

Similar and yet different – digitalisation and its consequences for individual occupational profiles

A comparison between industrial clerks and process mechanics



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This article uses two occupations as examples to show that while ongoing digitalisation often leads to similar changes at skilled worker level if considered in general terms, closer investigation of the respective workplaces reveal that these changes exert different occupation-specific effects. Commonalities and differences in the occupations of industrial clerk and mechanic in plastics and rubber processing are highlighted with regard to technologies deployed, changed tasks and new skills requirements. The article concludes with some estimates of the further development of the two occupations given the conditions of digitalisation.

Consequences of digitalisation – greater depth of focus required

Numerous studies over recent years have looked at the issue of how ongoing digitalisation is changing work and work organisation and at which new or modified qualification requirements are emerging for skilled workers as a result of this (cf. SCHMIDT/WINKLER/GRUBER 2016; Acat-ech 2016; HAMMERMANN/STETTES 2016). The general development of occupational work in both quantitative and qualitative terms has been a further object of consideration, and relevant prognoses have been drawn up (cf. e.g. HELMRICH et al. 2016, DENGLER/MATTHES 2015). Apart from a few exceptions, these investigations are usually of a cross-occupational nature, at best branch specific (for the metalworking and electrical sector cf. bayme vdm 2016, for the plastics manufacturing industry cf. STIELER 2015).

Nevertheless, attention has on several occasions been drawn to the fact that greater depth of focus is required in order to provide a specific response to the question of how digitalisation exerts an impact on work and thus also on the qualification requirements of skilled workers. The author team of the Gesellschaft Mess- und Automatisierungstechnik (VDI/VDE IT) [Institute for Innovation and Technology of the Association of German Engineers/Association for Electrical, Electronic & Information Technologies] arrives at the following conclusion. “A workplace-related descriptive model of the Industry 4.0 world of work would be expected to include a comprehensive description

of overarching development tendencies [...] which is also supplemented by and matched against a more precise depiction of the impacts of automation and digitalisation at workplace level” (VDI/VDE 2016, p. 17).

For these reasons, the BMBF/BIBB initiative “VET 4.0 – Qualifications and competences of skilled workers for the digitalised work of tomorrow” has addressed the issue of how work is transforming at skilled worker level in specific occupations.

The results of the project confirm the significance of the occupation-specific approach. It was revealed that, although many inter-occupational commonalities were identified, major differences also exist between the occupations in some cases with regard to the scope and effect of digitalisation. This article provides a comparative representation of this for the occupations of industrial clerk and mechanic in plastics and rubber processing (referred to below in abbreviated form as process mechanic). These occupations lend themselves to a comparative analysis since they exhibit differences in respect of workplaces and products. Whereas industrial clerks in the commercial sector primarily exercise office-based activities using the computer as a tool, process mechanics represent the only typical production occupation in the plastics manufacturing industry and mainly work in factory halls on various production and processing machines. The assumption is, therefore, that digitalisation will exert a different effect at skilled worker level.

Table
Presentation of the data basis

	Mechanic in plastics and rubber processing	Industrial clerk
Company case studies	7	9
Expert interviews (total)	17	38
of which skilled workers	5	18
of which management staff	8	5
of which training managers	4	15
Online questionnaires suitable for evaluation* (total)	201	399
of which skilled workers	35	105
of which management staff	102	91
of which training managers	145	306

* The total number of respondents from the three groups exceeds the total number of questionnaires because multiple responses were possible.

Study design, methodology and data basis

In order to identify the consequences, a multi-method design comprising a qualitative and a quantitative phase was selected. A data basis has been compiled in the Table for both of the occupations investigated. The differences in the number of company tours and interviews result from the fact that industrial clerks work in various sectors, each of which needed to be covered by company visits and interviews. In the case of the questionnaires, divergent figures are caused by the differing return rates. Preparatory steps for the individual investigations, survey instruments and results were discussed with an occupation-specific expert group for each occupation.

Changing workplaces

The analysis was conducted in accordance with the following questions.

1. Which digitalisation and networking approaches are to be found in company practice?
2. How does digitalisation change tasks in the respective occupations?
3. Which (new) competence requirements emerge for skilled workers as a result?
4. What consequences do the results have for the understanding of the nature of the occupation and for the development of the occupation in overall terms?

Deployment of technology

Digital technologies entered the conventional work areas of industrial clerks many years ago. Management control programmes (the predecessors of so-called enterprise resource planning [ERP] systems) were already being devel-

oped in the 1970s. These were used in rudimentary form by some companies for the purposes of data storage and analysis (cf. HESSELER/GÖRTZ 2007). Neither does the use of digital technology represent anything new for process mechanics. The automation of processes, the deployment of sensors and of open and closed loop control engineering and the systematic recording of operational data have all been standard practice in the plastics sector for decades. By way of contrast, the networking of internal and external systems would be a new development. However, virtually no sign of this can be identified for process mechanics thus far. It is also something which cannot be sufficiently quantified in the commercial sector. Nevertheless, the qualitative interviews give rise to the supposition that networking in the commercial sector may be far more heterogeneous than is the case with regard to pure IT saturation*. The spectrum ranges from working with stand-alone solutions at the company to the extensive interlinking of a company's own system with external systems. An example of the latter may be connecting the ERP systems of companies with the systems of major suppliers by using an interface, via which orders can be automatically transmitted to the customer as required and displayed in the customer's system.

In the case of the industrial clerks, it is also particularly noticeable that no difference is revealed concerning company size both in respect of the use of various technologies and with regard to the type of networking. The situation in plastics manufacturing presents a different picture. The interviews already made it apparent that digitalisation is more difficult for SMEs to achieve because of financial hurdles and in some instances due to insufficient digital infrastructure. Within the scope of the written question-

* 92 per cent of respondents state that their company uses at least three of the technologies that have been identified as important for the commercial sector.

naire too, respondents from small and medium-sized enterprises tended to evaluate the degree of digitalisation at their company as being low. Respondents from firms with a large number of employees were more likely to indicate a high level of digitalisation.

In the case of both occupations, it is possible to ascertain that the technologies currently being deployed should mainly be allocated to the field of software and thus particularly serve the purposes of data handling or control and monitoring of production processes. Technologies which are typical of Industry 4.0 (3D printing, augmented/virtual reality, collaborative robots), which would lead to a deep-seated change to production and process sequences, tend at present to play a less significant role for both industrial clerks and process mechanics.

Changing tasks

A similar tendency is displayed in both occupations in this respect. Monitoring tasks are increasing. In the case of process mechanics, this is also resulting in a shift away from primarily physical tasks and towards mental activities. This means that there is a rise in cognitive requirements for the fulfilment of some tasks and a fall in these requirements in respect of other tasks. One manager notes: *“The systems are taking on more and more tasks [...]. You get told what you have to do. That is one side of the coin. The other is that systems simply need to be kept going. I need to intervene, I need to be familiar with the system and I need to know what I am doing. [...] I have no idea whether the occupation of process mechanic will develop further in two directions. One direction simply involves monitoring and doing what you are told [...]. The other direction, which actually has a higher requirement, is someone who [...] really understands and can influence systems and can ensure that what someone else is told to do is right.”*

The routine tasks of industrial clerks are undergoing increasing automation, and processing is monitored. More complex tasks remain, and for this reason a general increase in cognitive demands can be observed here. One example of this is invoicing. Because most data is stored in the system, invoices can largely be prepared via an automated process. *“Work is shifting from doing to controlling.”* (Manager). The skilled workers need to intervene and draw up an invoice in the conventional way if problems occur and/or if a case turns out to be particularly challenging. In such a situation, the skilled workers will need to be able to find, understand and remedy possible errors.

Whereas the industrial clerks mostly perceive this change as being positive, for the process mechanics it means a distancing from the product and thus also affects the question of occupational identity. *“Of course, if this keeps continuing, then I don't know how I will identify with what we actually*

do. Am I producing a carton of milk or a car tyre or what?” (Manager).

Skilled workers in both occupations level the critical assertion that digitalisation also makes it possible to monitor workers and their performance. Digital technologies permit precise tracing of which employees have instigated which processes at which point in time and of their overall work performances within a certain period. This increased transparency is perceived as a burden by most of the skilled workers. One manager notes: *“I record more data. Suddenly, I am also able to analyse this data. This means in turn that I can assign the order to machine operator X, whereupon I have just seen that the order has been completed below the target speed on multiple occasions. This gives rise to anxieties. [...] Will I lose my job if I put in a few performances which are worse than those of my colleague [...] from the other shift? Things become transparent.”*

Changes in qualifications and skills requirements

The question as to how the skills demands made of skilled workers will change in the wake of digitalisation formed the core of the present project. At first sight, the results obtained in this regard did not offer much new information compared to cross-occupational studies already conducted. Thus, the outstanding relevance of social competences and above all the ability for lifelong learning, is also emphasised here. Other aspects stated as relevant are process knowledge, general IT skills and the handling of data and knowledge within the area of data privacy and data security. However, if taking a closer look at the competences mentioned, it is certainly possible to identify occupation-specific differences. The intention here is to illustrate this on the basis of the examples of “Handling of data” and “Knowledge in the area of data privacy and data security”. For process mechanics, the handling of data involves identifying and analysing relevant data, i.e. creating connections between the data and the reality it represents and ultimately using this as a foundation for decision making. The topics of data privacy and data security play only a marginal role, because process mechanics usually only receive and analyse data rather than generating or sharing it. This situation is different in the case of the industrial clerks. In areas where personal data is processed, such as in sales and human resources, knowledge and application of data protection are essential. Dealing with sensitive personal data requires clear regulations with regard to storage in the systems, and skilled workers will need to know and comply with these. They must know which information they can make available and which permissions they have and will also need to be able to anticipate effects. It is also important in this regard to consider the opportunities which exist for third party access, especially if data is

stored in the cloud. Unlike process mechanics, industrial clerks also need to research data and require an ability to evaluate data sources. They should also be in a position to check, manage and administer data which has been collected and received.

The level of responsibility associated with handling data thus rises for both occupations because, for example, decisions which previously would not have arisen due to the absence of available information (data) or would have been taken at a higher hierarchical level, now need to be made. The new skills requirements emerging for industrial clerks in connection with data handling are, however, much more wide ranging than those faced by process mechanics.

Development of the occupations

The influence of digitalisation on the continued existence and development of occupations is a much discussed topic. Alongside statements relating to quantitative changes, such as those made by FREY/OSBORNE (2013), these have also been propounded in respect of qualitative developments (cf. VDI/VDE 2016, KINKEL 2008), i.e. with regard to the development of the requirements level for skilled workers. Differences in both the forecast quantitative and qualitative changes can be identified with regard to both occupations forming the object of investigation here. The majority (59%) of the process mechanics surveyed expects that digitalisation will lead to a rising demand for skilled workers. Only two per cent are of the view that demand will decline. By way of contrast, most (56%) of the industrial clerks postulate that demand will remain the same, and 19 per cent even expect a fall.

Further differences are revealed with regard to the future requirements level. In the case of the process mechanics, a *polarisation* is indicated between an increase in simple tasks which can also be completed by semi-skilled and unskilled workers on the one hand and a rise in complex tasks which require a qualification level beyond that of current training on the other. This higher skills level is, however, explicitly not seen in the academic field. Conversely, with regard to the industrial clerks, tendencies are shown towards a so-called general upgrading, i.e. a rising qualification level for all skilled workers.

Consequences for vocational education and training

The results portrayed demonstrate that the consequences of digitalisation are very different in occupation-specific terms, although these differences do not in some cases become apparent until deeper analysis has taken place. This means that the consequences to be drawn for the further development of the occupations will also need to vary.

For the occupation of process mechanic, for example, driven by the tendency towards the polarisation of competence requirements, the fundamental question of a uniform occupational profile arises. If the intermediate qualification level disappears, it could be useful to ponder a split into a higher and lower qualified version of the occupation. Furthermore, in light of the identifiable increase in cognitive and monitoring tasks and the growing distance from the materials processed and products manufactured, consideration should be given to the target group of trainees. Whereas an interest in the materials of plastic and rubber and manual skills have always been the central aspects up until now, it may be possible in future to focus on trainees who have less interest in the materials but display an affinity with the specific production technologies and the associated digital technologies.

As far as industrial clerks are concerned, the consequences of digitalisation primarily lie in a more demanding set of requirements and impending academisation. The systematic interlinking of initial and advanced training could increase the attractiveness of a career in the occupation and enable the necessary training to be implemented. Additional and more detailed contents could be introduced such as data handling which, as mentioned above, is becoming more complex for industrial clerks in the wake of digitalisation and is associated with numerous new requirements. ◀

*(Translation from the German original in BWP 3/2019:
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Literature

- ACATECH – DEUTSCHE AKADEMIE DER TECHNIKWISSENSCHAFTEN: Kompetenzentwicklungsstudie Industrie 4.0. Berlin 2016
- BAYME; VBM (Hrsg.): Industrie 4.0 – Auswirkungen auf Aus- und Weiterbildung in der M&E Industrie. München 2016
- DENGLER, K.; MATTHES, B.: Folgen der Digitalisierung für die Arbeitswelt (IAB-Forschungsbericht 11/2015). Nürnberg 2015
- FREY, C. B.; OSBORNE, M. A.: The Future of Employment: How Susceptible are Jobs to Computerisation? Oxford 2013
- HAMMERMANN, A.; STETTES, O.: Qualifikationsbedarf und Qualifizierung. Anforderungen im Zeichen der Digitalisierung. Köln 2016
- HELMRICH, R. et al.: Digitalisierung der Arbeitslandschaften. Bonn 2016
- HESELER, M.; GÖRTZ, M.: Basiswissen ERP-Systeme. Herdecke 2007
- KINKEL, S. et al.: Arbeiten in der Zukunft. Strukturen und Trends der Industriearbeit. Berlin 2008
- SCHMIDT, K.; WINKLER, B.; GRUBER, B.: Skills for the future. Zukünftiger Qualifizierungsbedarf aufgrund erwarteter Megatrends. Wien 2016
- STIELER, S.: Digitalisierung in der Kunststoffverarbeitenden Industrie (Informationsdienst des IMU Instituts 5/2015). Stuttgart 2015
- VDI/VDE (Hrsg.): Arbeitswelt Industrie 4.0. VDI Statusreport. 2016