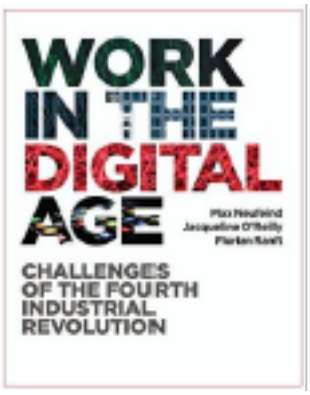
No Need for Automation Angst, but Automation Policies



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Technological change is increasingly turning the value chain into an automated and digitalised process. The digitalisation and automation of manufacturing processes is characterised by the use of increasingly autonomous systems and robots, as well as fully automated smart factories (Industry 4.0), which are interconnected with upstream and downstream business divisions. Similarly, service providers have been using intelligent software and algorithms on the basis of large volumes of data and web interfaces to digitalise and automate business processes. To this effect, businesses make use of big data analysis software, cloud computing systems or online platforms, to give but a few examples. In view of these technological developments – sometimes referred to as technologies of the fourth industrial revolution – an increasing number of concerns have been voiced in the public debate that this might lead to many jobs becoming redundant in the future. The idea of 'technological unemployment' is supported by a number of US studies which suggest that almost 50% of jobs are at risk of being replaced by new digital technologies (Frey and Osborne 2017). This raises a number of questions for both political decisionmakers and the general public: is it true that automation and digitalisation will result in major job losses? And if so, which jobs are at risk? In what ways are technological developments changing work processes and content? How will this affect qualification and skills requirements? Do we need to adapt in order to guarantee employee job security? This essay sheds some light on these questions.

AUTOMATION RISKS SEEM TO BE OVERESTIMATED

Frey and Osborne (2017) investigated how susceptible are jobs to computerisation by asking experts how easily certain occupations could be automated in the next two decades. As a result they estimate that 47% of all US employees are in occupations that are at high risk of becoming automatable in the next 10 to 20 years. Applying the

same methods to determine the automation potential of specific occupations in Germany and Europe yields similar results (Bonin, Gregory and Zierahn 2015 Bowles 2014). Hence, these findings subsequently spurred widespread automation angst and have sparked lively political debate public debate in recent years. However, there are good reasons to assume that these figures vastly overestimate the number of jobs that will actually become redundant due to technological advances in the next two decades.

First of all, usually, not all the tasks outlined in a job description can be automated to the same degree. In fact, though machines may take over certain tasks of any given job description, there are others that they cannot. Therefore, whether an occupation can be automated or not depends on how significant the type of tasks are that can be carried out by machines. Hence, even within the same occupation, the automation potential can vary greatly from job to job. An analysis of automation potential based on the actual task structure of individual jobs thus produces very different results (see Arntz, Gregory and Zierahn 2017). According to this analysis, the percentage of jobs in the US with a high automation potential (>70%) falls from 38% when applying Frey and Osborne's occupation-based approach to just 9% when looking at individual jobs (see Figure 4.1). One explanation for this significantly reduced automation potential is that many jobs involve tasks that are difficult to automate and that workers apparently specialise in different non-automatable niches within their profession. As a result, risk assessments that are based on occupational job descriptions for some representative workers do not sufficiently capture these non-automatable niches, and hence seriously overestimate the potential for automation. One potential reason for this result could be that workers increasingly shift their work towards tasks that complement these new technologies (Spitz-Oener 2006).

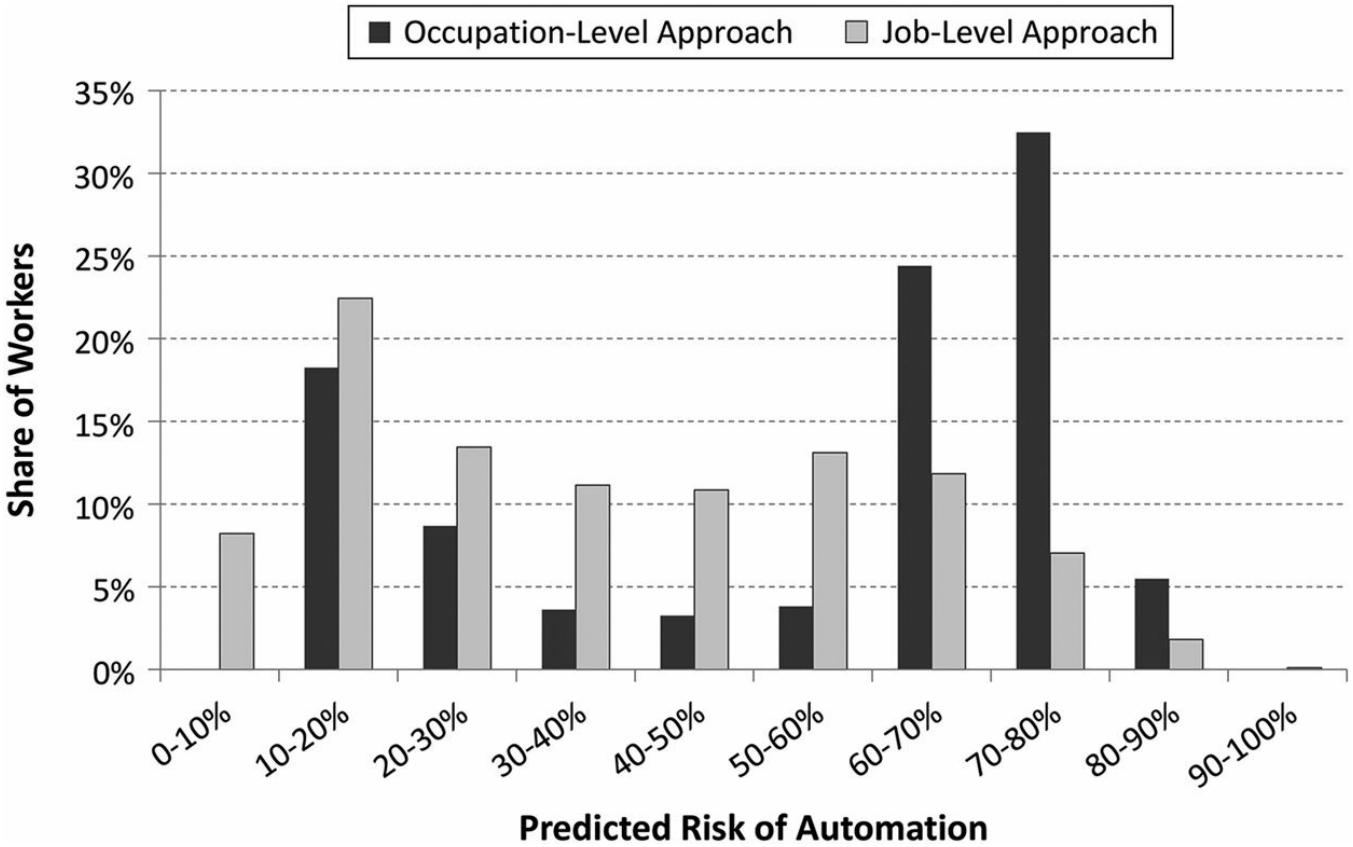

Figure 4.1 Automation potential on the US labour market. *Source:* Arntz et al. 2017.

These findings also hold for many other Organisation for Economic Co-operation and Development (OECD) countries. In particular, the use of an individual job-oriented approach has shown that the automation potential of jobs in 21 OECD countries is far lower than previous studies would have us believe (Arntz, Gregory and Zierahn 2016), though the results vary from country to country. While 12% of jobs in Germany and Austria can be automated, the figure for Korea is only 6%. Even though the cause-and-effect relationship is yet to be sufficiently studied, the analysis suggests that countries with the lowest percentage of jobs that can be replaced tend to invest more in information and communications technology (ICT) and have a more communication-intensive workplace structure as well as a more highly educated workforce. Hence, there is some evidence that the automation potential has been exaggerated and that future potential for automation is actually lowest in the countries that have already undergone some adjustments through ICT investment and upskilling their workforce. Notably, these expert-based risk assessments also correspond more or less with subjective assessments of employees regarding technological change; according to a German survey, 13% of workers expect their job to be carried out by a machine within the next 10 years (Arnold et al. 2016).

HURDLES TO DIGITALISATION LIMIT AUTOMATION

POTENTIAL IN THE SHORT- TO MID-RUN

Although the automation potential may thus be much lower than is often claimed, around 1 in 10 jobs still seems to have the potential to become automated. Expecting an increase in unemployment of the same magnitude, however, would be much too simplistic a conclusion, since automation potential only reflects the technical potential for job displacement (see also Arntz, Gregory and Zierahn 2016; Bonin, Gregory and Zierahn 2015). For example, it is quite likely that it takes longer for these new technologies to be adopted by firms on a grand scale than is often asserted. Initial analyses based on the representative IAB-ZEW Working World 4.0 survey conducted in early 2016 have shown that although around half of German companies are using "technologies of the fourth industrial revolution", on average only 5% of all firm assets could be described as "production facilities 4.0" and only 8% as "electronic office and communications equipment 4.0" (Arntz et al. 2016b).

Some of the main hurdles faced by firms when implementing technologies of the fourth industrial revolution are the increasing cost of data protection and cyber security measures, the need for specific training for employees on how to work with new technologies, high investment costs, and an increased dependence on external knowledge and services (Arntz et al. 2016a). Apart from these hurdles, a number of regulatory, legal or social road blocks do not prevent the introduction of these new technologies, but they could slow their diffusion. Some of the obstacles will be overcome at some point. Social preferences for certain tasks to be carried out by humans rather than machines (eg in areas such as care services) may limit the adoption of new technologies even in the long run. This could be done by establishing technical standards for implementing networked manufacturing and liability issues surrounding self-driving cars.

DIGITALISATION IS CHANGING JOBS BUT NOT REPLACING THEM

The implementation of new technologies does not necessarily lead to job losses if employees are increasingly carrying out tasks that are made more efficient by using new technologies without being replaced by these technologies (Acemoglu and Restrepo 2017; Autor 2015). This may also explain why only a third of the 13% of employees who believe their job could potentially be automated expressed concern over the security of their own job (Arnold et al. 2016). Since, from the perspective of companies, the use of new technologies goes hand in hand with increased work productivity as well as additional sales opportunities for new products and services

(Arntz et al. 2016b), the effects of digitalisation on overall employment are not necessarily negative.

TECHNOLOGICAL CHANGE CREATES MORE JOBS THAN IT DESTROYS

In order to make any concrete statement on the changes to overall employment over the course of digitalisation, we must consider both labour-saving and job-creating effects. From their initial empirical findings on the European level, Gregory, Salomons and Zierahn (2016) concluded that the net balance was previously on the whole positive. Figure 4.2 shows the corresponding aggregate effect of technological change in the period 1999–2010 on the labour demand of firms and dissects it into various causal factors. The lower limit is based on the assumption that only wage income leads to increased consumption in Europe, while the upper limit assumes that capital income also has a positive effect on the European economy through consumption. Overall, it appears that labour demand has increased as a result of recent technological change. The labour-creating effect of technological change thus seems to dominate the initial labour-saving effect. This is because the falling price of goods, together with increased consumption resulting from rising income levels, have led to an increase in labour demand in both the area of tradeable goods (this is an example of the positive product demand effect) and of non-tradeable services (this is an example of the positive product demand spillover effect). The latter effect is considerably stronger if capital income also contributes to consumption within Europe. This suggests that the effects of digitalisation on the labour market might also depend on how the profits of technological change are distributed and utilised.

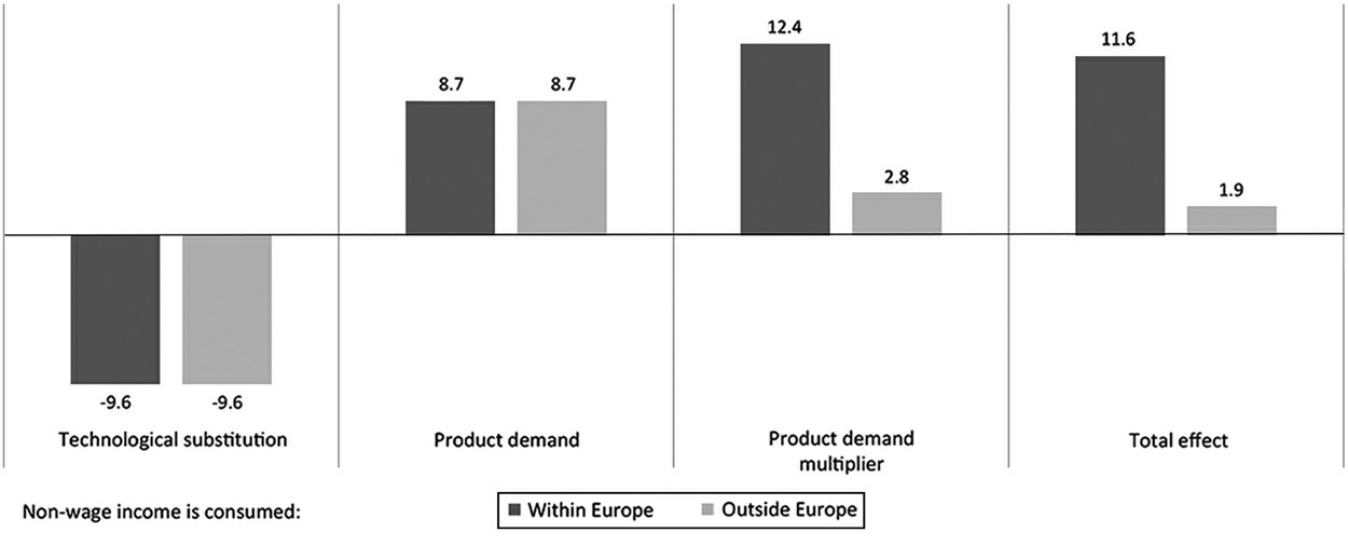

Figure 4.2 Labour demand in Europe, estimated change (in millions of jobs) 1999–2010. *Source:*

Gregory, Salomons and Zierahn (2016).

DIGITALISATION ALTERS QUALIFICATION AND SKILLS REQUIREMENTS

Even though overall employment is unlikely to drop significantly, this does not preclude massive structural changes. Jobs in IT and education are likely to benefit, whereas jobs in manufacturing industries where the use of machines and technical equipment is widespread will probably be hardest hit by staffing cuts (Wolter et al. 2015). This structural change will also lead to a change in qualification and skills requirements. Overall, the findings suggest that in the future jobs will be less physically demanding and instead more mentally demanding, as well as being more varied and complex. From the perspective of companies, job requirements will increase, particularly in the area of process expertise and interdisciplinary methods of working and transferable skills (see Figure 4.3). The latter primarily encompasses social skills (eg customer service) and creativity – in other words, skills where humans still have an advantage over machines. One of the side-effects of these developments, however, is an increasingly high mental strain on workers. Around two-thirds of employees believe that new technologies have led to increased workloads, with more and more tasks having to be completed at the same time (Arnold et al. 2016).

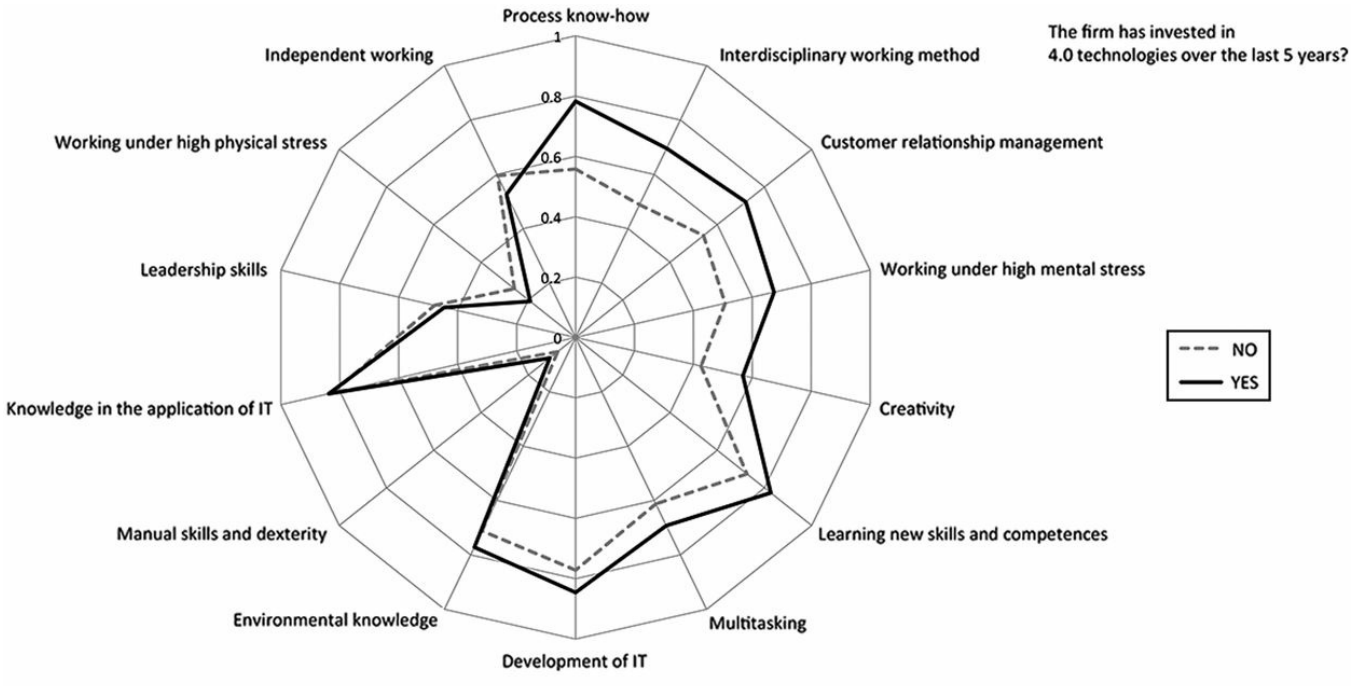

Figure 4.3 Increasing automation and changing skill requirements. *Source:* Arntz, Gregory, Jansen and

Zierahn (2016b).

TREND TOWARDS BOTH UP- AND DESKILLING

These changing skills requirements seem to be accompanied by an increased demand for better qualified workers even within occupations. According to the results of a survey conducted among German companies, the demand for qualifications is shifting as a result of digitalisation, particularly in the service sector, in favour of expert and specialist jobs (for workers with vocational training or further training on the job) and high-skilled jobs (for university graduates) and away from unskilled work (Arntz et al. 2016b). Employees have also begun to perceive this trend towards more highly skilled workers. In Germany, four-fifths of workers see a need to continuously develop their skills in order to keep up with higher job requirements (see Figure 4.4). Although this was observed across all qualification groups, the share of individuals seeking to upgrade their skills increases with the level of qualification. These changing skill and qualification requirements point to the new division of labour between man and machine in the near future. While machines take over tasks which are easier to programme and automate, human labour is mainly needed for less routine and skill-intensive tasks involving creativity and social interactions.

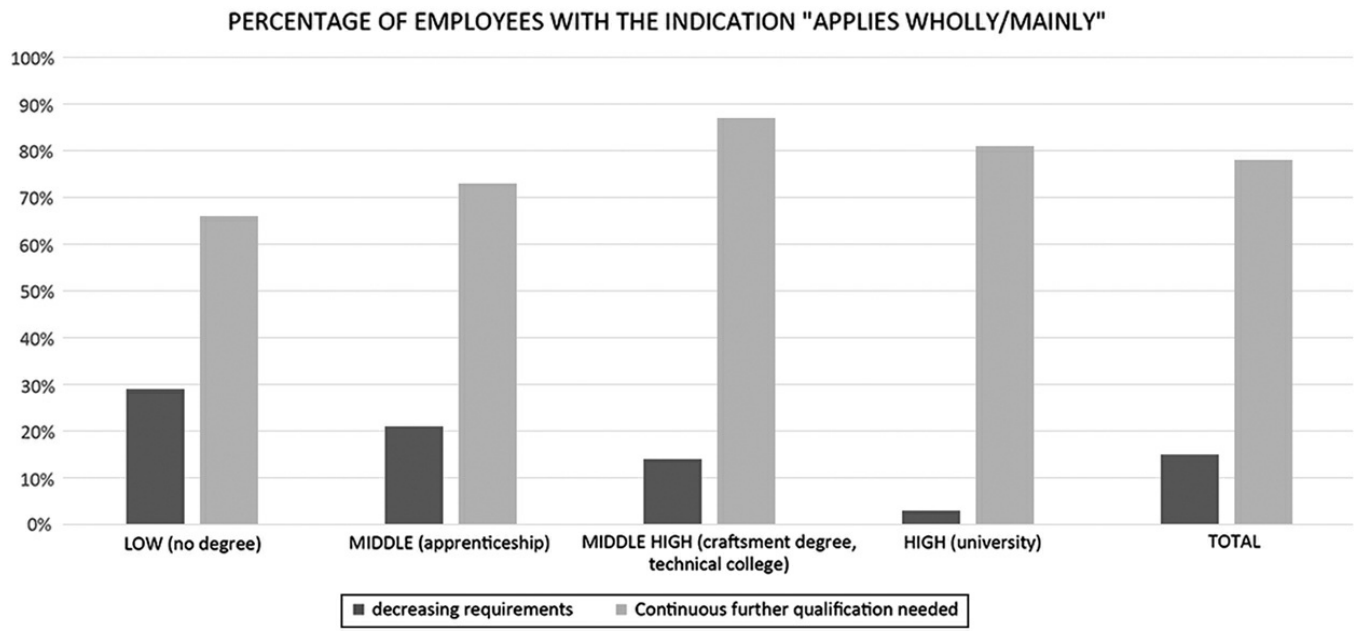

Figure 4.4 Competence requirements due to digitisation by education group, Germany.

The trend towards more highly qualified workers is not seen everywhere, however. Companies in the manufacturing sector are reporting a polarisation of qualification requirements. Demand for both low-skilled and highly qualified workers has risen, to

the detriment of workers with medium level technical qualifications – in other words, we are seeing a trend towards both higher and lower qualification requirements for workers. Indeed, 15% of workers in Germany reported that the skills and competencies required for their jobs had decreased over the past five years as a result of digitalisation (Arnold et al. 2016). Low-skilled workers in particular – around 1 in 3 – claim to have witnessed this sort of deskilling.

FROM RISING POLARISATION TO RISING INEQUALITY?

Even though digital transformation is not expected to trigger any negative aggregate employment effects, it is still creating a fundamental shift in labour demand between different occupations and fields of activity. This will put increased pressure on workers, particularly low-skilled workers, to adapt. The share of low-skilled employees performing tasks with a high automation potential is significantly higher than among employees with high or medium level qualifications. Employees' subjective expectations regarding the likelihood of their job becoming automated are similarly distributed across the different education groups (cf. Figure 4.5). Recent studies suggest that the pressure to adapt is shifting from workers with medium level qualifications, who were hardest hit in the 1990s, to low-skilled workers (Arnold et al. 2016; Arntz, Gregory and Zierahn 2016; Wolter et al. 2015).

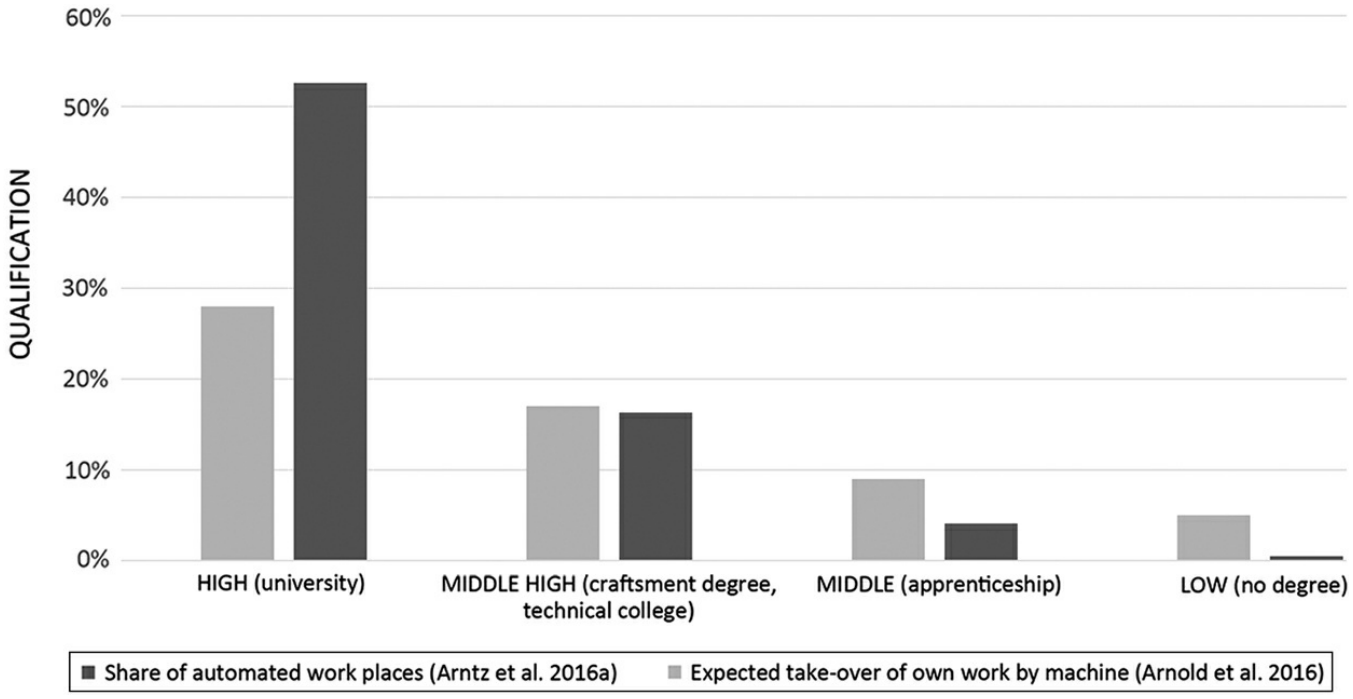

Figure 4.5 Automation potential and perceived threat from technological substitution by education groups.

As a result, the effect of digitalisation on the employment and wage structure may

change. While it is highly qualified workers in occupations involving a high level of non-routine tasks who benefit most from an increasingly demanding work environment, as machines and algorithms are complementary to their work and increase their productivity, until recently, it was primarily workers with medium level qualifications in occupations characterised by a high degree of routine tasks who had reason to fear that their jobs might be replaced by machines. As a result, over the last two decades employment among highly qualified workers at the upper end of the salary distribution – and to a lesser extent among low-skilled workers at the lower end – increased, while employment growth in the middle was fairly weak. In this way, labour markets in western economies have experienced widespread job polarisation (Acemoglu and Autor 2011). If in the future, however, low-skilled workers come increasingly under pressure as simple non-routine tasks become more easily automated, a period of job polarisation in the recent past might be superseded by a period of increasing inequality.

NEED FOR A COMPREHENSIVE POLICY RESPONSE

Overall, the challenges surrounding the digital transformation towards a Work 4.0 call for a policy approach that helps to unleash the full innovative and productive potential of this change, while at the same time ensuring that workers are not left out in the cold. In this regard, there are three key messages that can be derived from the research findings presented above.

First, workers' qualifications will have a central role to play. Continuous further training is important if workers are to meet the ever increasing skills requirements in many sectors. For this reason, many companies are intensifying their further training schemes and adapting the contents of their training courses. However, those whose jobs have the highest automation potential – low-skilled workers – actually see less of a need to continuously train and gain new skills than other, more highly qualified groups of workers. Corporate measures alone are not enough to combat a potential increase in inequality as a result of technological change. In addition, government programmes are needed to promote particular groups whose skill levels would otherwise fall further and further behind rising requirements. Moreover, these programmes should not only kick in once people have already lost their jobs; rather, they should be offered opportunities to gain higher qualifications alongside their current job that will help to keep them in stable employment.

Second, we can expect there to be a fraction of the labour force that is not in a position, and is unlikely to reach a position even through further training, to meet the

growing demands of the labour market. Employment and income risks might increase for this group and will represent a challenge for social policy. Due to a lack of research, however, the extent of this challenge as well as any potential remedies remain underdeveloped.

Third, initial findings suggest that the aggregate employment effects of digital transformation depend, among other things, on how the profits of digitalisation are distributed and utilised. While increased wage income bolsters local consumption and thus creates new jobs, increased capital income might be less beneficial for the local economy. This raises the question of whether lower tax rates for capital income compared with wage income represent a disadvantage to the input factor labour and whether an adjustment of the relative tax burdens could lead to more positive employment effects of digital transformation.

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