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Digitalisation, unions and participation: the German case of ‘industry 4.0’

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ABSTRACT

This article tackles the question of how labour representatives cope with the implementation of ‘Industrie 4.0’ in German manufacturing plants. Digitalisation of manufacturing is going along with challenges for employment, work organisation and working conditions. The article analyses one of the main strategies German unions have developed, the project ‘Work 2020’, which was to raise works councils’ awareness of the workplace impact of digitalisation, improve their knowledge of the changes, raise their capacity to respond and, finally, lead to the negotiation of workplace agreements on this issue with employers. The results of the analysis show that a strong interplay between unions and works councils and the activation of works councils by the unions have become indispensable preconditions for coping with the new challenges both of digitalisation and of the ongoing erosion of the German system of labour relations.

1 INTRODUCTION

Digitalisation is seen as a megatrend heralding a fundamental transformation of both industry and services, and with this is a new world of employment and a radical shift in the conditions under which work is performed. In the manufacturing areas, it is the vision of ‘Industrie 4.0’ in the sense of ‘cyber-physical systems’, which is at the core of this idea and which is encompassing networks of machines, products and people, driven by software and enabled through sensors and the application of artificial intelligence (Pfeiffer, 2015). Major transformations, such as those associated with digitalisation, are necessarily accompanied by profound challenges for work, employment and working conditions and also for the way employee interests are represented—in the case of Germany through the ‘dual system’ of trade unions and works councils. These organisations will be compelled to respond should digitalisation trigger a dramatic reduction in industrial employment or the undermining of agreed pay and conditions.

Confronted by these prospects, trade unions in Germany have opted to go on the offensive and adopt a strategy aimed at securing active participation in shaping change, as opposed to rejecting it and then fighting over the consequences. Examples of this include trade union involvement in an issue-based corporatism in German manufacturing (Schroeder, 2016), as exemplified in accords concluded at industry

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level. The most significant site for engaging with digitalisation, however, is the workplace, given that this is where investment and the introduction of new technologies take place and where they have an effect on employees, either in making employment more secure and, maybe, increasing the autonomy of work or in displacing them and reducing workers' control of the process of production. As Edwards and Ramirez (2016) have argued, the question is whether unions and employees should embrace new technologies or whether they should resist them. In order to shed light on this question, they distinguish several dimensions that characterise technologies like intended and unintended or direct and indirect effects, the question of reconstituting technologies, immanence effects of the technology on work organisation, the degree of success of a technology in meeting its aims and, finally, the degree of discontinuity.

However, unfortunately, for workers and unions, most of these questions cannot be answered in advance; some answers will show up only a while after the technology has been introduced, and some answers can only be given by scrutinising plant level developments in detail. Confronted with the implementation of new technologies, the challenge for unions and workers seems to be twofold: first, if possible, to decide whether to resist or to shape the implementation of new technology and its consequences, for example, in terms of immanence effects, in a way that could strengthen positive effects and reduce negative ones and, second, to get the information such decisions can be based on. Moreover, the answer of the unions also has to take into account their resources and capabilities (Lévesque and Murray, 2010) to develop effective strategies.

German unions have opted for the embracing solution. However, influencing the implementation of digital technologies of the 'Industrie 4.0' requires more than taking part in corporatist arrangements; it also requires the development of strategies to get information, to strengthen resources and capabilities on plant level and to influence the effects of technological change—which in Germany also means to support the works councils, as they are the legal workplace representations of workers. German trade unions tried to do this in the form of workplace projects, among them the trade union project 'Arbeit 2020' in North-Rhine Westphalia ('Work 2020 in NRW'), shortened here to 'Arbeit 2020'. This project was begun in 2016 as a joint exercise between three industry trade unions: IG Metall (metalworking), IG BCE (mining, chemicals and energy) and NGG (food, drink, tobacco, hospitality). When initiated, 'Arbeit 2020'—in addition to a further IG Metall project 'Work and Innovation'—was the most advanced German union project to address digitalisation.

Although a study of this trade union project mainly, the article can shed light on some more general questions: first, the opportunities and limits of trade unions and workers to exercise any effective influence on digital technologies and, second, the resources and capabilities they have to do so or they might be able to develop—which also might give hints on country-specific effects of digital technologies based on the interactions of the industrial relations actors (Lloyd and Payne 2019). Before turning to the project 'Arbeit 2020', the article will look at some selected research findings on the incidence of digitalisation, its implications for work and employment and on how German trade unions have begun to address these issues. This then forms the basis for evaluating the outcomes of the 'Arbeit 2020' project. How have trade unions and works councils responded to the impending digital transformation? What approaches and strategies have they developed?

2 THE DIGITAL TRANSFORMATION OF WORK ORGANISATION AND NEW TRADE UNION APPROACHES TO INTEREST REPRESENTATION

2.1 'Industrie 4.0': Definition and incidence

The notion of 'Industrie 4.0', as developed for the German export sector, rests on the premise that digitalisation will trigger a radical technological break leading to a 'fourth industrial revolution' (Arbeitskreis Industrie 4.0, 2012; Spath, 2013). The technical core of 'Industrie 4.0' consists of the creation of cyber-physical systems in which people, machines, materials and products are networked via systems of sensors and communicate over the Internet. 'Industrie 4.0' has also embraced discussion of new forms of robotics (Gerst, 2016), digital assistant systems (Kuhlmann, 2018; Niehaus, 2017) and, in particular, artificial intelligence (Hirsch-Kreinsen, 2018).

One task that followed on from the launching of 'Industrie 4.0' has been to gauge the extent to which it has been realised in practice. Surveys suggest that the spread and penetration of digital technologies at company level lag some way behind the visions and models circulating in the policy community (Howaldt et al., 2018). A survey on the modernisation of production in Germany conducted by the Fraunhofer ISI Institute in 2017 found that although around two-thirds of responding firms had introduced software systems for production planning and control, only a third made use of digital visualisation, digital exchange with customers and suppliers or technologies to automate and manage internal logistics (Lerch et al., 2017). And according to a survey of some 2,000 works councils in its organising sphere carried out by the trade union IG Metall (as part of its 'Atlas of Transformation' project), there were digitally linked production facilities in 47 per cent of plants, automated production planning in 44 per cent, smart glasses and tablets for information and control in 36 per cent, robotic assistants in 16 per cent and artificial intelligence used to automate administrative functions in just 12 per cent (IG Metall, 2019).

2.2 Transformations of work

As with digitalisation, changes in the nature of work do not conform to a single pattern. Hirsch-Kreinsen (2014, 2015) distinguishes a number of scenarios for the development of work organisation, with the options ranging between two distinct poles. One of these poles represents a highly divided form of work organisation with a growing gulf between the tasks, skills and status of workers in simple and highly standardised operations and the skilled activities performed by employees in planning and administrative roles who enjoy considerable autonomy. The other pole consists of a 'swarm' organisation, in which the main task of skilled employees, working within networked structures, is to resolve process issues when operations experience disruption, breakdown or other special circumstances.

Current research suggests a similar degree of complexity for other dimensions of work. On employment, there are a number of widely varying forecasts. Several have applied the approach proposed by Frey and Osborne (2013) to Germany. One conclusion is that while 42 per cent of occupations are highly susceptible to automation, the proportion of actual activities at risk is much less at just 12 per cent (Bonin et al., 2015). Dengler and Matthes (2015) arrived at the similar result that 15 per cent of employees in Germany work in an occupation in which 70 per cent of activities could easily be automated. By contrast, other studies have emphasised the accelerating structural shifts between branches and occupations and a trend towards more

demanding job requirements (Zika et al., 2018). These studies expect the employment impact to be neutral or even positive because of the creation of new jobs in new business areas.

The debate around skill requirements is also a complex one. While some authors, and in particular, the proponents of 'Industrie 4.0', expect skill demands to rise, with an increasing requirement for employees to be able to diagnose and resolve errors and breakdowns (Kagermann, 2014), others, such as Brynjolfsson and McAfee (2016), anticipate a polarisation between simple and highly skilled activities. And some researchers have argued that the changes in skill requirements, at least for skilled manufacturing operations, have so far been modest (Abel, 2018).

This all suggests some difficulty in isolating the effects of digitalisation on work, not least because those trends that have been identified are often heading in opposite directions—a problem not helped by the fact that digitalisation is accompanied by other factors that also have an impact on work, such as corporate globalisation, the financialisation of corporate governance and profit-driven restructuring and divestment (Haipeter, 2018). In the course of one of a regular series of surveys of works councils, respondents were asked about developments in their working conditions under the overall rubric of 'risks of digitalisation' (Ahlers, 2018a). In all, 78 per cent of respondents indicated that they had noted growing work intensification and around 25 per cent a growth in both the standardisation of activities as well as greater behavioural and performance control. Conversely, just under 40 per cent reported greater scope for autonomy in carrying out their work responsibilities. The 'Transformation Atlas' research conducted by IG Metall (IG Metall, 2019) also found a wide range of responses, with 45 per cent of works councillors indicating that digitalisation might serve to reduce work-related stress and 77 per cent that it would lead to new forms of stress. This latter finding also chimed with other representative surveys of employees. According to the 'Good Work Index' developed by the German Trade Union Confederation (DGB), work intensification was strongly associated with the level of digitalisation: some 60 per cent of employees in workplaces with a high level of digitalisation reported feeling stressed and working under time pressure, with 69 per cent subject to frequent interruptions (DGB Index Gute Arbeit, 2017).

2.3 German trade unions' new strategic repertoire

Over the past decade or so, German trade unions have developed a number of new approaches to union revitalisation and undertaken a major overhaul of their strategic repertoire. This was triggered by the erosion of the traditional 'dual system' of employee representation in which workplace arrangements based on statutory elected works councils are complemented at industry level by sectoral collective agreements negotiated by trade unions. Coverage by industry-level collective agreements fell from some 70 per cent in the 1990s to just over 50 per cent by 2017, with only just under 40 per cent of employees represented by a works council—a drop of some 10 percentage points in recent years. Less than 30 per cent of employees worked in workplaces that were covered by both a collective agreement and also had works council representation, the core of the dual system (Ellguth and Kohaut, 2018). This has been exacerbated by the sharp decline in union density, with only some 20 per cent of employees now union members.

As a consequence, the dual system of industrial relations no longer shapes the majority of employment relationships in Germany, leading to the parallel existence of

three worlds of work (Schroeder, 2016). The first consists of Germany's export industry, in which the dual institutions have retained their influence; in the second, these institutions exist but only patchily, and employers might informally draw on the provisions set out in industry-level agreements to set their own standards; and in the third, the effect of these institutions is effectively non-existent. The union project 'Arbeit 2020' is aimed at the first of these three worlds. But even here, there are many 'grey areas' 'with 'weak structures lacking any real trade union tradition and with no real effective union workplace activity' (Wetzel, 2013: 25).¹

Trade unions have responded to these developments with a range of new strategies, with three approaches taking particular priority: organising initiatives to recruit new members, activating works councils and fostering participation by both existing members and employees more generally. These elements have been developed to varying degrees by DGB-affiliated unions, and the approach set out below deals with the policies pursued by IG Metall. IG Metall has set about developing *organising* into a 'member-orientated offensive' (Wetzel, 2013) with two prime aims: first, tackling the 'blank spaces' where there is neither works council nor collective bargaining coverage and, second, engaging with workplaces where these institutions exist formally but where this no real union presence on the ground. IG Metall has so far made some €170 million available over nine years for organising projects with the aim of making this a routine part of the union's work (IG Metall Bezirk Baden-Württemberg, 2019).

The strategy of *activating works councils* is mainly focused on workplaces that are within the 'first world' and have both a works council and are covered by collective bargaining. While organising strategies are primarily intended to recruit new members, with improving works councils' capacity to act a secondary consideration, activation projects directly target works councils' capacity to engage in workplace exchanges with management, with recruiting new members a desirable but essentially secondary objective.

Participation is a strategy that extends across a range of issues and projects. For example, member participation has played a key role in generating democratic legitimacy in negotiations during local disputes over derogations from agreed industry standards (Haipeter, 2011). Participation has also been a core principle in organising campaigns (Thünken, 2018) and collective bargaining rounds, as with the large-scale employee surveys carried out by IG Metall in 2009, 2013 and 2017 (Bahnmüller and Salm, 2018).

2.4 Works councils and codetermination

In the debate on 'Industry 4.0', German works councils can hardly rely on ongoing codetermination practices in the introduction of new technologies. Empirical evidence in this issue is scarce; there are some hints to be found in the debate on automation in German sociology in the 1980s. The findings of Kalmbach et al. (1981) on the introduction of industrial robots in the automotive industry (specifically at VW) are exemplary. According to this, the works councils welcomed the use of robot technologies as a contribution to improving competitiveness and as an opportunity to reduce

¹In contrast to works councils, and aside from a right of access, trade unions do not have statutory rights at the workplace. Workplace trade unionism, based on activists who might be designated as 'shop stewards' (*Vertrauensleute*), will be mainly concerned with recruitment, supporting trade unionists on the works council and informing about and mobilising for industry-level negotiations.

restrictive working conditions at automated plants. However, they did not attempt to influence these developments. Works councils have been much more passive recipients than active agents of technological change. Things were different in other subjects like work organisation. During the 1990s, mainly in the automotive industry, works councils of the big OEM and suppliers, in collaboration with IG Metall, were able to develop and advance progressive approaches to work organisation, such as semi-autonomous teamworking (Bahn Müller and Salm, 1996; Kuhlmann et al., 2004). However, they lost the competition with lean concepts of group work favoured by the companies.

Today, the practice of codetermination is still divided between large-scale enterprises and Small and Medium Enterprises (SMEs). It is the big companies especially in the manufacturing sector which begun to adopt a new approach to workplace codetermination, with works councils responding to the difficulties raised by comanagement by developing a practice that might be termed 'strategic interest representation', recently exemplified at VW (Haipeter, 2019). 'Strategic employee representation' has four central elements: the pursuit of greater influence over strategic business decisions; the strategic development of works councils' organisational structures and resources by adapting their operational approaches to new challenges; the strategic inclusion of employees in the practice of codetermination through participation and direct communication; and the strategic coordination of different levels of employee representation and the development of a practice of 'transnational representation in multinational firms. One consequence, however, has been that works councils now need more material resources and greater individual competencies, both of which also have to be addressed strategically.

By contrast, localised research findings suggest that codetermination has a much lower profile in such workplaces and that works councils exhibit a number of operational shortcomings (Meyer, 2017). Workplaces with between 51 and 500 employees are also precisely those in which the decline in the incidence of works councils has been most marked in past decades, with a drop of 13 percentage points (Ellguth and Trinczek, 2016), attributable to the absence of active unionised employees, poor linkages between unions and works councils and a lack of acceptance of codetermination by managements (Artus et al., 2016). One rationale for trade union activation projects, such as 'Arbeit 2020', is to improve the capabilities of works councils in SMEs and begin to embed elements of strategic employee representation in such workplaces.

This is especially relevant as digitalisation is now posing a unique set of challenges for works councils, with recent surveys highlighting a growing need for training to enable works councillors to engage with this issue. According to the Wirtschafts- und Sozialwissenschaftliches Institut (WSI) survey, some two-thirds of works councils draw on employees with the requisite skills when dealing with digitalisation, around a half set up working parties and about 40 per cent turn to their trade union or to external consultants (Ahlers, 2018b). IG Metall's 'Transformation Atlas' (IG Metall, 2019) found that more than three quarters of works councils reported an urgent need for advice and training; only 48 per cent stated that they were provided with early information on change projects; and just 38 per cent said that they were included in the development and implementation of digital projects.

As yet, the issue of digitalisation has largely been dealt with in workplace-level agreements, concluded by works councils, on issues such as data protection and home or mobile working (Baumann et al., 2018). However, broader agreements on the introduction and the consequences of digitalisation as such are a rarity. There are

number of reasons for this (on the following, see Matuschek and Kleemann, 2018). Digitalisation has an overarching character, touches on a wide range of issues, is difficult to demarcate and, as a consequence, hard to capture in a set of precise provisions. In addition, works councils—and sometimes also plant or company managements—are not adequately informed about digital technologies and their implications. One factor in this is that digitalisation is often introduced in the form of small projects with decentralised responsibilities, meaning that knowledge is also locally held and not easily accessible from the centre.

Trade union projects to support works councils on digitalisation, such as ‘Arbeit 2020’, are therefore confronted by a complex challenge that embraces several distinct tasks: activating works councils, mobilising resources, generating knowledge about the workplace impacts of digitalisation, identifying suitable areas for intervention and negotiating procedural agreements on works council participation. And in SMEs, one major challenge is to reconfigure how codetermination is practised and bring about a fundamental improvement in the effectiveness of employee representation in such workplaces.

3 THE TRADE UNION PROJECT ‘ARBEIT 2020’

3.1 The project and research methods

Given these developments, ‘Arbeit 2020’ is well embedded in the new strategic repertoire of German trade unions; however, it has little historical precursors in works councils’ practices. Its aim was to raise works councils’ awareness of the workplace impact of digitalisation, improve their knowledge of the changes, raise their capacity to respond and, finally, lead to the negotiation of workplace agreements on this issue with employers. Thirty plants were included in the project’s first phase, with a second phase underway as of summer 2019. This initial phase was supported by a team of researchers², among them the author, in the context of a research project supported by the German Hans-Böckler-Foundation, that tracked ‘Arbeit 2020’ over a two-year period.

The main focus of ‘Arbeit 2020’, which follows in a line of union activation projects, is to provide advice to works council through a team of full-time union project officers and consultants. The process envisages a multistage procedure for participating workplaces that includes up to 10 days of consultancy advice and should draw in a range of workplace actors. The process begins with comprehensive assessment of the state of digitalisation at a workplace, culminating in the creation of a ‘digitalisation map’. Drawing this up will also involve dialogue with employees, as they are both operational experts and also the actors most immediately confronted by technical innovation. The next stage is to identify key issues with works councils with the ultimate aim of entering into negotiations with management to conclude ‘Agreements for the Future’ (*Zukunftsvereinbarungen*) setting out how the challenges of digitalisation will be jointly addressed.

The analysis of the project is based on case studies of the companies, or, to be more concrete, of the ‘Arbeit 2020’ processes developed there. Case study analysis followed

²I want to express my thanks to my colleagues Gerhard Bosch, Tabea Bromberg, Anne-Christin Garnix and Jutta Schmitz-Kießler who worked in this project with me; without them, I would not have been able to write this paper.

the principle of 'diversity' advocated by Pflüger et al. (2010) and tried to include as many workplaces as possible from those that participated in the project in a case study research. The core of the case studies consisted of an investigation into the provision of advice by consultants and negotiations and its outcomes and effects. The study included 19 of the 30 workplaces included in the first wave of 'Arbeit 2020'—as of summer 2019, a second wave was underway and a third wave in planning. The workplaces covered were in the organising scope of two industry trade unions, as set out in Table 1: IG Metall (metalworking) and NGG (food, drink and tobacco, hospitality).

The case studies involved the monitoring the 'Arbeit 2020' process via the participation of researchers in workshops and expert interviews with works councillors in which they were asked about their assessments of the process and its results and the changes of their own work that went along with it. Nearly all the interviews were conducted with works council chairs as these tended to be the local sponsors of 'Arbeit 2020' in their plants, had the broadest contextual knowledge, and also typically set the tone in the various works council bodies. In addition to the case studies, expert interviews were conducted with the full-time union officials and consultants associated with the project. The interviews took from one to three hours, were transcribed fully and then coded and analysed in the form of separate case studies.

3.2 En route to 'Industrie 4.0'? The findings from the digitalisation maps

What did the 'digitalisation maps' produced in the workshops find? And what can be deduced from them in terms of the current state of digitalisation in the workplaces in the project? All 29 of the maps produced up until the end of the period covered by the research have been included in this assessment. The workplace maps represent an instrument that enables the findings on the degree of digitalisation and changes in working conditions in the workplaces included to be depicted graphically. The maps are broken down by the individual departments—like sales, purchasing, maintenance, planning or assembly—of the establishments under scrutiny. They are based on indicators specific to each of these departments. Indicators covered two basic dimensions. The first relates to the level of digitalisation and encompasses two aspects: the degree of interconnectedness and the degree of technical control, each of which constitute defining features of automation and of 'Industrie 4.0'. The second dimension relates to work and includes the three aspects of changes in employment, job requirements and working conditions. Each of the options for the five aspects is ordinally scaled.

For the purposes of evaluation, the large number of individual departments in each establishment was grouped into four basic clusters: direct production, including manufacture and assembly; manufacturing-related services, ranging from work preparation to logistics; administration, including purchasing, sales, HR and IT; and research and development (R&D). The incidence of these four clusters in the case-study workplaces varied from 16 R&D departments to 77 direct production departments, 98 administrative departments and 99 departments for manufacturing-related services. The number of departments bears no direct relationship to the numbers of workers employed; overall, some 6,500 employees were engaged in production, 3,300 in manufacturing-related services, 2,300 in administration and 800 in R&D.

What are the findings? The majority of departments engaged in direct production are networked across departments—that is, with IT connectivity to other departments—either in production or administration. Typical examples would be the

Table 1: *The establishment sample*

Establishment	Trade union	Employees	Status of establishment	Methods
Furniture	IG Metall	260	Single establishment—investor ownership	Monitoring/works council interviews (2)
Electro 1	IG Metall	1,250	Single establishment—family management	Monitoring
Electro 2	IG Metall	1,500	Head office—family-owned: international operations	Monitoring/works council interview
Electro 3	IG Metall	350	Head office—family management: international operations	Works council interviews (2)
Plant Construction 1	IG Metall	4,900	Group head office (AG)—international operations	Monitoring/works council interviews (2)
Plant Construction 2	IG Metall	Division: 1,800 550	Head office—family-owned: international operations	Monitoring
Auto Components 1	IG Metall	550	Head office—family management: international operations	Monitoring/works council interview
Auto Components 2	IG Metall	3,000	Head office—family management: international operations	Monitoring
Auto Components 3	IG Metall	1,000	Head office—family management: international operations	Works council interviews (2)
Engineering 1	IG Metall	2,000	Head office (SE) international operations	Monitoring/works council interview

(Continues)

Engineering 2	IG Metall	283	Group head office: foreign-owned limited company	Monitoring/works council interviews (2)
Engineering 3	IG Metall	250	Head office—family management: international operations.	Monitoring
Drive Systems 1	IG Metall	400	Head office—family management: international operations	Monitoring/works council interview
Drive Systems 2	IG Metall	550	Head office—family management: international operations.	Monitoring/works council interview
Undertaking	IG Metall	500	Head office—AG and public part-ownership	Monitoring
Metalworking	IG Metall	370	Single establishment—family-managed	Works council interview
Automation	IG Metall	1,400	Head office (AG)/group with international operations	Works council interviews (4)
Food 1	NGG	210	Group head office (AG)—international operations	Monitoring/works council interview
Food 2	NGG	160	Group head office (AG) international operations	Monitoring/works council interview chair

Note: The formal term 'establishment' (*Betrieb*) from the applicable legislation is used in this table rather than 'plant' or 'workplace'. AG, Aktiengesellschaft: German public limited company; SE, Societas Europaea.

programming of machinery and equipment, which is carried out by the production preparation department in line with planning requirements and transmitted to the equipment concerned, or it might include processes through which production equipment sends requests for materials or parts to logistics or purchasing. The dominant form of interconnectedness in manufacturing-related services was also across departments, either through links to production or other areas, such as design. Not surprisingly, the level of interconnectedness to external firms was much greater in administration and R&D than elsewhere as these constitute the classic interface between organisations and their environment (Berger, 1984). Purchasing is always much more frequently networked with suppliers and the sales department with downstream manufacturers or wholesalers. Interfirm connections are also significant in the area of R&D, typically because of cooperation in development work, with cross-departmental linkages either to other development operations or to design facilities. Nearly all departments are now networked across the board via enterprise resource planning systems.

This does not necessarily mean that networking is accompanied by a high level of automation in the form of autonomous equipment and programmes. The exception to this was direct production, where there were more departments with autonomous technologies and technologies providing decision options or solutions. Typical examples would be automated equipment controlled by programming undertaken by the production preparation department that indicates decisions for either production or production planning that are calculated by the system itself using data from orders, equipment availability and material supplies, but which require human intervention and are therefore only semi-autonomous. Truly autonomous operation without such intervention, representing the highest level of digitalisation and automation, remained the exception in the plants in this study. One initial and tentative conclusion from this data—given that it is confined to the small number of participating establishments—is that no fundamental breach with the past or technological disruption, along the lines suggested by the dream of a ‘fourth industrial revolution’, has yet taken place. Rather, firms continue to move along existing technological paths by adding new programmes and linking these with those currently in use or by adding new machines or machine lines to individual areas of manufacturing while continuing to operate installed equipment. Taking into account the dimensions by Edwards and Ramirez, it is much more continuity than discontinuity to be observed, and old technology is reconstituted in digital networks.

What was the impact of technology on employees’ work situation? In all the departmental clusters, aside from direct production, the number of departments that saw an increase in employment exceeded the number in which employment had fallen in recent years. According to the digitalisation maps, therefore, there was a positive change in employment levels associated with a structural transformation in employment from manufacturing (by operatives) to areas dominated by white-collar employment. Both these trends match the development seen in the German manufacturing industries as a whole. Between 2012 and 2017, the number of employees in manufacturing, which includes the organising scope of the trade unions involved in the project ‘Arbeit 2020’, rose by some 5 per cent (calculated from Destatis, 2018). At the same time, there is a long-run trend towards the tertiarisation of the industrial sector (Haipeter et al., 2016).

Across all departments, there has also been a positive change observed in terms of job requirements. ‘Job requirement’ in the digitalisation map refers to any

improvement or deterioration in the performance of work as a result of changes in required skills or competencies. This does not mean that digitalisation will not have negative effects on workers' skills in the future; the finding is that there has been no discernible deskilling effect up to now and that firms still build on qualified work quite typical for the German production model. By contrast, working conditions have moved in a very different direction. Defined as the sum of several subindicators, working conditions were made up of, first, physical and mental workloads, including job intensification, stress and work strain; second, working time autonomy and stress generated by overtime working; and third, ergonomic problems. Leaving these qualifications aside, the message from the workshops was unambiguous: the dominant trend in all the departmental clusters was that working conditions had worsened.

3.3 Work-related issues

What did works councils and other project participants make of these findings? And what practical priorities in the field of work-related issues did they identify? The four most common issues raised in the case-study plants were employment security, working conditions, training and, finally, problems of leadership, internal communication and business processes. Securing the future of their plants and employment security were paramount issues for work councils in the project 'Arbeit 2020'. Their greatest concerns, and the biggest current threats to employment, were not related to digitalisation or technology in most instances, however, but lay in their experience of interplant competition, the possibility of the relocation of operations and, in a few cases, serious business problems at their employer.

Working conditions were also influenced by a range of factors, including digitalisation. Of these, the most important in virtually all the sample plants was the very tight approach to staffing adopted by firms as a result of an HR policy driven by the bottom line. This was compounded by the pursuit of a high level of equipment utilisation that called for large amounts of overtime working. The main contribution of digitalisation in this area was work intensification, with employees under pressure to resolve software problems or operate numerous poorly integrated systems.

Skills and training also emerged as a major area of works council activity. In some cases, the main focus was on training and on continuing training in others. The workshops also uncovered a number of very basic problems with how further training was planned, with several plants failing to undertake any systematic evaluation of training needs. In some instances, problems were more specific and related to individual areas—in particular, that of digitalisation. Training was seen as especially inadequate when new software was introduced. These deficits were ascribed to cost-cutting strategies of the companies.

While the first three issues are part of the classic repertoire of workplace codetermination, leadership and communication rather belong to the sphere of 'corporate culture'. As experts in 'shaping the software of a workplace' (Kotthoff, 1995: 428), works councils nonetheless have a core responsibility for this area without this customarily being set down in formal agreements. The major elements of this field are the transparency and communication of decisions at both workplace and corporate levels, problems of leadership and management and the lack of employee inclusion, interpersonal problems and concerns about a lack of recognition. Although these are

generally not directly linked with digitalisation, they are seen as setting limits on raising the level of digitalisation matched with cooperation and connectivity.

3.4 'Agreements for the future'

Negotiations on 'Agreements for the Future' (*Zukunftsvereinbarungen*) can be seen as a form of 'integrative bargaining' (Walton and McKersie, 1991). In contrast to conventional collective bargaining, they are not about distributive issues—in some instances, of necessity, a zero-sum game—but are positive-sum games offering benefits of cooperation to both negotiating partners. However, such negotiations are hard to plan for as there is no statutory requirement to negotiate them: they are voluntary for both sides. 'Agreements for the Future' were concluded in seven plants in the study during the period of the research.

What factors favoured the conclusion of such agreements? The most important precondition was an underlying consensus on the part of the parties at workplace level about the mutual benefits of such an agreement. While works councils might hope to gain greater influence over the introduction of digital technologies and the direction of working conditions, managements have an interest in winning the agreement and understanding of works councils and employees or see advantages in including them to help strengthen their operations. In most cases, such an underlying consensus does not come about by chance but is rooted in a tradition of cooperative industrial relations.

Nonetheless, negotiations call for more than this and cooperation alone is not enough. The most significant factor militating against the negotiation of such forward-looking agreements was the emergence of supervening conflicts. Although normal in the 'conflictual partnership' that is held to characterise German industrial relations, in some cases, such disputes led to a mixing of different issues and a combination of 'integrative' and 'distributive' bargaining. Staffing cuts, disputes over working hours or derogations from industry-level agreements can swiftly overtake any negotiations on 'Agreements for the Future', also providing companies with the opportunity to view cooperation over 'Arbeit 2020' as a service for which they could subsequently extract concessions elsewhere. Works councils and trade unions were not generally willing to accede to this. Nonetheless, this logic was unlocked at 'Plant construction 1' and 'Electro 2' where, despite highly complex negotiating situations, it did prove possible to isolate the issues raised by 'Arbeit 2020' and translated these into agreements. The critical factor in both these cases was the high level of activity on the part of work councils, each of which was strongly supportive of such agreements and, by the application of a certain amount of pressure and their own negotiating skills, was able to secure them.

The main issues covered by 'Agreements for the Future' are training and continuing training and, especially, the participation in digitalisation projects, which offers the opportunity for works councils to influence the implementation of digital technology from the outset. Further common topics are workforce recognition, working hours, workloads and data security. However, the main feature of these agreements is that they are essentially procedural in nature. All provided for the establishment of joint working parties for dealing with the issues and refining them to a point at which it would be possible to agree specific actions. In this sense, the agreements have also generated a fresh imperative for employee representatives as without their active involvement in these processes, no improvements would be possible should problems

occur. Works councils are called upon to be both the drivers and sponsors of the implementation of these agreements. More precisely, the agreements mark the start and not the end of the process by which works councils can shape how digitalisation proceeds at their workplaces.

This then raises the question as to what happens once such an agreement has been concluded. Given the limited time frame of our research, it was not possible to arrive at any systematic findings on this issue. Nonetheless, some information was gleaned from interviews with works councillors, revealing a wide range of practice. On the one hand, there were cases in which concluding an 'Agreement for the Future' opened up new issues and areas for activity and, as with 'Furniture', 'Metalworking' and 'Auto components 3', was used to undertake a fundamental restructuring of how the works council operated. In these cases, joint working parties were established and works councils were active in pursuing the new topics. At 'Furniture', the works council even reassigned its entire operations to the working parties and dissolved its previous committees, most of which had only ever existed on paper. On the other hand, there were instances where the opportunities offered by the agreement had not been made use of nor could be made use of. One conclusion from this variance is that concluding such an agreement does not automatically equate to the activation of the works council. Rather, works councils need to acquire the habit. 'Arbeit 2020' can provide a useful basis for this as plants in which such agreements have been concluded will be included in the second wave of the project, with the support offered by the project possibly enabling some life to be breathed into the agreements.

3.5 Participation and trade unions

The success of 'Arbeit 2020' rested not only on a favourable set of initial conditions in terms of workplace industrial relations but also on two other factors: employee participation and close cooperation between works councils and trade unions. Employee participation was significant—in fact, indispensable—for two reasons: first, it opened up a route to expert knowledge in areas in which works councils could not call on this from within their own ranks as it related to departments that were unrepresented in the works councils' committees, and second, it created contacts, interests and legitimation for 'Arbeit 2020' and the process of interest representation overall. How this took place differed considerably as between workplaces in the project. In most cases, employees were drawn on selectively to make up for any shortfalls of knowledge within the works council. This was especially so for departments that had traditionally kept their distance from the works council, which were not represented on it and, conversely, which works councils had done little to cultivate. One consequence of this mutual distance was that works councils—as in 'Metalworking'—knew very few people in these departments that they could talk with, aside from those with a prior interest in the works council or, as in 'Drive systems 2', knew no one at all and asked the HR department to find contacts. This situation led to a genuine learning effect at 'Metalworking', where the works council stated that, given the experiences made, today he would more actively present the project to all the plant's departments and ask for volunteers to identify those employees with a real interest to attend the project. In other cases, as at 'Automation' and 'Electro 3', additional interviews were conducted with employees, widening the 'empirical basis' of the process of creating the digitalisation map. In addition, as works councillors at 'Electro 3' emphasised, it also raised the significance of the maps to management as they were

an expression of broad employee knowledge. Participation was also used strategically as a power resource for employee representation in other instances. At 'Electro 2', this was the case for a departmental meeting in the development area, where the works council lent its support to the workforce in a dispute over a proposed relocation of the department. And at 'Furniture', surveys and departmental meetings with employees in the sales department bolstered contacts with this group of employees and opened this area up strategically for employee representation, both of works councils and trade unions.

The trade unions had difficulties to be perceived as initiators of the project as the communication with the employees largely was organised along the communication channels of the works councils. However, there were case-study plants in which 'Arbeit 2020' was positioned from the start as a trade union project. In these cases, as at 'Furniture' and 'Metals', the project was viewed and implemented as means for mutually strengthening both facets of employee representation, although, as yet, there have been no major organisational breakthroughs—aside from 'Metals' where trade union membership rose from 30 to 50 per cent of the workforce. As far as the works council was concerned, the project led to a fresh image of IG Metall as an influential force at workplace level with an enduring rather than short-term impact. This might well be attractive to employees who expect a trade union to be more than simply a party to industry-level collective bargaining but rather an organisation that engages with the details of workplace issues. And although 'Arbeit 2020' is not an organising project in the narrow sense of the term, but is aimed at improving the capacity of works councils, this in itself holds out the prospect for trade organising given that classic organising approaches do not concern themselves with issues of influencing and shaping workplace developments.

4 SUMMARY

Digitalisation in the various branches of manufacturing industry currently exhibits a somewhat fragmented and piecemeal character. This is an important result of the information generated in the 'Arbeit 2020' project about the dynamics of technological change as a precondition for assessing the impacts of technology. Far from revolutionising production technologies or disrupting existing technical or organisational structures in the form of a singular event, 'Industrie 4.0' is edging forwards more incrementally, with a continuity in reconstituting predigital technology. This has made it difficult to pin down exactly when 'Industrie 4.0' might have begun and what its earliest features were. It is often not centrally coordinated, with organisations often lacking any centralised and accessible knowledge of the changes underway.

The effects of this on employment and employees' working situation can be summarised in three points. First, as yet, expectations that employment levels would fall have not been borne out by events. In fact, employment in German manufacturing generally as well as in the case-study companies has risen in recent years, albeit with a shift from manufacturing to administrative roles and with a flavour of uncertainty of future developments. It is no accident that employment security has remained a core works council priority in the 'Arbeit 2020' project. Apart from that, only little degradation effects of skills and competency requirements have been observed in the project workshops. Implementing innovative technologies has generated new skill demands, at least up to now. One significant finding from 'Arbeit 2020',

however, was that firms were far from making an adequate response to the need to develop the skills required to match these new and rising demands; another was the increase of workloads. In part, this might be related to the increase in the level of digitalisation and automation; at the same time, working conditions have deteriorated because of excessively tight staffing levels, fierce cost and budgetary pressures, and frequent overtime working.

Given these data, digitalisation maps drawn up at departmental level have proved to be an important instrument for creating transparency over how digitalisation is proceeding in practice at workplace level and the challenges this poses. In this way, the maps created a foundation on which works councils could acquire knowledge and assess the dynamics of technological change and its impacts. Moreover, information could be directly deployed as a power resource and a guide to action. This also applies even if no 'future' agreements are concluded. Changes in management and a shift to 'distributive' or 'concession' bargaining over job cuts or derogations from agreed industry standards can supervene to put a stop to this process. 'Agreements for the Future', in line with current processes of digitalisation, are procedural in nature. They formulate opportunities—or better requirements—for action and participation on the part of works councils, some of which were already being put into practice in the case-study plants. Especially, these processes offer the possibility for the works councils to influence technological change in digital projects from the start; we still need more information on how efficient works councils are in doing this.

One prerequisite for this is that works councils adopt a strategic perspective towards the issues and objectives explored in the project and that they develop a participatory approach. Making use of employees' expert knowledge and promoting their participation through means such as surveys and departmental meetings constitute significant new resources for works councils. By extending works councils' knowledge of digitalisation and its consequences at the workplace, employee expertise and involvement constitute knowledge resources that can help guide future action. It is also a resource that promotes legitimacy as it helps anchor works councils in their constituent workforces. And finally, employee expertise and involvement is a power resource that can strengthen works councils' position *vis-à-vis* management.

The findings show that German unions in the manufacturing sector, although suffering from membership losses and a decline of collective bargaining coverage, still have resources and capabilities to develop a new strategic repertoire, and within this repertoire, projects tackle the specific challenges of technological change in the form of 'Industrie 4.0'. The impacts of these incremental changes have to be tracked on plant level in order to understand and to assess them. This is why union projects have to focus on strengthening the resources and capabilities of the plant-level representatives of workers—the works councils. As a result, the dual character of German industrial relations—cooperation between works councils and trade unions at workplace level—will play an increasingly important role in responding to the current challenges and transformations and serve as the foundation for revitalising employee representation. For German trade unions, this means developing their workplace activities and, where possible, linking the activation of works councils with steps to strengthen their own workplace organisational power. This new division of work between unions and works councils, the activation of works councils by unions and the more active role played by works councils in technological change, seems to be an essential feature of the renewal of workers' representative in Germany. The interplay of these actors and institutional levels is what can be called a 'country effect' of German

industrial relations in technological change. However, this interplay—and the country effect going along with it—has its limits. The situation is different in the many workplaces that have no works council: here, trade unions face a much more demanding task as any organising strategies will also have to create works councils structures where none have existed. In this sense, trade union organising and the activation of works councils should be seen as complementary strategies in the overall repertoire of trade unions.

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