

Enzo Weber*

Employment and the Welfare State in the Era of Digitalisation



Enzo Weber
IAB Nuremberg and
University of Regensburg

Everyone has been talking about digitalisation and 'Industry 4.0' for several years now. Although some of this discussion is hype, profound changes in the labour market can be expected thanks to intelligent, interconnected digitalisation. After previous industrial revolutions, this ongoing process now involves interconnecting the virtual-digital and physical worlds, as well as machine learning in production. The aim is that the value chain can be controlled entirely by digital means, or that it can control itself in a self-organised way, within and beyond company borders. The result is supposed to be a more efficient, flexible, and individual production chain.

From a business point of view, two main concerns can be identified: on the one hand, a new way of organising and dividing labour in production, as well as between humans and machines. On the other hand, however, digitalisation is also about developing new ideas and creating new value by tapping the digital potential that can be harnessed from large amounts of data. This all amounts to new business models on the market side of companies.

For the labour market and the welfare state, two major issues arise: firstly, what is the future of employment; and secondly how can public institutions handle this profound technological change?

STRENGTHS AND WEAKNESSES OF GERMANY 4.0

What is the outlook of a continental economy like Germany, particularly in the light of digitalisation? On the one hand, Germany is economically well-equipped; on the other hand, however, a range of completely novel challenges awaits, as Weber (2016) argues. German companies are particularly well-represented in interconnected mechanical and plant engineering, as well as sensor technology. Those sectors play to the typical strengths of the investment goods and export industry. In cloud technology and big data, however, there are other leaders; primarily based in the United States. It is these latter fields, however, that could form the core of intelligent control and communication. In this respect, Germany could quickly find itself in the position of an extended workbench of a modern digital economy if there is an excessive focus on traditional strengths like mechanical engineering. Germany's undisputed strength in the export of

high-end industrial goods, particularly over the last decade, could no longer be guaranteed under such circumstances.

Its second strength, which could also turn into a weakness, lies in the structure of the German economy. While the news is dominated by major corporations, the vast majority of workers in Germany are employed by small and medium-sized companies (SMEs). In the past, there was no need to worry about the innovation capacity of German SMEs. However, 4.0 Digitalisation is happening on a whole new level of abstraction, complexity, and interconnection; and handling it is no mean task within the limited structures of smaller companies.

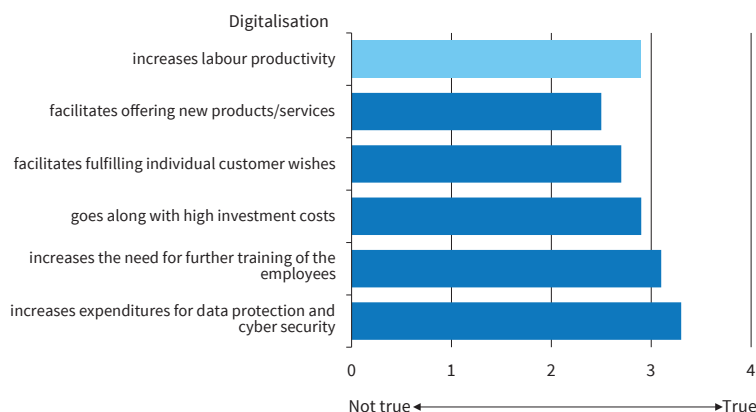
Moreover, the German system is also facing a number of internal challenges too. Production, knowledge, sales and development activities are growing ever closer together. This means that the typical German dividing line between tasks is blurring. At the same time, hierarchies are becoming flatter. The importance of formal authority is increasingly being replaced by topic-specific networks and streams of information. The strengths of many German companies, oriented towards productivity and quality, must be developed further towards flexibility. Particular emphasis should be placed on reconciling companies' need for flexibility with that of their employees. Demands are growing, especially with regard to short and long-term working hour arrangements, and partly also due to a shift in the perception of social roles. In some areas, this means that entirely new technical possibilities will arise for such a connection, but the organisational implementation remains a challenge.

EMPLOYMENT: NO DECLINE, BUT MAJOR CHANGES

Even if 4.0 Digitalisation is heavily implemented in Germany, its effects on the labour market in particular will be ambivalent. When observing digitalisation from a technological perspective, the typical result is a high degree of substitution of human work by machines. From the perspective of the welfare state, this has led to intense discussions over an unconditional basic income: while productivity would rise, a substantial drop in the number of jobs would call into question the income distribution mechanism that our working societies are currently built on.

The actual effects of digitalisation on the labour market, however, require a comprehensive economic assessment while taking into account a variety of effects: jobs disappear, new jobs are created, demands and activities change, production becomes more efficient, new products are created, income is generated and introduced into the economic cycle, labour supply and demand as well as wages and prices are adapted. The results of current assessments differ immensely, as shown by discussions in Frey and Osborne (2013) or Autor (2015). On the one hand, there are fears of massive job losses as contemporary occupations are rendered superfluous by robots, and on the other, there

Figure 1
Corporate Assessments of the Effects of Digitalisation
 Levels of agreement



Source: IAB/ZEW Business Survey 'Working World 4.0', 2016.

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are hopes of large-scale employment and innovation gains.

This ambivalence is also reflected in company survey results. Figure 1 shows, for example, that respondents believe that digitalisation will increase labour productivity. This means that the same value can be created with less labour. However, companies also expect additional effects on new products, investments, further education, and data privacy, among others. If all of these services were performed, this would generate additional employment.

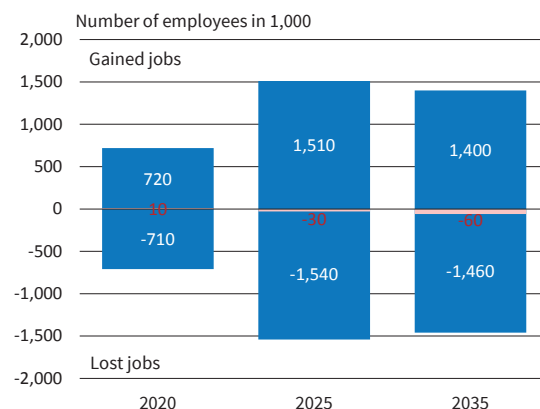
A study comprehensively analysing the effects of 4.0 Digitalisation on the economy and the labour market was recently presented by the Institute for Employment Research (IAB), the Federal Institute for Vocational Training, and the Institute of Economic Structures Research (Wolter *et al.* 2016). Compared to the predecessor study, 'Industry 4.0' (Wolter *et al.* 2015), the perspective is broadened and the implementation of 'Economy 4.0' including digitalisation in the services sector is considered. While the keyword for Industry 4.0 is often a 'factory devoid of humans', the services include, among other things, 'autonomous driving' or fully automated logistics.

The study takes the current labour market projection from the *QuBe project* as the 'basic scenario' and compares it to an 'Economy 4.0 scenario'. The latter is specified along the lines of a comprehensive set of assumptions that cover the implementation of 4.0 Digitalisation in Germany. This scenario shows an increase in value creation by approximately 80 billion euros (almost 3 percent of current GDP) within the span of ten years beyond the basic scenario. In the light of increasing productivity and higher demands made of employees, this results in higher wage sums on the one hand and higher profits on the other, given more efficiency and revenue for new products. The employment level does not show any significant changes. The whole scenario therefore reflects neither the fear of high job losses nor the hope of high job gains. Behind

that, however, there are considerable changes: a large-scale introduction of Economy 4.0 in the year 2025 would result in the loss of approximately 1.5 million jobs, which were still there in the basic scenario, but also in the creation of 1.5 million additional jobs in other areas (see Figure 2). The trend shown by these results is confirmed by Warning and Weber (2017), who examine the present employment dynamics subject to company-level digitalisation trends. No overall negative employment effects can be identified, but companies with a trend towards digitalisation show a higher rate of both hiring and dismissal rates.

In particular typical professions in the manufacturing are like machine and facility-controlling and maintenance professions are in decline. Dampening effects can also be found in electronics, chemical, and synthetic materials professions, as well as office and commercial services professions. The strongest repercussions are felt in the occupational areas of finance, accounting and book-keeping. By contrast, IT, scientific and teaching professions (which benefit from the need for further training) are on the rise. In terms of requirement levels, the demand for complex and highly complex activities is growing by approximately 800,000, while it is declining for unskilled (- 60,000) and particularly specialist activities (- 770,000) (see Figure 3). Expressed in qualification stages, this is reflected in gains in the academic area, as well as losses in the vocational and unskilled area. This shows that the development towards Economy 4.0 will also affect the medium-skill range of the labour market, which is particularly strong in Germany. But one must not interpret these effects as a mechanical process: speci-

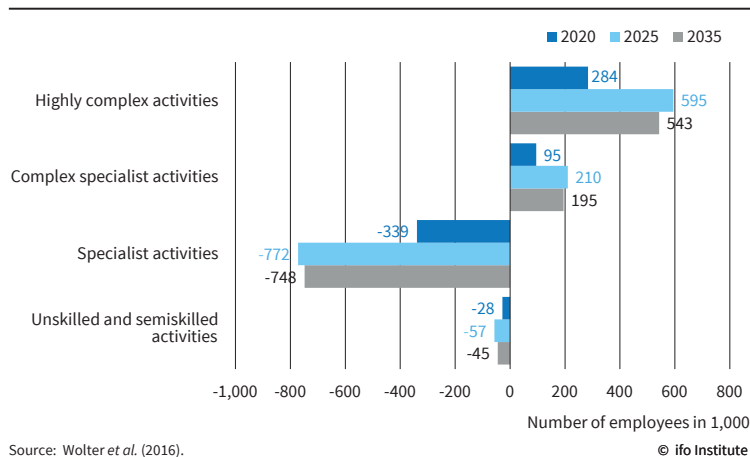
Figure 2
Jobs Lost and Gained as Compared to the Basic Projection
 Yearly average



Note: Balances red colored.
 Source: Wolter *et al.* (2016).

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Figure 3
Employees by Requirement Level Compared to the Basic Projection



alists may also benefit from a rise in complex activities if they develop their own competences accordingly. Even today, many employees with vocational training do not work at the specialist level, but at the complex specialist level. Many others, however, hold jobs in the unskilled area.

When looking at industries, we can see that the effect on employment in the manufacturing sector is particularly negative, despite sales increases. The industries that benefit most from that scenario are information and communication, education, and activities of households as employers of domestic staff. While the positive effects on the two former industries can be explained by a greater need for consultation and further education as a side effect of digitalisation, the increase in employment in the households sector is less obvious. Here we see the effects of a rising income and demand level, whereas the jobs in question can be automated to only a relatively limited extent. 4.0 Digitalisation therefore also creates jobs in areas that are not even directly connected to it. That is a general characteristic of employment reactions to technological change, and its overall effects can therefore only be illustrated in a comprehensive approach.

Overall, the effects of Economy 4.0 may even lead to some kind of compensation of the emerging imbalances, mitigating shortages in medium-skill jobs based on vocational training. By contrast, additional demand is generated for the sharply increased supply of labour in the academic field. An effects analysis of labour market developments therefore also needs to consider changes in the labour supply in addition to the changes in labour demand that currently dominate the debate.

DIGITALISATION DOES NOT ONLY AFFECT LOW SKILLED JOBS

However, this seemingly elegant result does not constitute an all-clear. According to the results, the difficult labour market situation of low-qualified persons is on a downwards trend and will deteriorate further in the future. Even although impulses are possible in this area

like, for example, the use of assistance systems such as data goggles and mental/ergonomic relief through human-machine collaboration, the way humans process information in the concrete working environment must be taken into consideration. Therefore, even with digital support, the most important factors will still be transparency, task-oriented design, openness towards human intervention, and qualification. Moreover, tasks could come up for low-skilled workers if structural changes emerge in jobs at the medium-skill level, leading to

a redistribution of individual, hard-to-automate tasks like short cleaning or maintenance activities, which have hitherto been covered in these jobs. As regards the welfare state, it is nevertheless conceivable that labour market policy measures for improvements in the low-skill sector will become even more important. The overall macroeconomic effects of the phenomenon of Economy 4.0 entail major challenges on a political and company level in view of the major shifts and changes in workplaces foreseeable in the future.

VOCATIONAL TRAINING FOR A DIGITALISED ECONOMY

Education and further education play an important role. To what extent Economy 4.0 will push back, or even eliminate, entire professions remains to be seen – the automation of tasks does not equal the automation of entire jobs, which combine tasks with interaction, flexibility, problem solving, adaptability, and common knowledge. In any case, professional requirements will change, and the effect strongly depends on the areas in which this change is best received.

The Economy 4.0 process, which creates new task profiles through digitalisation, must be addressed according to one's own strengths in international competition. As right as it may be to place an obvious emphasis on university training, the clear specific strengths of the German system lie in the vocational training system and its interlocking of theory and practice. Then again, vocational training content is often oriented towards rather narrowly-defined job profiles and a specific working environment, which can limit one's capacity to adapt and evolve in professional life, as Hanushek *et al.* (2017) show. Moreover, Dengler and Matthes (2015) demonstrated that there are a high number of routine activities, especially in many jobs at the vocational training level, which are comparatively easily to programme.

Policy must therefore be active rather than simply reactive, and should focus on the further development of strengths in order to train people who have the

potential to shape the implementation of Economy 4.0. As production, knowledge, and development activities grow closer together and hierarchic control recedes, creative leeway is created that may even extend to the vocational training area. In the context of the implementation of 4.0 Digitalisation, high-quality employment becomes a business model precisely when staff is available who can take on new and responsible tasks. It stands to reason that digital content should be integrated more strongly into vocational training. But it is at least as important to teach competences such as conceptual and creative thinking, as well as abstraction and communication skills, so that these new possibilities can be used in the most effective way. In the German system, the (secondary) master craftsman qualification provides a corresponding starting point. A ‘master tenure track’ system, i.e. an integrated master craftsman qualification, might be a good idea to make this vocational training path more attractive. This qualification could be strengthened with other competences, including value creation-oriented process understanding, innovative thinking, and basic skills in the handling of scientific results.

FURTHER EDUCATION SHOULD BE ON PAR WITH INITIAL TRAINING

Due to changing and growing requirements, further training after initial training will become decisive to continuously further developing competences. Based on the IAB Job Vacancy Survey, Warning and Weber (2017) find, for example, that companies with a trend towards digitalisation in particular increasingly expect new staff to possess additional skills acquired through courses. The findings of the IAB and ZEW business survey ‘Working World 4.0’ also indicate a significant increase in demand for further training with regard to digitalisation (see Figure 1). Educational policy is mainly concerned with initial training; and labour market policy with the unemployed. But technological change must be mastered by those currently in employment. This calls for a policy of further training – which represents a major amendment to the future welfare state.

In this respect, we need to adjust to new developments. The risk of dismissal is currently at an all-time low in Germany, which is particularly conducive to a booming labour market. According to the above-mentioned scenario results, however, labour market dynamics will gather impetus significantly, which also means increased inflows into unemployment. If the pace of structural and occupational change accelerates, consulting in the fields of further and new qualification will become essential. Sound and early decisions need to be taken as to whether placement in the current field of action, further development, or reorientation is the right way. On a cautionary note, however, it is worth remembering that during the structural change in and after the 1970s, which marked a departure from

conventional factory work, the labour market failed to prevent the build-up and hysteresis of unemployment of low-skilled workers in particular.

Against this background, Weber (2017) argues that a labour market policy awaiting job losses and inflows into unemployment is unlikely to be able to master the critical effects of digital change on its own. After all, as soon as unemployment occurs, labour market policy has to deal with it singlehandedly (plus the collaboration of the unemployed), i.e. policy can only draw on its own resources and measures. Looking upstream, however, there are cooperation options in terms of further corporate training initiatives. Companies have information on their concrete needs from a production and market perspective, which makes them central players on the further training stage.

Public politics, however, should undertake the support and funding of further training activities in the form of qualification consulting for companies and employees or a share in the costs of measures and work loss. After all, further training not only helps employees and their company, it is also an important macroeconomic factor: investments in further training help them to master digital change, i.e. to develop high-quality employment on a broad base as the core of a digital business model.

In order to achieve this, further training must be on a par with initial training. This also means that the advantages of formal qualification, highly visible in Germany, are combined with the flexible acquisition of skills. The establishment of further training could be strengthened by a legal system on an institutional level where universal (and digital) competence standards are developed and additional qualifying achievements are formally recognised under those standards. With the right modularisation, this could even lead to fully valid qualifications, as explained by Kruppe (2012). General competence standards would improve information and orientation, make quality assurance easier, and increase the relevance of further training for professional development in the labour market, especially if formally recognised.

The traditional strengths of the German *Mittelstand* could be endangered, should individual companies’ capacity for conquering new digital business models prove insufficient. The same applies to further training, a field where particularly small companies should receive political support – also and especially in the form of consultation competence and network creation. Further training policy is not only labour market policy, but also serves a second goal: strengthening companies’ ability to adapt and evolve.

It must be borne in mind, however, that political activity should not hamper companies’ commitment to further training. It is all about support and collaboration, not taking over. Financial aid from the public sector is especially advisable for further training, which nurtures general knowledge and skills and not so much for specific measures tailored to individual

companies with specific activities. Appropriate certification should be a prerequisite, as this would facilitate the recognition of qualifications and achievements at the same time.

A purely personal further training policy involving, for example, personalised education accounts would run the risk of creating staff availability uncertainty for companies and of depriving them of some of their own competence and responsibility for human resources development. It is precisely this further training competence, however, which must be effectively used on the policy side. Yet, not all companies and groups have the same further training options. The same is true for shorter employment relationships. Similarly, the need for professional reorientation regularly goes beyond the current job. So if the existing further training options are not sufficient, or if the desired measures are not situated at the corporate level in a way that makes sense, support should also be provided independently from the corporate context. That way, the advantages of cooperation with corporate further training initiative could be combined with individual development support.

FLEXIBILITY AND LABOUR MARKET INSTITUTIONS

Digital tasks can typically be completed in a flexible manner. Using 4.0 technologies, activities that used to be location or environment-specific can also be switched to a digital basis. This opens up new activity options outside of the usual standard employment relationships for self-employed individuals, for example. Here too, however, assessments need to remain realistic: Economy 4.0 not only brings new possibilities, but also new complexities and makes higher demands of staff. In order to meet those demands, companies will also require a very well-qualified core workforce with company-specific knowledge. And even if jobs do not become fully flexible, social security for a labour force working more flexible hours must be refined. After all, they are equally in need of security in case of unemployment, old age, and nursing care dependency as if they worked in a traditional employment relationship subject to social security contributions. By the same token, steps must be taken to ensure that it is not tax payers who end up acting as de-facto insurers, covering costs incurred. Extending compulsory social security contributions to include all forms of employment – and notably self-employment – is recommended as the logical consequence; the rules of on-demand compulsory insurance would have to be adapted. This will surely require a special unbureaucratic – and digital – procedure for small and short-term jobs. In addition to the question of social security, the market for flexible digital services will have to take organisational shape, which will also involve setting standards or establishing employee special interest groups.

Moreover, it is becoming increasingly essential to reconcile the growing flexibility needs of both compa-

nies and employees. Warning and Weber (2017) find that newly hired personnel in companies with a trend towards digitalisation more often face varied work content, but sometimes also have to deal with tight schedules, overtime, and changing working hours. Faster product life cycles and globally connected economic activities are opposed to changed family lifestyles and individualised employee requirements. While new digital technology can adapt to the latter, there is also the risk of professional requirements seeping into private life. Legal protection from overloading must remain in place, but great importance should also be placed on coordination processes both at a company level and among social partners to ensure that the multitude of possible constellations can be adequately catered for. Flexibility and protection can be agreed under the principle that employees' concessions have to be balanced by the employer's side. Thus, it could be guaranteed to make appropriate comprehensive packages in terms of worker protection in case of increased flexibility; packages that may also include holiday provisions, release from duty for further training, or corporate health management measures. In general, such policy options show the value of building and maintaining strong industrial relations, not only in the case of Germany.

CONCLUSION

The advent of smart, interconnected digitalisation is accompanied by major challenges. The welfare state will not have to adapt to an economy largely operating without jobs. On the contrary, the world is full of undone work. The effects on the labour market will mainly take place in the well-known field of tension of economic adaptability to technological change and structural problems.

Importantly, the institutions of the welfare state face enormous challenges. There is a pressing need for measures in economic, educational and labour market policy that will support and advance a digital economic and labour market model. Further developing vocational training, designing a policy of comprehensive further training, and organising social security and corporate flexibility are key steps forward in this endeavour.

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