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THE IMPACTS OF DIGITALISATION ON THE WORKING ENVIRONMENT

AT A GLANCE

Digitalisation will change the future working environment, with different impacts for different occupations. Substitution potentials determine which occupations could already be substituted by computers or computer-controlled machines. The findings show that fears of massive loss of jobs are unfounded.

Ongoing digitalisation will change the working environment, with different impacts for different occupations. The discussion is often dominated by fears that on-going digitalisation will leave many unemployed. One very popular U.S. study by Frey and Osborne predicts that almost half of all jobs in the United States could be automated over the next two decades (Frey/Osborne 2013). The study is frequently used as the basis for calculating automation probabilities for Germany by recoding the U.S. occupational codes to German occupational codes (Brzeski/Burk 2015; Bonin et al. 2015). These studies often find similarly high values for Germany.

WORKING ENVIRONMENT 4.0

Dengler and Matthes challenge the transferability of Frey and Osborne's study to Germany and calculate substitution potentials for Germany (Dengler/Matthes 2015a). The substitution potential indicates the extent to which an occupation could already be substituted by computers or computer-controlled machines today (in the year 2013). The substitution potential is determined for each occupation by calculating the proportion of routine tasks that can already be substituted by computers or computer-controlled machines following programmable rules (Dengler et al. 2014). Tasks such as sorting and calculating can already be done by computers, while managing and advising can only be computer-supported. Substitution potentials concentrate only on the technical feasibility. Legal and ethical obstacles are excluded, as are cost considerations. We use occupational data from the BERUFENET expert database of the German Federal Employment Agency; thus, the specific characteristics of the German labour market and education system can be directly considered (BERUFENET 2013).

SUBSTITUTION POTENTIALS BY REQUIREMENT LEVEL

The findings are presented for different levels of occupational aggregation. First of all, the substitution potential is differentiated by requirement level (Figure 1). One would expect the substitution potential to fall as the requirement level rises. In fact, as the findings reveal, both unskilled/semi-skilled occupations, typically requiring no vocational training, and specialist occupations, which usually require at least two years of training, demonstrate similar substitution potentials at approximately 45 per cent, i.e., approximately 45 per cent of the tasks in these occupations could already be done by computers today. Only complex specialist and highly complex occupations offer a little more protection from automation.

SUBSTITUTION POTENTIALS BY OCCUPATIONAL SEGMENTS

Substitution potentials also vary considerably between occupational segments (figure 2). The substitution potential is highest in the manufacturing occupations, where the mean exceeds 70 per cent. According to Frey and Osborne this represents a very high risk of automatisation by digitalisation. With almost 65 per cent

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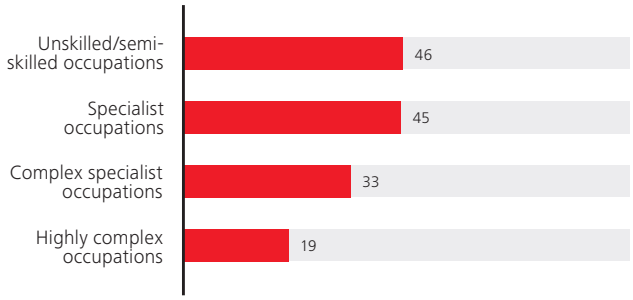
Figure 1
Substitution potentials by requirement level (%)



Proportion of tasks that could already be substituted by computers or computer-controlled machines today (%).
Source: Dengler and Matthes (2015a, b), Berufenet (2013).

occupations concerned with production technology are also characterised by high substitution potentials.

In all other occupational segments the substitution potentials are below 50 per cent. The lowest figure is found for service occupations in social sector and cultural work. This is not surprising, as it is hard to imagine many of the activities involved here – such as childcare and teaching – being taken over by computers. And despite the advent of robotic vacuum cleaners and networked surveillance cameras, occupations in cleaning services as well as safety and security occupations are still dominated by tasks that are difficult to automate and mostly manual.

SUBSTITUTION POTENTIALS BY REQUIREMENT LEVEL AND OCCUPATIONAL SEGMENTS

Examination of substitution potentials by both requirement level and occupational segments reveals that the highest substitution potentials are not always found in the unskilled/semi-skilled occupations (Figure 3). In certain occupations the specialist and complex specialist activities turn out to be easier to automate than the unskilled/semi-skilled. While the occupations in agriculture, forestry and horticulture demonstrate the expected pattern (the higher the requirement level the lower the substitution potential), the risk for unskilled/semi-skilled activities in occupations concerned with production technology is smaller than for the specialist activities. The findings for occupations in building and interior construction are of particular interest: unskilled/semi-skilled activities have the lowest substitution potential, while complex specialist activities face even higher risks than specialist activities. This can be explained in particular with the technological possibilities already existing for complex specialists through the use of computers when planning and calculating buildings.

Unskilled/semi-skilled and specialist occupations in the business management and organisation segment have a similarly high substitution potential of approximately 60 per cent, meaning that administrative and organisational office and secretarial tasks could already largely be substituted by computers (Dengler/Matthes 2015a).

Figure 2
Substitution potentials by occupational segments (%)

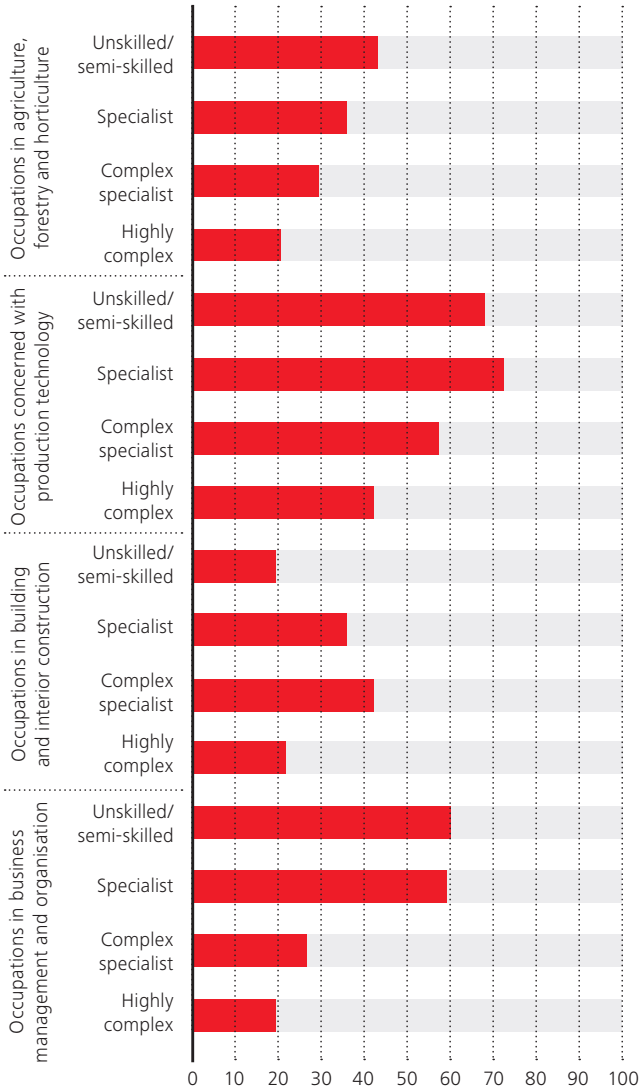
Proportion of tasks that could already be substituted by computers or computer-controlled machines today (%).
Source: Matthes and Dengler (2015a,b), Berufenet (2013).

IMPACTS ON EMPLOYMENT

Finally, we consider the extent to which employees subject to social contributions are affected by the substitution potentials of the occupations (Figure 4). Approximately 11.8 million employees subject to social contributions (40 per cent) work in occupations with low substitution potentials, where at most 30 per cent of tasks could be substituted by computers or computer-controlled machines. Of these, 2.4 million (8 per cent) are in occupations where none of the tasks can currently be automated. These include occupations such as bus driver; while their work can be supported by driver assistance systems, self-driving vehicles for public roads are currently still in the development phase. However, also other manual tasks such as tasks of chimney builders, hairdressers and geriatric nurses are also currently not substitutable by computers.

Approximately 13.2 million employees (45 per cent) have a medium substitution potential, meaning that between 30 per cent and 70 per cent of their tasks could be substituted by computers. Approximately 4.4 million employees (15 per cent) are confronted with high substitution potentials, where more than 70 per cent of tasks can be substituted by computers.

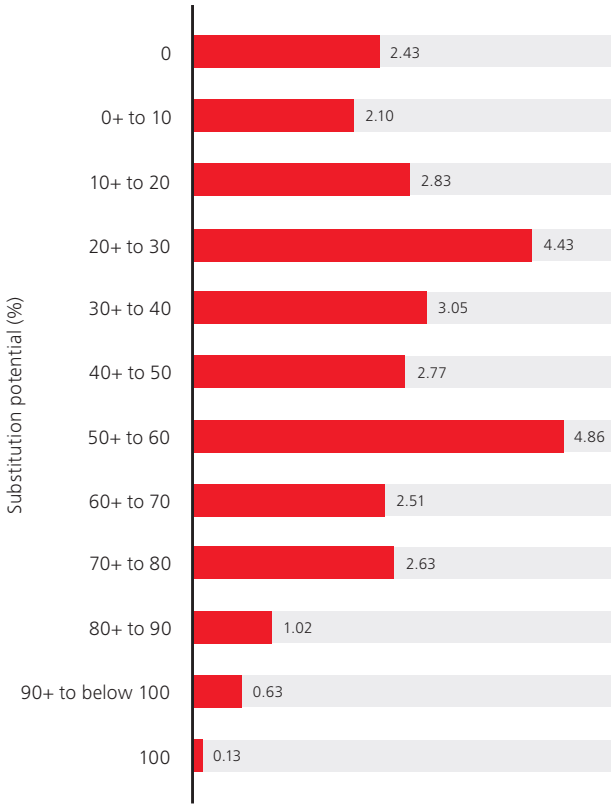
Figure 3
Substitution potentials by requirement level for selected occupational segments (%)



Proportion of tasks that could already be substituted by computers or computer-controlled machines today (%).
Source: Dengler and Matthes (2015a), Berufenet (2013).

These include 100,000 employees (0.4 per cent) with a substitution potential of 100 per cent. For example, all the tasks of a processing technician can already be substituted by computers or computer-controlled machines. Even the tasks of a proofreader, who checks only for mistakes (as distinct from editors who revise content and style) can already be done entirely by computers.

Figure 4
Impacts of substitution potentials for employees subject to social contributions in Germany (millions)



Impacts for employees subject to social contributions by level of substitution potential.
Source: Dengler and Matthes (2015a, b), Berufenet (2013).

CONCLUSIONS

The findings show that unskilled/semi-skilled and specialist occupations reveal similar substitution potentials with approximately 45 per cent. Only complex specialist or highly complex occupations are connected with a lower substitution potential. One of the greatest challenges will be to maintain state-of-the-art knowledge and abilities Thus, (initial and further) training in particular will become more and more important, not only for the low-skilled, but also for specialist workers. Schools must ensure that computers are not simply provided to students, but applied in a conscious and controlled way for learning or self-organisation. Vocational training must ensure that all trainees are familiarised with the latest technological innovations in their occupation. Furthermore, specialist workers also need more support to equip themselves to meet the new challenges of the digital working environment.

The findings also demonstrate that fears of a massive loss of jobs through ongoing digitalisation are currently unfounded. Approximately 15 per cent of employees in Germany are confronted with a high substitution potential. But that does not necessarily mean that their jobs will be lost. Whether these tasks are in fact taken over by computers will depend on other factors such as legal and ethical obstacles, as well as considerations of cost (Bonin et al. 2015).

It is even conceivable that digitalisation could lead to an increase in employment rather than a decrease. The computers and computer-controlled machines have to be developed and constructed. Specialists will be needed to control, monitor and maintain them. And they in turn will have to be trained to handle the new technology. The process of digitalisation can also generate product, process and service innovations, and productivity growth causing prices to fall (Möller 2015). Thus, the overall employment effect may be positive.

About the author

Katharina Dengler is an economist at the Institute for Employment Research in Nuremberg. Together with Dr. Britta Matthes she analyses the impacts of digitalisation on the working environment.

On this Publication

This contribution draws heavily on Dengler/Matthes (2015a) and was orginally prublished as Katharina Dengler: Folgen der Digitalisierung für die Arbeitswelt, WISO direkt, Friedrich-Ebert-Stiftung, Bonn.

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