knowledge of customer service is important, as Figure 5 shows. This again reflects the large increase in the numbers of employees in service occupations over recent years. Knowledge of customer service is followed in relative importance by knowledge of languages. It is also not surprising that computers and electronics have grown most in importance among the competencies required in most jobs ('mass competencies').

The middle section of Figure 5 shows the importance of 'niche competencies' within the 'knowledge' category. These are important for less than half of the new jobs created, but the number of jobs requiring them is increasing rapidly. For example, although knowledge of communications and media is important for only 116,000 of the 1.3 million new jobs created, there was an 86% increase in the number of these jobs between 1990 and 2013.

The right-hand section of Figure 5 shows the skills that have declined in importance. For example, 115,000 new jobs were created between 1990 and 2013 for which mechanical knowledge is important but 165,000 others disappeared, leaving a net loss of 50,000 jobs.

Figure 5. Importance of 'knowledge' competencies for new jobs created between 1990 and 2013



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

Trends in requirements for 'skills'

The skills of 'active listening and speaking' are crucial requirements for most Swiss employees: active listening skills are important for 95% of jobs and speaking skills for 91% (see Figure 6). These skills encompass the ability to convey information appropriately and are therefore essential in almost every occupation. The biggest requirement for these skills is in teaching.

There has been a marked increase since 1990 in the importance of skills that could be subsumed under the heading of 'creativity', including complex problem-solving skills. These are now important for 67% of all Swiss employees, compared with 58% in 1990. The main reason is that jobs requiring high-level qualifications (such as doctors, lawyers, engineers and technicians) have grown substantially in number in recent years, and complex problem-solving skills are particularly important for them. A majority of employees in the Swiss economy now have advanced qualifications: for example, more than 40% of the working age population has a higher education qualification.[15]

Social skills, such as social perceptiveness and coordination, have also become more important. One reason for this is the large rise in the number of employees needing such skills, such as managers across a range of sectors and those working in occupations with a requirement for social interaction and negotiation. These include doctors and non-graduate healthcare staff. The number of jobs for non-graduate healthcare staff rose by almost 16,000 between 1990 and 2013, with a further 11,000 new jobs for healthcare assistants. There were also 18,277 new jobs for social workers and 7,043 for psychologists. During this period some new occupational categories emerged. For example there were less than 100 conference and event planners in 1990, compared with 2,800 people in 2013.

Figure 6. Importance of 'skills' for Swiss employees: top 10

Competency	Category	1990	2013	
Active listening	Content skills	95%	95%	→
Speaking	Content skills	89%	91%	↑
Critical thinking	Process skills	87%	90%	↑
Process monitoring	Process skills	83%	87%	↑
Reading comprehension	Content skills	73%	81%	↑
Time management	Resource management skills	70%	77%	↑
Social perceptiveness	Social skills	69%	75%	↑
Coordination	Social skills	63%	72%	↑
Judgement and decision-making	System skills	64%	72%	↑
Complex problem-solving skills	Complex problem-solving skills	58%	67%	↑

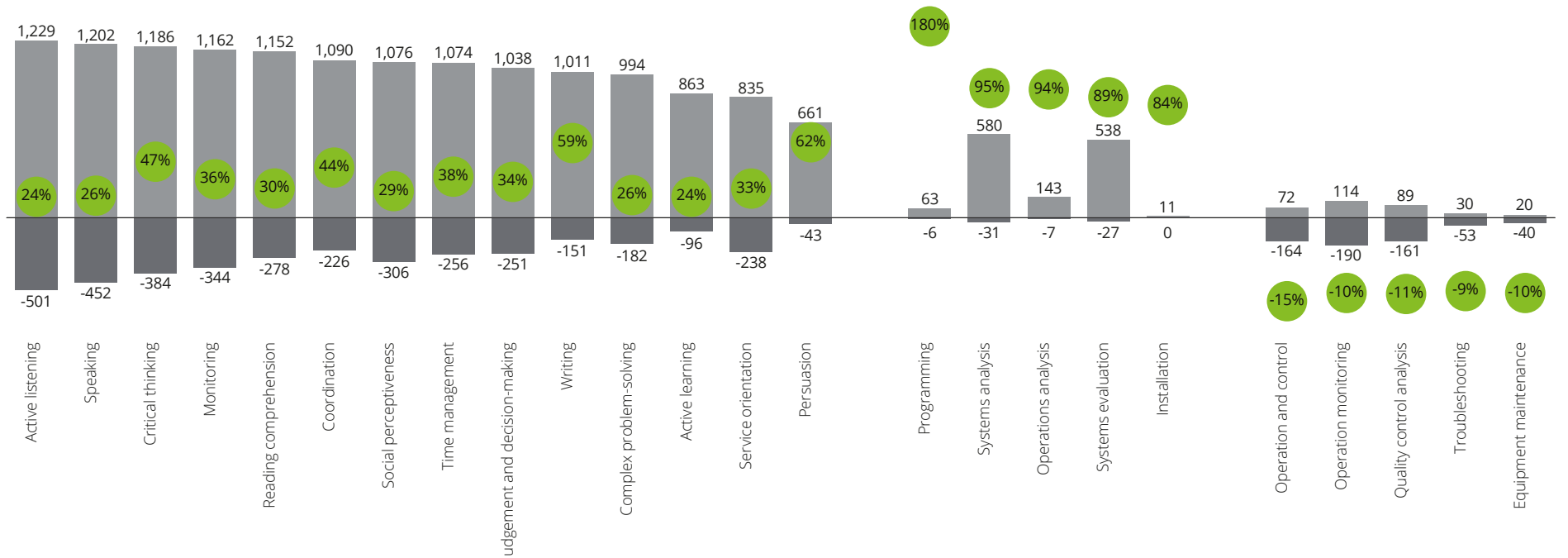
Note: The percentage figure illustrates the proportion of employees for whom a particular skill is at least 'important' to the exercise of their occupation, i.e. ranks ≥ 3 on a scale of 1 to 5.
Sources: Federal Statistical Office, O*NET, Deloitte Research

Figure 7 is similar to Figure 5, but shows the importance of each ‚skills' competency for new jobs created and job lost between 1990 and 2013, and also the percentage net increase or decline in the number of jobs requiring the skill. A range of skills are important for many of the new jobs created in this period, such as critical thinking, writing, and persuasion. The large number of new jobs requiring active learning shows not only the increased importance of training, but also the fact that although there was a big increase in jobs within teaching and training, acquiring skills is ultimately the responsibility of individual employees.

Among the niche skills (in the middle section of Figure 7), programming soared in importance by 180%, representing a net total of 57,000 new jobs. In an environment of ongoing digitalisation, this is unsurprising, yet the importance of programming is particularly highlighted by the fact that it has grown most in importance overall. Skills in systems and operational analysis, which are particularly important for engineers, architects and systems analysts, have also become substantially more important. Web and multimedia designers constitute a virtually new occupational category in this area, with numbers rising from almost zero in 1990 to more than 4,000 in 2013.

In contrast, a number of less complex skills decreased in importance over this period. These included operation and control, a skill needed to operate stationary or mobile machinery, among others. In both these areas, there was a net loss of more than 35,000 jobs between 1990 and 2013.

Figure 7. Importance of 'skills' for new jobs created between 1990 and 2013



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

Trends in requirements for 'abilities'

Among abilities, 'basic sensory and cognitive abilities' tend to dominate required competencies. They include near vision, oral comprehension, problem sensitivity and oral expression (see Figure 8). These abilities were already important in 1990 for virtually every occupation As a result, there was very little scope for any further increase in their importance, with the exception of except for near vision. The increase in importance here can be attributed primarily to the growing use of digital devices in most occupations.

The situation regarding another group of cognitive abilities – deductive reasoning and inductive reasoning – is rather different. In 1990 these abilities were important for 80% of jobs, but by 2013 this had increased by several percentage points. Along with problem sensitivity, these abilities are crucial to creative thinking, and their importance for a growing percentage of jobs illustrates the significance of creativity for Swiss employees. There were also increases between 1990 and 2013 in the number of jobs that that rely on organising information – not surprising, given the substantial increase in data volumes that organisations now handle.

Employee numbers increased substantially in occupations where cognitive abilities are crucial, particularly in a range of occupational categories requiring tertiary-level qualifications, such as managers, lawyers and doctors. For example, between 1990 and 2013 there was an increase more than 20,000 in the number of doctors and medical specialists alone.

Figure 8. Importance of 'abilities' for Swiss employees: top 10

Competency	Category	1990	2013	
Near vision	Sensory abilities	99%	100%	↑
Oral comprehension	Cognitive abilities	98%	97%	↓
Problem sensitivity	Cognitive abilities	96%	95%	↓
Oral expression	Cognitive abilities	95%	95%	→
Speech recognition	Sensory abilities	90%	92%	↑
Information ordering	Cognitive abilities	88%	91%	↑
Speech clarity	Sensory abilities	87%	89%	↑
Deductive reasoning	Cognitive abilities	84%	89%	↑
Written comprehension	Cognitive abilities	79%	84%	↑
Inductive reasoning	Cognitive abilities	77%	82%	↑

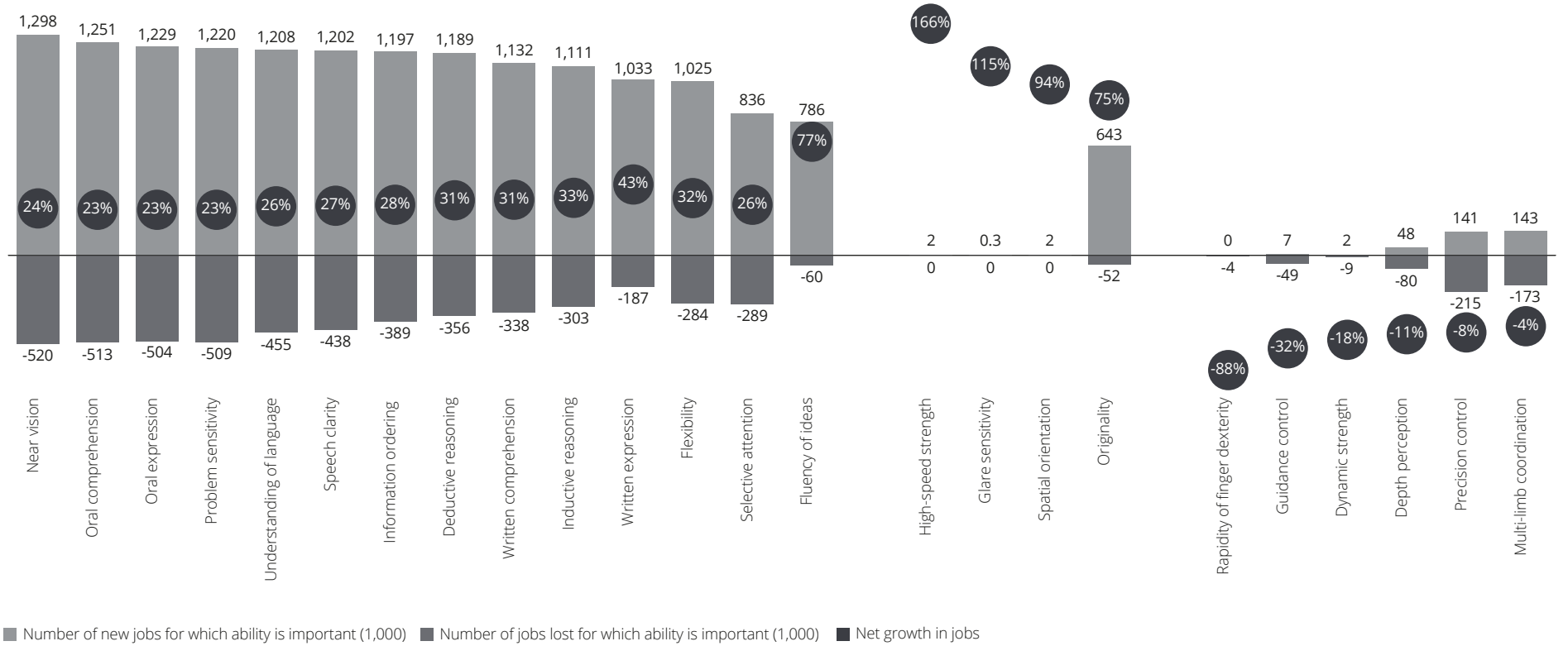
Note: The percentage figure illustrates the proportion of employees for whom a particular ability is at least 'important' to the exercise of their occupation, i.e. ranks ≥ 3 on a scale of 1 to 5.
Sources: Federal Statistical Office, O*NET, Deloitte Research

Figure 9 is similar to Figures 5 and 7, showing the importance of particular abilities for new jobs created and jobs lost between 1990 and 2013, and the increase or decline in the number of jobs for which the competency is important. A number of competencies increased in importance both in absolute terms (number of jobs) and in relative terms during the period. There were significant increases in jobs requiring basic abilities such as as near vision, which is crucial for the operation of machines and computers. There were large percentage increases in abilities that underpin creativity, such as problem sensitivity, deductive reasoning and inductive reasoning. The number of jobs for which fluency of ideas is important also grew markedly, demonstrating that the world of work has become more complex and more demanding, and attaches much greater importance than in the past to competencies such as creativity.

There was some reduction in the number of jobs for which physical abilities, such as physical coordination, are important. The net loss of jobs needing finger dexterity and finger speed is an indication particularly that this ability, required for operating machinery and typing, have declined in importance with the increase in automation.

The most important 'niche' ability – high-speed strength – may seem at first glance to be out of line with the trend of declining importance of physical abilities. However, this niche ability has an importance rating of 3 or more for only two occupations: athletes and professional sportsmen and sportswomen; and prison officers. Across these two categories, only around 2,000 new jobs were created between 1990 and 2013.

Figure 9. Importance of abilities for new jobs created between 1990 and 2013



Sources: BFS, O*NET, Deloitte Research

4. Which competencies will the labour market need in the future?

There seems to be wide agreement that the advance of automation and digitalisation will continue to transform the competency requirements for employees over the coming years. However, it is difficult to predict exactly how the importance of each specific individual competency will change, or which competencies have a low capacity for automation and will therefore be in demand in the labour market. Technological change cannot be predicted accurately predicted, so any attempt to look into the future is inevitably subject to uncertainty. Even so, it is possible to make certain assumptions as the basis for models that will help to predict future trends.

Indicators for assessing future potential

We have used two indicators to identify a range of competencies for which the Swiss labour market will have a particular need in the near future and which are very difficult to automate. The first is an extrapolation of employment numbers for the period 1990-2013 to predict competency requirements in the period to 2030: this is intended to highlight the sectors that will be creating large numbers of jobs (see Box). Very recent technological developments that have not yet had an impact on employment, and future technological developments, are excluded from this analysis, and we have therefore used a second indicator – capacity for automation or protection against automation – to identify 'automation probability'. The lower the capacity for automation of a particular competency, the more unlikely it is that a machine or software program will replicate it over the coming years. (Competencies and jobs with a low capacity for automation are referred to here as 'future-proof'.)

Competencies that are particularly future-proof include those that give human employees the edge over machines (and are therefore almost impossible to automate) and those for which there is strong demand in the labour market demand and/or for which new jobs will be created. In the analysis that follows, we divide these future-proof competencies between the three O*NET categories: 'knowledge', 'skills' and 'abilities'.

Box: Methodology

The calculation of future competency requirements is based on two indicators. The first is an extrapolation of employment trends between 2013 and 2030 on the basis of Federal Statistical Office data on employment growth between 1990 and 2013. The underlying assumption is that occupational groups that have grown in size over recent years – such as graduate occupations, the health professions and IT – will continue to grow in future while those that have declined – such as unskilled agricultural workers, counter staff and secretarial occupations – will continue to decline. Our extrapolation shows that overall, almost one million new jobs will be created in the growing occupations between 2013 and 2030 and that there will be an overall loss of 350,000 jobs in the declining occupations. This will take the net job creation figure to around 650,000.

The second indicator is a calculation of the extent to which individual competencies can be automated. More specifically, it uses correlation coefficients between the importance rating of 350 individual competencies and their automation probability value. The nearer this correlation coefficient for a specific competency is to -1, the greater the protection against automation – or, to put it another way, the less likely it is that a machine or software program will have this particular competency within the next few decades. The data on automation probability are taken from Frey and Osborne (2013).

Future requirements for 'knowledge'

Knowledge of languages offers a good level of protection against automation and scope for substantial job creation (see Figure 10). The size of the circle for language competency in the Figure shows that by 2030, more than 600,000 new jobs are likely to be created for which linguistic knowledge will be important. This area of knowledge will also be important for more than 90% of existing jobs by 2030, as the position of the circle on horizontal axis of the diagram shows.

The capacity for automation of knowledge in the areas of psychology, sociology and anthropology is lower. In contrast with knowledge of languages, however, these competencies are 'niche knowledge areas', which will be important for only a small proportion of new jobs created. Nevertheless, jobs requiring these knowledge competencies will grow by about 30% in importance by 2030. Knowledge of computers and electronics will also become increasingly important, and will be needed for about half of all new jobs and half of existing jobs by 2030, up from 40% in 1990 when computers and electronics were still a niche knowledge area.

The future looks gloomier for jobs for which production, mechanical and food production knowledge is important, because of its relatively high correlation with automation probability. In other words, the more important this knowledge competency is to an occupation, the higher the occupation's capacity for automation. Job losses are likely to continue in these sectors, although this prediction does not apply to all occupations requiring mechanical knowledge: there will also be job opportunities if this specialist knowledge can be combined with other skills, as in the case with mechanical engineers and mechanical electricians for example.

Figure 10. Future importance of 'knowledge'

Sources: Federal Statistical Office, O*NET, Frey and Osborne 2013, Deloitte Research

Future requirements for 'skills'

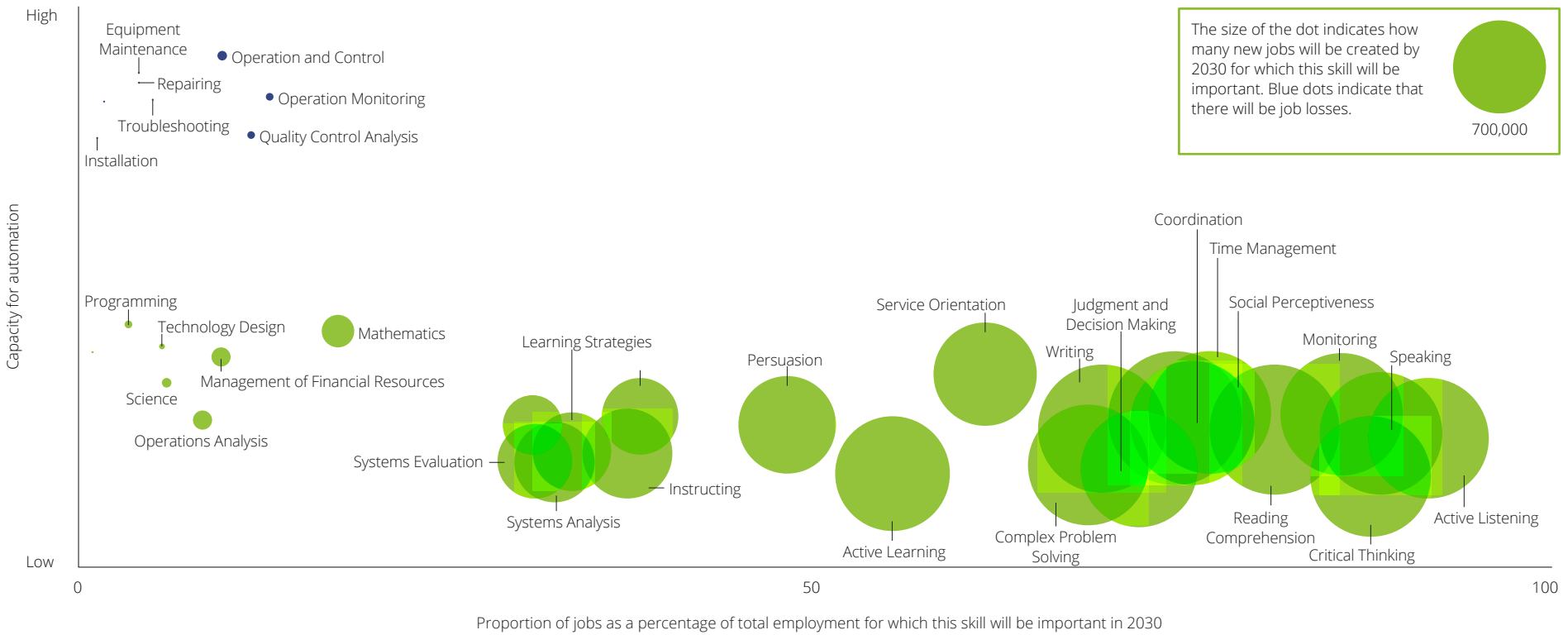
A cluster of individual skills are particularly future-proof, as Figure 11 shows. These include basic skills, such as writing, speaking, reading comprehension and critical thinking, which are the basis for acquiring further, more specific, skills. These more specific skills can be sub-divided into two groups: skills that can be grouped under the general heading of 'creativity', such as complex problem-solving, and social intelligence skills, including social perceptiveness.

Niche skills include systems skills, such as systems analysis and systems evaluation, which are required mainly by employees who handle sociotechnical systems (such as software developers and web developers). Both will be important for carrying out 40% of the roughly million new jobs expected by 2030 – some 400,000 newly-created jobs. They account for about 30% of all jobs in, highlighting that these two skills will have grown substantially in relative importance.

Skills in programming and mathematics do not have a particularly low capacity for automation, and therefore offer 'only' a high, but not very high, level of protection against automation and job losses. We shall return in detail to the reasons for this at the end of this section.

> "It is increasingly important to think about customers right across the value chain. In future, both companies and individual employees will be thinking about integrated processes and the necessary process knowledge, rather than distinguishing between isolated products and product knowledge."
>
> **Volker Stephan, Head of HR, ABB Switzerland**

Figure 11. Future importance of 'skills'



Sources: Federal Statistical Office, O*NET, Frey and Osborne 2013, Deloitte Research

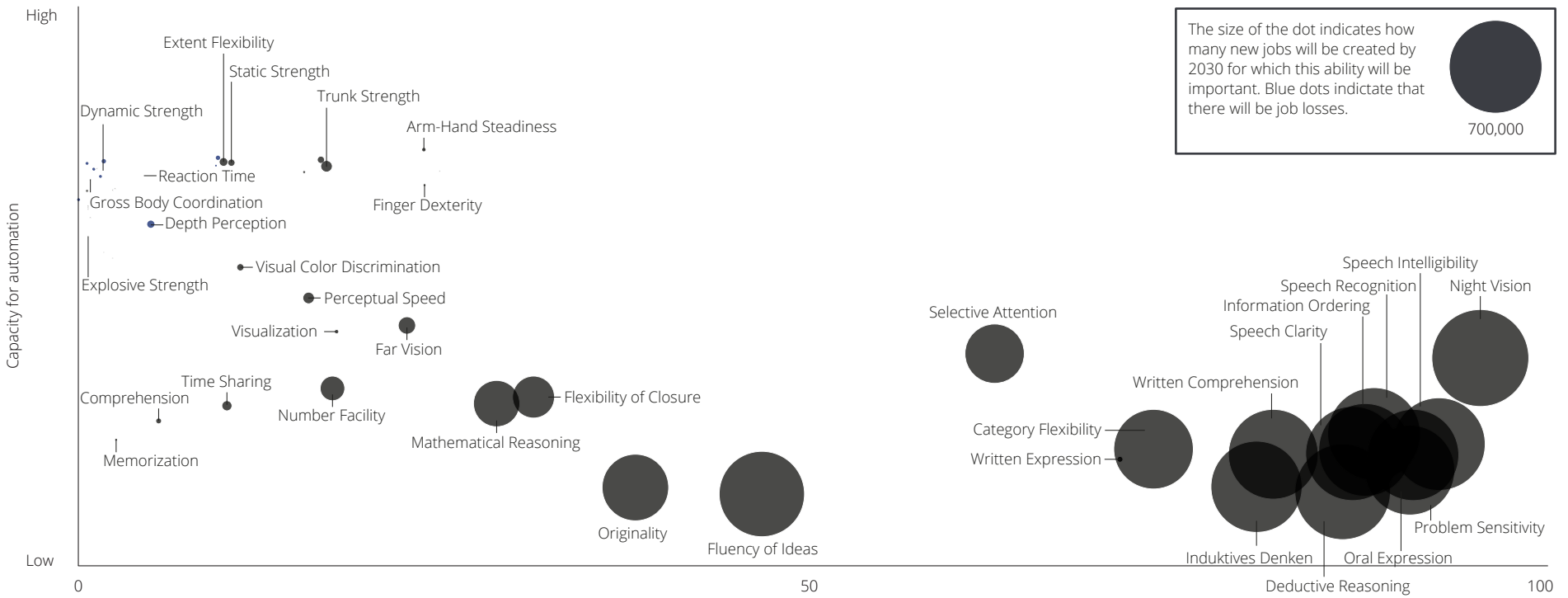
Future requirements for 'abilities'

Clustering is even more marked with abilities than with skills. The right-hand side of Figure 12 groups shows abilities that are particularly future-proof. These can be grouped into two categories: basic abilities; and logic and creativity. As with skills, basic abilities are the basis for developing the second group, logic and creativity. The greater an individual's abilities in oral and written expression, and ability to understand and reproduce information orally and in writing, the better he or she will perform in terms of deductive reasoning, inductive reasoning and problem sensitivity.

The middle section of Figure 12 shows two niche abilities, originality and fluency of ideas. These belong to the 'logic and creativity' group of abilities: they have very little capacity for automation and are also growing in importance at a much faster than average rate. By 2030, these abilities will be required for almost 50% of jobs, and so will become 'mass' rather than 'niche' abilities Another group of niche abilities lies further to the left in Figure 12, quantitative abilities (such as mathematical reasoning and number facility) and perceptual abilities (such as perception and flexibility of closure). These are also unlikely to be automated.

Physical and psychomotor abilities, such as extent flexibility and dynamic strength, offer little future employment potential: they wil probably be relatively easy to automate in future, and will therefore be less in demand in the labour market.

Figure 12. Future importance of 'abilities'



Sources: Federal Statistical Office, O*NET, Frey and Osborne 2013, Deloitte Research

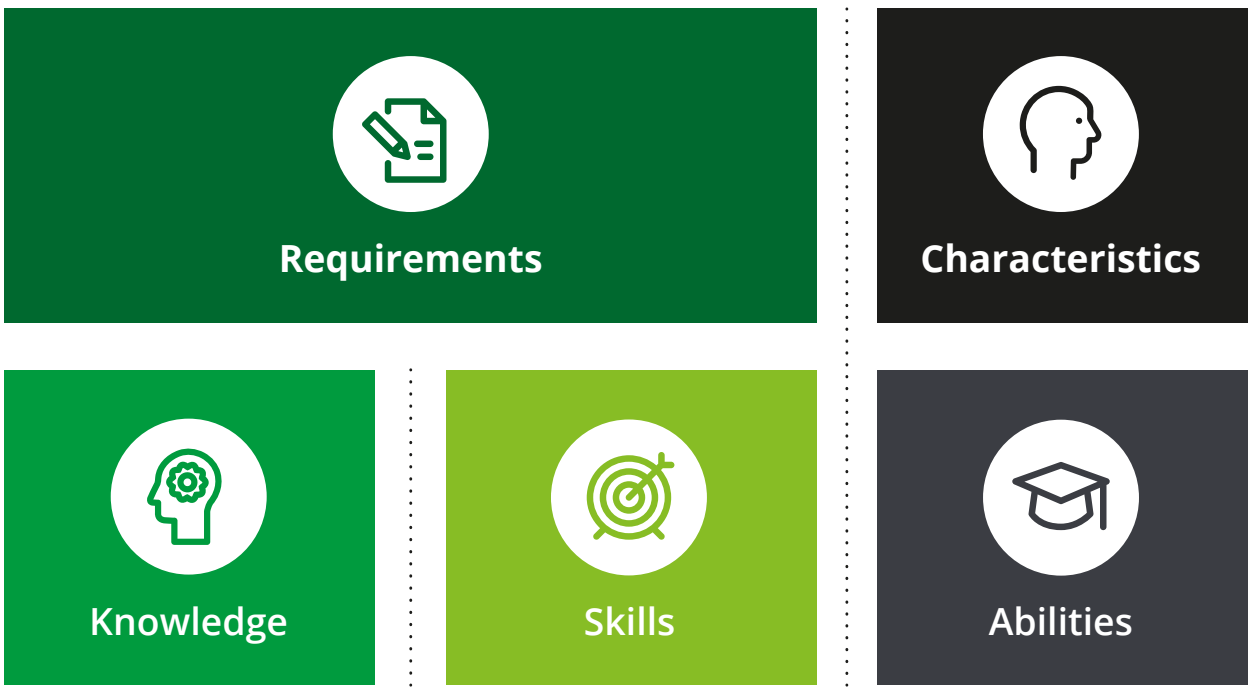
Which are the most future-proof competencies?

As we have seen, a number of competencies in knowledge, skills and abilities can be considered future-proof. However, identifying competences that are future-proof provides only a partial answer to the question asked at the beginning of this section – how important will individual competencies be in the labour market in future, given a background of increasing automation? As well as identifying individual future-proof competencies, it is important to identify their interaction and interdependencies.

For example, employees who only have good speaking and writing skills will not be adequately equipped for the future, in spite of the fact that these two skills provide a high level of protection against automation and will be important for most newly-created jobs. It is far more important that they should be combined to create a basis for acquiring more advanced competencies. Below, we therefore show future-proof competencies that can be derived by considering mutual interaction and interdependencies. For this analysis, the competencies defined by O*NET and listed at the beginning of section 3 are sub-divided into 'requirements' (knowledge and skills) and 'characteristics' (abilities). Figure 13 illustrates this sub-division.

'Requirements' are employment-related attributes that can be acquired and/or developed through training and experience, such as specialist knowledge and skills. 'Characteristics' are long-term and/or innate attributes that influence performance and the capacity of individuals to acquire or develop knowledge, skills and abilities.

Figure 13. Sub-division of competencies into requirements and characteristics



Sources: O*NET, Deloitte Research

Requirements: the importance of creativity, social intelligence and ICT

Future-proof 'requirements' can be sub-divided into a number of areas (see Figure 14). The first of these is 'basic competencies', which include reading comprehension, speaking, critical thinking and active learning. Basic competencies are the basis for acquiring more advanced competencies, primarily creativity and social intelligence. There are both 'mass competencies', which are required for a large number of different occupations, and 'niche competencies' which apply to a smaller number of specialist occupations. Creativity and social intelligence are almost exclusively mass competencies, which are already important for many occupations and are likely to gain in importance in future.

Creativity involves creating something new: it includes solving complex problems that require non-standard solutions. Where creative decision-making and flexible problem-solving are important in an occupation, humans will continue to have an advantage over machines in the future.[16] Employees who have good basic competencies alongside a high level of creativity are therefore likely to be well-equipped for the future.

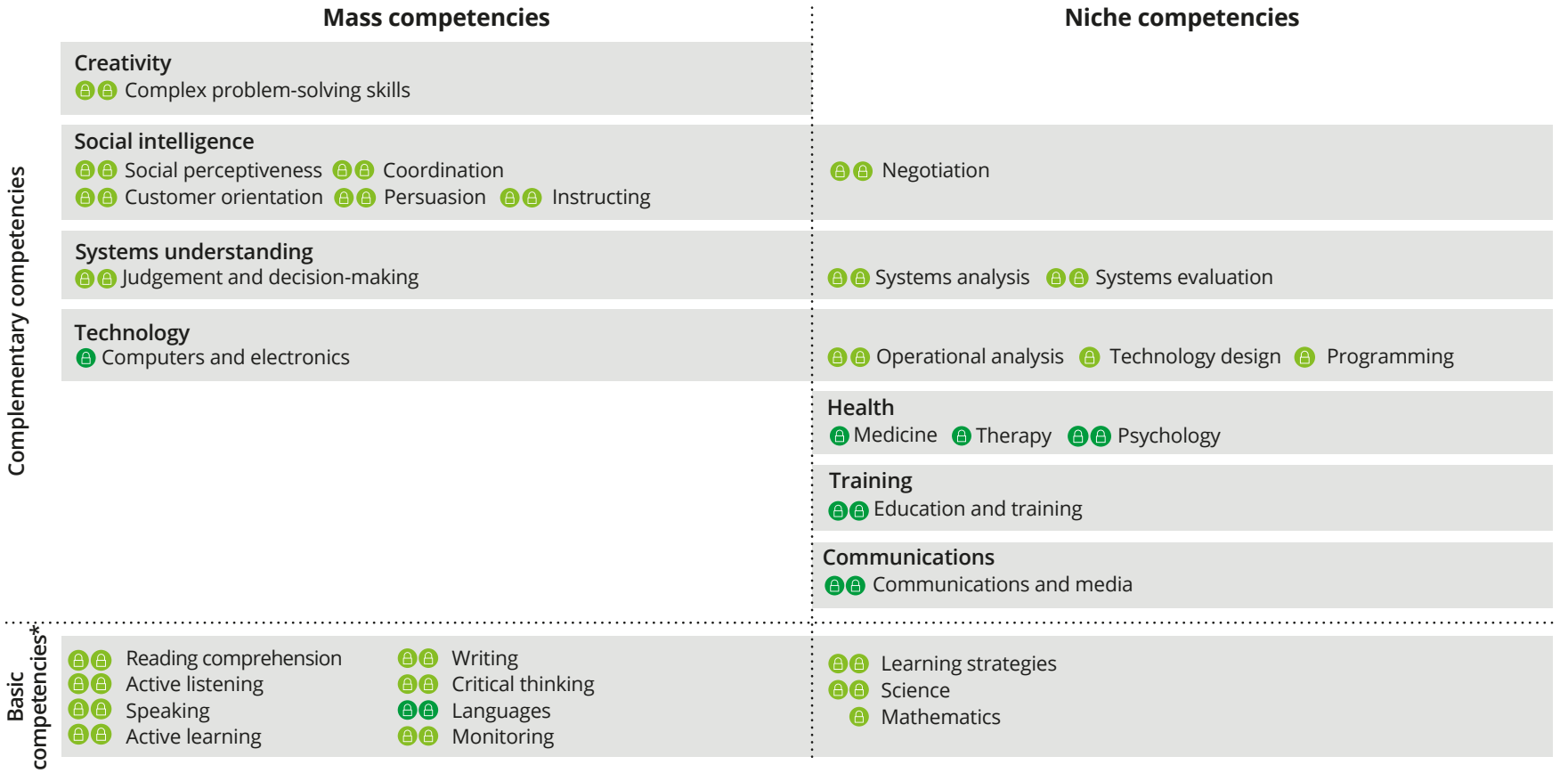
The same is true of employees with a high degree of social intelligence in addition to the basic competencies in Figure 14. Social intelligence includes social perceptiveness, persuasion and negotiation. Although algorithms and robots are able to reproduce certain aspects of human interaction, they are not well equipped to identify human emotions and react appropriately.[16]

Niche competencies are grouped into three areas: health, training and communications. These will be particularly important for a smaller group of occupations than mass competencies. In the health area in particular, growth in jobs over the next few years will be particularly strong. As the padlock symbols in Figure 14 show, knowledge itself has a high capacity for automation in medical and therapy and by itself does not offer very high protection against automation. However, employees who are able to combine knowledge with a high level of social intelligence are likely to enjoy good opportunities in the labour market in future.

Figure 14 shows two requirements, systems understanding and technology that lie between mass competencies and niche competencies. Each of these requirements includes competencies that are important for the broad mass of employees and some that are important for a smaller number. Both requirements are particularly important for occupations in the information and communications technology (ICT) sector.

Three of the four competencies in the technology area have a high capacity for automation and only one has a very high capacity. As OECD research has shown, a combination of ICT-specific skills with social skills or creativity is likely to be particularly important in future.[17] Our analysis points to the same conclusion: where ICT skills are bundled with social skills or creativity, there is a higher negative correlation with automation probability, and therefore a higher degree of protection against automation. This is particularly evident with programming skills: taken on their own, they have a -0.35 correlation with automation probability, and so have a medium capacity for automation. However, when they are combined with complex problem-solving skills, the correlation coefficient rises to more than -0.60, providing considerably greater protection against automation.

Figure 14. Future-proof 'requirements' ('knowledge' and 'skills')



Knowledge: Very high level of protection against automation
Knowledge: High level of protection against automation
Skills: Very high level of protection against automation
Skills: High level of protection against automation

* Basic competencies offer necessary but not sufficient protection against automation

> “Alongside intuition and creativity, flexibility and openness to innovation will be the key characteristics that give human beings a critical edge over machines on the labour market.”
>
> **Hans Werner, Head of HR Swisscom**

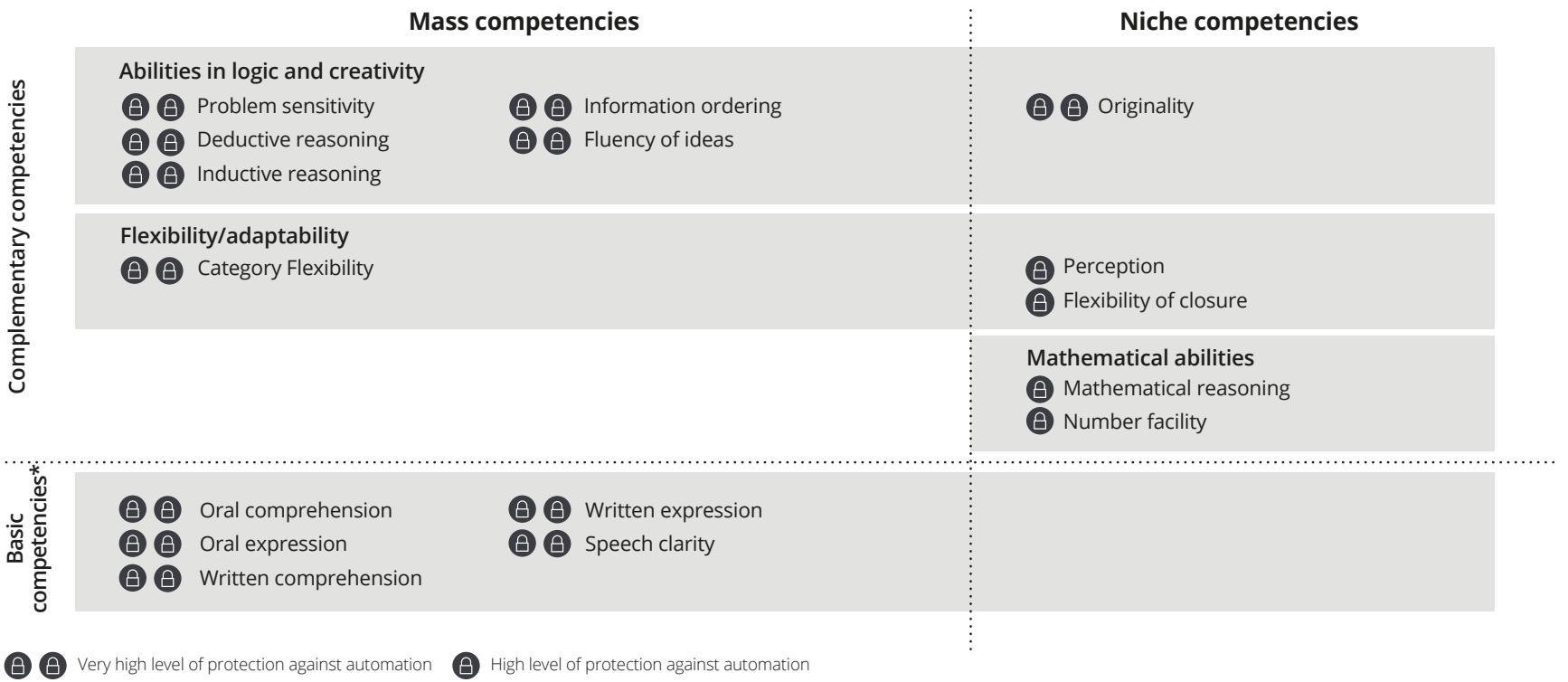
‘Characteristics’: the importance of logic and creativity

Characteristics and abilities that are particularly future-proof can be divided into four categories, as shown in Figure 15. The basic competencies are mass competencies which form the basis for development of the other three categories. The basic characteristics comprise competency in written expression, spoken expression and understanding, which are crucial to many new jobs and have only low capacity for automation.

Logic and creativity are comparable to social intelligence and creativity in Figure 14 because they involve creative elements such as originality. In general, these are mass competencies. The growing importance of ‘big data’ has given particular importance to deductive reasoning and inductive reasoning, as well as to the organisation of information. According to a study by the University of Phoenix Research Institute, the ability to understand large quantities of data and to translate them into abstract concepts will be one of the key abilities required by employees in the digital age.[18]

The third area of future-proof characteristics – abilities – consists of mathematical niche competencies. They have a high level of protection against automation. The fourth area, flexibility and adaptability, is discussed on page 40.

Figure 15. Future-proof 'characteristics' ('abilities')



*Basic competencies offer necessary but not sufficient protection against automation

Interaction between social and mathematical competencies

It is noticeable in Figures 14 and 15 that technical, mathematical and ICT competencies often provide only medium levels of protection against automation, although it is generally agreed that they are already important for the labour market and are likely to become even more important in future. They are also particularly important when combined with other competencies.

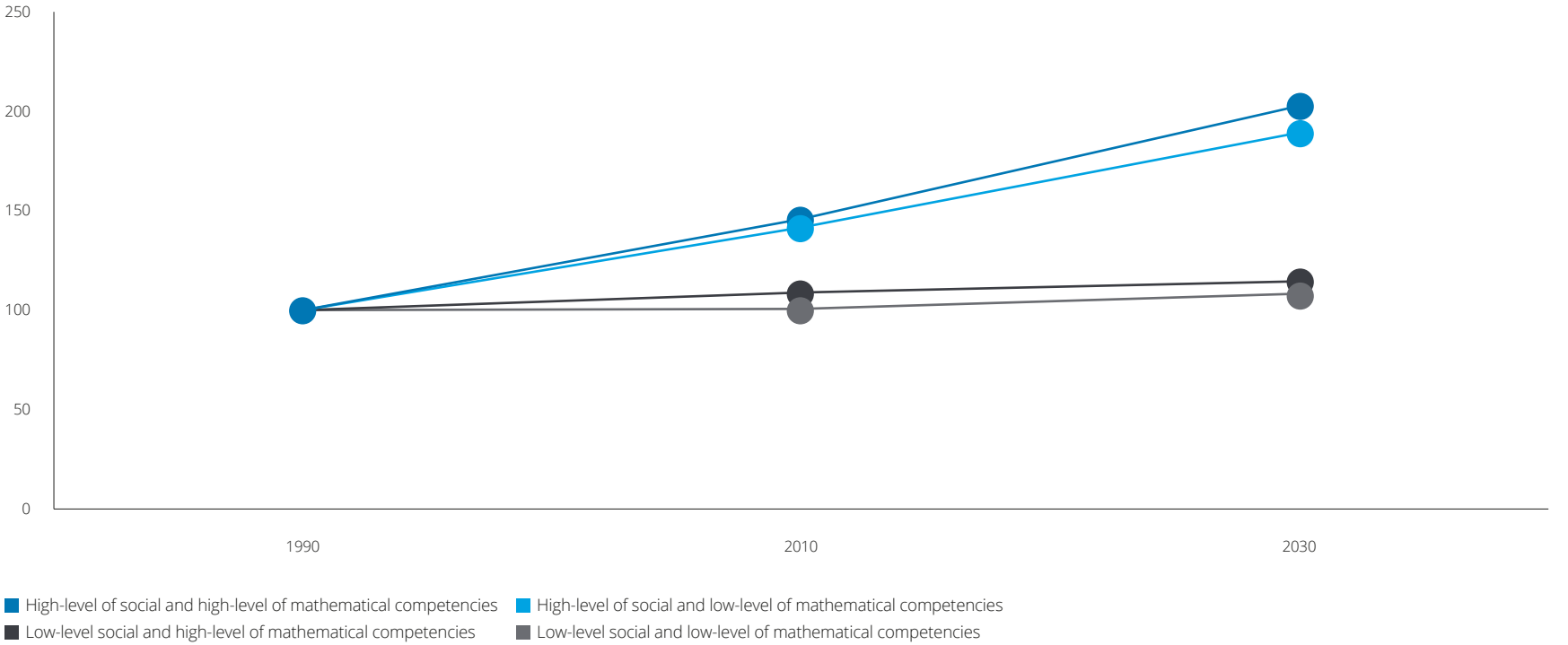
A study by Harvard University shows that employment and pay levels in the US have dropped since 1980 in occupations that require high levels of mathematical competencies (number facility and knowledge and competencies in mathematics) but low levels of social competencies (social perceptiveness, coordination, persuasion and negotiation).[19]

The opposite is true when a high level of both mathematical competencies and social competencies is required. In other words, mathematical competencies are important but confer far greater advantage on the labour market when they can be 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 digitalisation, increasingly form part of flexible organisational structures and working practices, which require high levels of communication and organisational competency.

As Figure 16 shows, this is true not only in general but also specifically in the Swiss labour market, at least as far as employment is concerned. Using a similar methodology to the Harvard study, we have found that the number of Swiss employees who combine high levels of mathematical competencies and excellent social competencies has risen markedly, and the number is likely to continue rising up to 2030. The occupations include, for example, architects, engineers and managers in the financial sector, which rely on good social competencies for cooperation with both customers and team colleagues. This contrasts with occupations that require high levels of mathematical competencies but low levels of social competencies: here, job numbers are stagnating or, at best, growing only very slightly. This includes many occupations, such as credit or financial analysts, where the work is performed relatively autonomously and where employees are therefore less reliant on cooperation with customers or team members.

Figure 16. Growth in jobs requiring social and mathematical competencies (Base: 1990=100)



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

Flexibility and versatility offer future prospects for those with lower qualifications

So far, we have demonstrated that employees with high levels of basic competencies and also excellent creative or social competencies are likely to enjoy very good prospects in the labour market in the future. The same is true for ICT and technical competencies and for niche competencies in the areas of health, communications and training: individuals who are able to combine such knowledge with creative or social competencies are best placed to prosper in the digital age. This applies in particular to occupations for which high qualification levels are needed.

But what are the prospects for non-highly qualified employees who have craft competencies and high levels of physical and psychomotor competencies, but for whom it is difficult to acquire high levels of creative and social competencies? As studies by David Autor show, the digital age offers some prospects for this group, too.[9] Individuals have an advantage over machines, not only in the area of creative and social intelligence, but also in terms of their versatility, flexibility and capacity to adapt to situations. It is still relatively difficult for machines to react to unexpected situations and to communicate on that basis. This is the main reason why new jobs will most likely continue to be created in occupations such as hairdressing and food preparation, for example.

5. What does this mean for the education and training system?

In the previous sections, we have identified different groups of competencies that will be in particularly high demand in the digital age and do not easily lend themselves to automation. In this section, we now turn our attention to the implications for education and training institutions in Switzerland. How can the training system equip workers in the future to respond to automation and digitalisation? And how can it be sure it is training for the right skills while at the same time enabling those already in work to acquire new, future-oriented skills?

Relatively high permeability and high qualification levels

Switzerland enjoys an excellent international status in the area of training. The 'Higher education and training' pillar of the World Economic Forum's Global Competitiveness Report 2016-2017 ranks Switzerland in first place.[20] The Swiss training system is based on two elements, vocational training and academic training, and ensures broad labour market integration and career-focused training and specialisation for young people. It is one of the main contributors to the country's low level of youth unemployment.

The education system is also characterised by a relatively high level of permeability between vocational training and academic training. This is a particular advantage in the digital age. Structural change driven by automation and digitalisation is destroying certain occupations and creating others. As explained in section 2, this means that although there is net job creation, jobs are also being transformed both within and between sectors. Some of the people affected are having to switch sectors and train for an entirely new occupation. Because the training system in Switzerland is relatively permeable, such switching is comparatively easy, although there may be some obstacles in practice. For example, an individual who has completed a course of vocational training or an apprenticeship still has the option many years later to undertake a second apprenticeship, engage in higher-level vocational training or complete a vocational school diploma ('Berufsmatura'), followed by study at a university of applied sciences.

Further advantages of the education and training system, in relation to the changes in labour market requirements occasioned by automation and digitalisation, are the relatively high level of permeability within the training system and the increasing number of employees with a tertiary level qualification (a degree or advanced vocational training).

Expressed as a percentage of the total working age population, around 40% of Swiss nationals now have a tertiary level qualification, and the Federal Statistical Office estimates that this figure is likely to rise to 50% by 2025.[21] As research shows, high qualification levels offer good protection against automation, since they require or involve high levels of competency in the areas of creativity, generation of ideas and logical thinking, and also social intelligence.[22]

As a result, there is less need for universities and universities of applied sciences to question whether they are teaching the right skills. However, there is still some concern about the low proportion of graduates with qualifications in MINT subjects (mathematics, information technology, natural sciences and technology) and in medicine. A number of improvements could be made: adapting the priorities of more academic secondary schools and placing greater emphasis on MINT subjects, as well as expanding heath training, adjusting university tuition fees, and optimising the proportion of different school curricula to the needs of following education programs and occupations.

Basic education: a greater focus on teaching ICT competencies

There is a need for action in the area of basic compulsory education, which should improve its promotion of social skills. Although there no 'one size fits all' approach to teaching social intelligence, there is general agreement that a greater focus on group and project work, interviews and presentations is likely to help. Research has also suggested that there are benefits to be obtained from developing social intelligence as early as pre-school education.[23]

There is also a need to update the ICT competencies element of basic education. Knowledge of computers and electronics has evolved over recent years from a niche competency to a mass competency. At the same time, the importance of skills in programming, systems analysis and systems evaluation has risen substantially and will continue to increase in the future. It is therefore essential that young people should acquire ICT competencies early in their education. A first step in this direction was the 'Lehrplan 21' ('Curriculum 21') initiative, which made media and computing a separate specialist subject in schools.[24] However, the focus must shift from learning how to use digital devices to understanding the way in which digital technology works and the organisation and structuring of data. This will foster competencies in a number of areas such as creativity, technology or systems understanding – key competencies in the digital age.

> "With its 'dual' training system, Switzerland is fundamentally well equipped for digitalisation and the challenges it will bring. It will, however, also need to make some adaptations, such as focusing more on MINT subjects, improving training efficiency and increasing harmonisation."
>
> **Valentin Vogt, President, Swiss Employers' Association**

Teachers have a vital role to play in helping students develop these competencies, and they will require targeted in-service training to keep them up to date with new developments and maintain their mastery of the basic functions of digital technologies. Teacher training should also increase its focus on ICT competencies. The same applies to school principals, who have a key influence on the teaching framework provided by the school and on its teaching staff. A high level of permeability is also desirable in the teaching profession, and there should be initiatives to facilitate career changers from the private sector to retrain as teachers: their ICT competencies and practical work experience more generally offer a highly relevant and authentic preparation of trainees for their subsequent working lives and increase, diversify and renew the experience and competencies of the teaching staff across the board.

Vocational training: a need to accelerate the process

Action is also required in the area of vocational training. Although most training has a high level of practical orientation, so that the necessary specialist competencies are identified and developed, it can sometimes be slow in responding to short- and medium-term changes in requirements. One reason for this is that different stakeholders need to be involved in adapting an occupation or the competencies required for it (professional associations, government agencies, the cantons, etc.) and this is very time-consuming. It is worth looking for ways to speed up this process so that the provision of training courses responds more rapidly to changes in the labour market without jeopardising the quality of the training on offer.

As well as teaching specific technical competencies, it is becoming increasingly important that vocational training systems should focus more on general education and specifically on the basic competencies identified in section 4, such as mathematics and languages. Increasingly, automation will involve the loss of jobs that comprise mainly routine tasks, and will accelerate the transformation of jobs both within and between sectors. Employees are therefore unlikely to see their future as training for a single occupation, in which they will remain all their lives.

> "It will be important in future to have curricula that strike a balance between stability and flexibility. Trainers need be bold and leave space for innovation, rather than specifying everything in detail."
>
> **Amalia Zurkirchen, Head Education, Kaufmännischer Verband**

The think tank Avenir Suisse believes that vocational training should therefore be seen much more as an entry point into a lifelong career.[25] Permeability within the training system and a focus on basic competencies will support this.

Continuing training: lifelong learning

Both initial training and continuing training have a crucial role to play in developing competencies. Continuing training is of particular relevance for employees whose jobs survive automation but are transformed, and for those whose jobs have disappeared and who are seeking alternative employment in similar areas. In this context, lifelong learning is the key. For employees, the issue is not simply having or acquiring the future-proof competencies set out in section 4: they also need to receive continuing training so that they remain up to date and are able to respond rapidly to changes in occupations caused by digitalisation and automation, and demonstrate the flexibility that is becoming essential in the labour market.

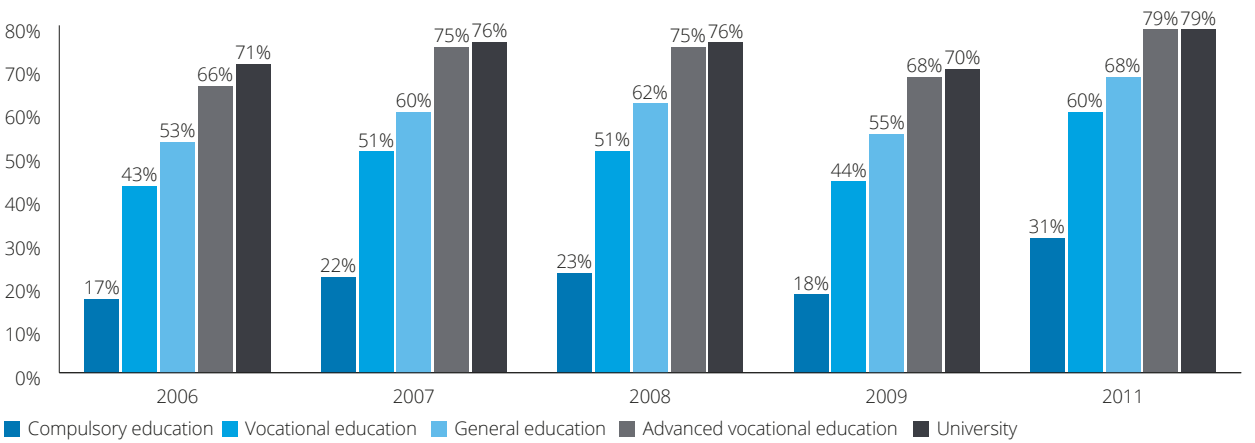
Switzerland is well-positioned in terms of continuing training. Its workforce enjoys one of the world's highest levels of further training, and the numbers who receive continuing training has also risen steadily in recent years, more than in countries such as the US and the UK.[26] As Figure 17 shows, however, employees with a low level of initial training also tend to be the least likely to receive further training. In contrast, those who have the highest qualifications are the most likely to receive continuing training. This is a problem, because higher levels of education and training tend to protect individuals against the impact of automation. In other words, those with higher levels of education face less risk of losing their job as a result of automation.

The low proportion of employees with modest qualifications who engage in further training can probably be attributed less to a shortage of financial resources and more to the lack of time and the absence of motivation, openness and curiosity – three characteristics that will be in particular demand in future.[27] Against a background of constantly developing technologies, it will be important for companies to find staff not only with the appropriate skills but also who are motivated, open to and curious about acquiring new knowledge and new skills. Raising the awareness of employees is one way of seeking to promote these characteristics. Starting with basic education, but especially within vocational training, young people should be made aware of the importance of lifelong learning in the digital age and the potential consequences of not engaging in it. Lifelong learning is ultimately an individual responsibility, not the responsibility of the state or individual companies, although both the state and business can take measures to support the raising of this awareness.

Additional education or further training will also help employees who lose their job as a result of structural change to find new employment.

Further measures to increase the relatively low proportion of those with low qualification levels who engage in further training – might include reducing barriers created by time or regulatory constraints. For example, consideration might be given to whether an older career-changer should undergo exactly the same vocational training and obtain the same qualification as a school-leaver, or whether re-training for career changers could be tailored more to the individual's situation and experience. Career changers already have qualifications and experience, so for them retraining could be targeted at filling the gaps in their skills. In many cases, this would save both time and expense, and would also restore their employability more quickly.

Figure 17. Participation in non-formal continuing training activities by 25-64 year-olds



Sources: Federal Statistical Office, Deloitte Research

> "Switzerland has one of the highest continuing training quotas of any country around the world. However, it serves those with low skills levels worse than those with higher skills levels. There is work to be done here."
>
> **Josef Widmer, Deputy Director, State Secretariat for Education, Research and Innovation**

6. What does this mean for companies?

Companies, as well as employees and training institutions, also face major challenges in tackling the changes brought about by automation and digitalisation. 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. They also need to invest in their current workforce and provide continuing training so that employees can develop and expand their skills and knowledge.

Using automation and digitalisation to search for new staff …

New technologies offer excellent options for talent management. The increase in available data improves selection and recruitment, and staff management, as well as facilitating close networking with both applicants for jobs and existing staff.

In order to exploit the available opportunities, companies should develop a competency model, which incorporates both its corporate values and also the specific requirements for individual jobs. The required competencies for each job should be identified, quantified more than is currently the case. They should then be used both in the recruitment process for new staff and the performance evaluation of existing employees.

> “Digitalisation opens up huge opportunities for recruitment and talent management. Processes can be harmonised globally. Data-driven HR generates more information and so better talent management, better HR planning and better networking.”
>
> **Guido Ruoss, Global Head HR, Julius Bär**

Greater use of data analysis in the recruitment process will facilitate more accurate evaluations. Technology and algorithms can be used to identify candidates online. Potential applicants can be identified actively using social networks and the data obtained may be used to carry out basic checks. Mobile and social media user data can be set against the skills, values, interests and other key aspects of the advertised position. The search for candidates can be expanded to potential applicants who would be suitable for the position and may be interested, but who have not applied or are not currently seeking to change jobs. Indications of potential willingness to change jobs may also be established using social media user data. Applications actually submitted can also be evaluated using social media user data and additional information about applicants can be gathered and evaluated.

The company’s brand or reputation is a key factor in staff recruitment. The company should be perceived as attractive, particularly in its core roles, to enable it to attract applicants with high potential. New technologies can help to increase market profile and brand attractiveness. The company as employer should adopt active HR marketing. A presence on social networks and the development of links outside traditional recruitment platforms will support efforts to develop brand reputation and create an image of openness, willingness to communicate, modernity and innovation.

… and in the recruitment process

Despite the increased use of technology, most companies – in particular those for which social skills are particularly important – are unlikely to abandon face-to-face selection procedures. In such cases, technology can be used to support these procedures, saving time and costs and generating and evaluating additional data.

A range of background processes could be automated, such as the transfer of data field content from application forms and (where possible) the simultaneous checking of this data for accuracy. Further data analysis could be used to generate additional information about applicants and about the application process, for example to obtain indications of the probable behaviour of applicants, such as their likelihood of accepting or declining a job and the length of time they are likely to stay in the job if they are appointed.

Technology might also be used for direct contact with applicants. For example, companies could acquire further data about applicants in the form of videos or testimonials, or gather additional information through gamification (online games). The application process might include an online behavioural test to enable skills and cultural values of individual applicants to be compared in detail with the company's values or with the skills required for a particular position.

> "When recruiting new staff, it will be important for companies to identify not only their current potential but also their future potential. Employees will have to undergo continuing training and will need a sense of curiosity and enjoy uncertainty. Companies need to recognise and promote this mindset."
>
> **Siegfried Gerlach, CEO Siemens Switzerland**

Video interviewing – for example, for the first round of interviews – might reduce costs and the time commitment for both sides. Such interviews would generate further information from verbal and non-verbal communication, which the company could use for assessment and in subsequent stages of the recruitment process.

New opportunities for talent management

In a rapidly changing market environment, where both employers and employees have increasing demands and expectations, talent management cannot afford to stand still. Talent management should develop the experience of employees and support learning, and recognise performance and provide remuneration based on teamwork and value creating for the company from a diverse and multicultural workforce. Focusing on the individual will meet the requirements of different groups of staff more effectively.

By promoting career models that are also supported outside the individual company, employers can increase staff involvement and loyalty. Improving the employability of staff increases their market value, and the company benefits from this through increased productivity: it should therefore make further staff development a key concern, particularly for highly-talented employees. Companies that promote talent are more attractive to employees with talent and potential.

New technology and digital applications might also be used to create an attractive (and productive) workplace, offering digital, agile and flexible employee development and assessment systems that enhance employee performance and staff loyalty.

> “Lifelong learning is ultimately the responsibility of employees. The same is true of personal development. However, we as companies can provide impetus and support our employees in this process.”
>
> **Walter Jung, Head of Talent Management, Genossenschaft Migros Zurich**

Using digitalisation to optimise further training

The advances in digitalisation and automation are making continuing training increasingly important. To remain competitive, companies need to keep abreast of technological advances and, where possible, to drive such changes themselves. This requires appropriately skilled employees. Investment in ongoing skills development for the workforce is therefore central not only to talent management strategy but also for the company's prospects of success. Even where companies invest in further training for employees who then leave the company, which might seem to represent wasted expenditure, it is vital that they should remain able to attract, retain and develop highly talented staff.[28]

Companies should therefore embed a recognition of the importance of continuing training within their corporate culture and performance assessment arrangements. Training needs to be job-specific, so that it is clear to employees which training is useful to them and why. This will improve both the relevance of training provision and employee motivation. Support should also be given to encourage employees to undergo further training, for example by providing financial incentives and through cost sharing by the company. Training can also be integrated into employees' day-to-day work in short, digestible and well thought-through formats: for example an employee who performs a particular role and might be offered short relevant training sessions to improve their competencies for that role. This would make further training directly relevant and would require only minimal time commitment from employees.

New technologies also create new opportunities, for example for social learning and for 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.

For the company, it is important not only to encourage and promote continuing training by the workforce but also to convince and involve employees. Self-directed learning organised by individual employees themselves is the most effective option: ultimately, they will accept only what they perceive as relevant and interesting. Individual learning programmes therefore need to reflect personal preferences and individual needs in terms of learning style, pace of learning, interest and experience. Creating digital spaces would enable deep learning to take place and new competencies to be acquired. The user interface of many relevant software programs at work and the control elements of many machines are increasingly similar to the interface of software used privately (for example on smartphones), and this facilitates the transfer to the workplace of digital skills acquired privately.

7. Appendix 1: List of competencies

Knowledge

Business and Management	Manufacturing and production	Engineering and technology	Mathematics and science	Health services	Education and training	Arts and humanities	Law and public safety	Communications	Transport
Administration and Management	Production and Processing	Computers and Electronics	Mathematics	Medicine and Dentistry	Education and Training	Languages	Public Safety and Security	Telecommunications	Transport
Clerical	Food Production	Engineering and Technology	Physics	Therapy and Counseling		Foreign Language	Law and Government	Communications and Media	
Economics and Accounting		Design	Chemistry			Fine Arts			
Sales and Marketing		Building and Construction	Biology			History and Archeology			
Customer and Personal Service		Mechanical	Psychology			Philosophy and Theology			
Personnel and Human Resources			Sociology and Anthropology						
			Geography						

Skills

Content skills	Process skills	Social skills	Complex problem-solving skills	Technical skills	System skills	Resource management skills
Reading Comprehension	Critical Thinking	Social Perceptiveness	Complex Problem Solving	Operations Analysis	Judgment and Decision Making	Time Management
Active Listening	Active Learning	Coordination		Technology Design	Systems Analysis	Management of Financial Resources
Writing	Learning Strategies	Persuasion		Equipment Selection	Systems Evaluation	Management of Material Resources
Speaking	Monitoring	Negotiation		Installation		Management of Personnel Resources
Mathematics		Instructing		Programming		
Science		Service Orientation		Operation Monitoring		
				Operation and Control		
				Equipment Maintenance		
				Troubleshooting		
				Repairing		
				Quality Control Analysis		

Abilities

Cognitive	Psychomotor	Physical	Sensory
Oral Comprehension	Arm-Hand Steadiness	Static Strength	Near Vision
Written Comprehension	Manual Dexterity	Explosive Strength	Far Vision
Oral Expression	Finger Dexterity	Dynamic Strength	Visual Color Discrimination
Written Expression	Control Precision	Trunk Strength	Night Vision
Fluency of Ideas	Multilimb Coordination	Stamina	Peripheral Vision
Originality	Response Orientation	Extent Flexibility	Depth Perception
Problem Sensitivity	Rate Control	Dynamic Flexibility	Glare Sensitivity
Deductive Reasoning	Reaction Time	Gross Body Coordination	Hearing Sensitivity
Inductive Reasoning	Wrist-Finger Speed	Gross Body Equilibrium	Auditory Attention
Information Ordering	Speed of Limb Movement		Sound Localization
Category Flexibility			Speech Recognition
Mathematical Reasoning			Speech Clarity
Number Facility			
Memorization			
Speed of Closure			
Flexibility of Closure			
Perceptual Speed			
Spatial Orientation			
Visualization			
Selective Attention			
Time Sharing			

Source: O*NET

8. Appendix 2: Overview of studies of automation conducted by Deloitte Switzerland

November 2015
The impact automation has so far had on the Swiss labour market

May 2016
The future impact of automation on the Swiss labour market

October 2016
The impact of automation on individual sectors in Switzerland

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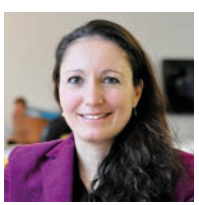

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Designed and produced by Deloitte Creative Studio. J11592