

Trade unions' responses to Industry 4.0 amid corporatism and resistance

VALERIA CIRILLO, MATTEO RINALDINI, JACOPO STACCIOLI,
and MARIA ENRICA VIRGILLITO*

Abstract:

The aim of this paper is to shed light on the paths, directions, and ensuing degrees of technological adoption fostered by trade unions or, alternatively, forms of resistance thereof, in the so called 'Italian Motor-Valley', a distinctive technological district located in the outskirts of Bologna, Italy, specialised in the engineering and automotive industry. We find that the introduction of Industry 4.0 technology opens up a new space of action for trade unions in influencing firms' decisions on technological adoption. However, this new scope can have ambiguous effects, depending on how the process is governed. On the one hand, trade unions' involvement in said decisions might end up fostering corporatist tendencies, favouring the alignment of workers' and managers' objectives. On the other hand, such a major involvement can help both recomposing old forms of dualism and revitalising workers' role in the crucial issue of work organisation.

Cirillo: Università degli Studi di Bari "Aldo Moro", Italy;
email: valeria.cirillo@uniba.it
Rinaldini: Università degli Studi di Modena e Reggio Emilia, Italy;
email: matteo.rinaldini@unimore.it
Staccioli: Catholic University of the Sacred Heart, Italy;
email: jacopo.staccioli@unicatt.it
Virgillito: Sant'Anna School of Advanced Studies, Italy;
email: mariaenrica.virgillito@santannapisa.it

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The term 'Industry 4.0' (hereafter, I4.0) has been recently introduced to identify a new set of technological artefacts meant to stand at the core of the new 'intelligent factory'. These are characterised by a high degree of automation, digitalisation, and interconnection. Their introduction has produced a series of technological and organisational changes within the workplace of manufacturing firms, both within industrialised and catching up economies (see Cirillo et al., 2021c). The degree and direction according to which the introduction of I4.0 artefacts – and the ensuing transformation of organisational routines – emerge are the result of the interaction between employers and employees. However, the presence or absence of an

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organised workforce can create major differences in the specific patterns of adoption. In particular, trade unions (hereafter, TUs) have played a crucial role in influencing the implementation of technological and organisational practices (for recent evidence, see Jürgens and Krzywdzinski, 2016; Smith and Vidal, 2019).

The aim of this paper is to shed light on the paths, directions, and degrees of technological adoption fostered by TUs or, alternatively, forms of resistance by TUs, in the so called 'Italian Motor-Valley', a distinctive industrial district located in the outskirts of Bologna, Italy, specialised in the engineering and automotive sector. The analysis of the strategies employed by TUs when they face technological change is based on industrial relation studies (Slichter et al., 1960; Litwin, 2013); however this analysis has been largely dismissed with reference to the latest I4.0 wave until recently (Bosch and Schmitz-Kießler, 2020; Doellgast and Wagner, 2022). This paper intends to fill this vacuum. Our empirical investigation is based on one year of intense field-work activity consisting of semi-structured interviews with middle managers (mainly in HR, planning, and R&D departments), workers, TU delegates, and focus groups with local TU leaders, the latter being responsible for the coordination with firm delegates.

The questions under scrutiny include the following: have TUs played a role in managing the process of technological change and, if so, to what extent? In which respect have TUs facilitated, or prevented, the adoption of new organisational practices? To what extent are TUs empowered by new grounds of bargaining and able to widen the represented workforce composition (e.g. including white-collar workers)? To answer these questions, these interviews aim to detect the emergence of organisational practices typical of the lean I4.0 transformation, namely empowerment of the workforce (e.g. the designation of team-leaders), practices of job-rotation and mechanisms of active worker participation (e.g. teamwork), training practices, monetary and non-monetary incentive schemes and career opportunities.

We conclude that the introduction of I4.0 technology opens a new space of action for the role of TUs in influencing firms' technological adoption decisions. However, this new scope of action can have ambiguous effects, depending on how the process is governed. On the one hand, the involvement of TUs in said decisions might end up fostering corporatist tendencies, favouring the alignment of workers' and managers' objectives. On the other hand, such a major involvement can help recompose old forms of dualism and revitalise the role of workers in work organisation. Our findings are to be understood within the context of a general weakening of industrial relations in Europe (Ebbinghaus and Visser, 1999) and a progressive erosion of the power of TUs under the Eurozone's institutional framework (Rathgeb and Tassinari, 2022). In the following, the notion of corporatism that we adopt is closer to managerial corporatism than societal corporatism. While the latter intends to regulate the relationship between capital and labour at the societal level, the former regards the capital-labour relationship at the firm-level (Brulin and Nilsson, 1991). Managerial corporatism, therefore, has two meanings: first, it defines workplace identity and adherence to corporate culture; second, it refers to the capacity of organised labour to bring its own interest against the employers – for a macroeconomic approach to this subject, please see Alvesson (1991), as this is beyond the scope of our research.

The paper is organised as follows: in section 1 we discuss the relationship between TUs and innovation both from an historical and theoretical perspective, with a comparative focus on other European instances. In section 2, we present our research objectives and methodology as well as provide a brief description of the firms under study. Section 3 outlines our empirical findings, distinguishing the role played by TUs in the technological adoption, work

organisation, and working time. In section 4, we present a critical discussion of our results. Finally, section 5 concludes by positioning our findings within the scope of representation, the restructuring of various differences in the workplace –as well as the emergence of new ones.

1. The relationship between trade unions and innovation

What role have TUs historically played in the process of adoption and implementation of innovations and how is this relationship changing in the wake of the current I4.0 wave? While we don't seek to revise the entire body of literature on these topics (Hyman and Streeck, 1988; Bamber and Lansbury, 2013; Davies, 2018), in the remainder of this section we revisit the theoretical drivers guiding heterogeneous responses of TUs to technical change (section 1.1), the importance of technological change as a space for negotiation within the Italian industrial relations system (section 1.2), and the emerging new roles and scope of actions of TUs as a result of I4.0 adoption and, more generally, digitalisation, as compared to other European countries (section 1.3).

1.1 Factors behind the heterogeneous responses and tendencies toward managerial corporatism

The role of TUs vary across firms and over time. In some instances, they foster the adoption of technology and related high-performance work practices (see Gill, 2009; Gill and Meyer, 2013; and the case made by Shaiken et al., 1997), while in others they hamper the implementation of new forms of coordination, when perceived as a threat by TUs themselves (Herrigel and Sabel, 1999).

Factors which might play a role in explaining such heterogeneity are quite diverse and include:

- institutional settings and state-level characteristics of the TU system;
- local TU attributes expressed in the changing ability to negotiate and bargain over technological change;
- contingent firm-level characteristics, such as the country of origin of the parent company (Germany vs. Italy and Japan, in this paper), the type of production or the market factors (high-end vs. low-end, customised vs. standardised products).

Across such variety of factors, a common tendency that influences the relationship between TUs and technology is the change in the main attributes and scope of TUs activity, both at the macro and the micro level. The transition of Swedish TUs from societal to managerial corporatism represents an exemplary case. Early studies on the Swedish model record the passage from a macro-level solidaristic corporatist approach until the 1980s, meant to preserve universalistic rights, particularly in terms of central level wage bargaining, to micro-level corporatist approaches initiated with the phase of reorganisation of the workplace production process, according to the new lean and integrated production model, flexible specialisation, soft power, and flattened hierarchies (Brulin and Nilsson 1991). This change in managerial strategy came from the US and meant to align the American organisational model with the Japanese one (Ouchi, 1982). The adoption of the new management strategy exerted a strong impact on the cohesive and highly unionised Swedish model, reconfiguring TUs and

progressively moving them away from national bargaining so that they became more oriented to express local, firm-level power in terms of work organisation.

At the beginning of the post-Tayloristic phase, in Sweden in the early 1970s, new forms of work organisations were put in place, including experiments inspired by the sociotechnical approach of joint participation of employees and employers to co-manage the firm, with the aim of reaching societal corporatism and to create a “union-management national strategy”. After a discontinuation of these early programs due to political contrasts, single party (employers or unions) programs were activated, notably the New Factory program promoted by the Swedish Employers Confederation, which was implemented for example at Saab and Volvo, and the Demos project activated by the Swedish Centre of Working Life, which was meant to make effective the Codetermination Act, a law passed in 1977. The attempt to reach concrete co-determination in the workplace, marked by the double objective of increasing firm efficiency and ameliorating working conditions, was even backed by the State by means of a specific Worker Environment Fund financing programs and supporting local initiatives to modify the organisation of work (Brulin and Nilsson, 1991). This series of events represent a transition from societal corporatism to managerial corporatism.

In some cases, these programs led to a flattening of hierarchies, which translated into the abolition of the supervision departments, the creation of self-management teams, and even job-rotation at both administrative and shop-floor levels. In fact, of the main results of these programs was overcoming the separation between blue- and white-collar workers. At Volvo, in the late 1990s, TUs were not merely accepting of substantial car models upgrades, but they were actually making their own proposals and exerting strong influence in the final production decisions. Unions that were organised in committees at the plant and department levels, were strongly involved in projects and were locally trained by the “Metal Workers’ Union at Volvo which designs its education programme around the needs of the Volvo workshops” (Nilsson, 1999, p. 475). However, such experiments in which institutional settings, local TU attributes, and firm-level characteristics interact – as was the case of the Volvo factory in Udevall – were occasional; majority of Swedish firms lacked these forms of new work arrangements.

The gradual passage toward managerial corporatism has also been documented with reference to the German and Canadian automobile industry: this can be seen in the role of unions and work council actions vis-à-vis the introduction of High Performance Work Systems (Rutherford and Frangi, 2021). In Germany, since the eighties, work councils have acted as a key transmission mechanism of acceptance and adherence to the new production model, so much so that they have been labelled “crisis managers, agents of change and drivers of modernization” (Muller-Jentsch, 2008, p. 270). Work councils had to find the way to both promote employee participation and maintain their role in the new emerging bottom level hierarchies as Team Leaders. While work councils have been progressively subsumed into managerial interests, trade unions, and particularly IG Metall, struggled to balance the representation of universal workers interests and the representation of managerial ones, particularly when it came to temporary workers. This dynamic exacerbated the core-periphery dualism inside firms (Holst, 2014).

1.2 Trade unions and technological change in the Italian industrial relations system

Italian industrial relations have historically lacked proper regulations and bargaining agreements concerning the introduction, implementation, and adoption of technological and organisational innovations.

According to Della Rocca (1985), until the mid 1980s, Italian collective agreements had not contained specific clauses to regulate work organisation and workers' welfare in the event of the introduction of new technologies, the only exception being article 15 in the collective agreement between publishers and printers of registered newspapers and press agencies (Della Rocca, 1985, p. 33). Two factors might explain this vacuum. First, a delay in the Italian productive structure in the level of adoption of information and communication technology with respect to other European countries, which indirectly favoured a lack of contractual regulation. Second, the incremental nature of technological adoption, meant to tackle contingent operational problems rather than promote radical technological upgrading or state-led industrial policies.

As a result, the introduction, adoption, and ensuing problems with the use of new technological artefacts were considered both by TUs and managers to be a minor, secondary topic across all sectors. The banking sector, one of the first to undergo major technological changes with the introduction of electronic data processing (EDP) (Caselli, 1982), constitutes an exception therein. In this case, employees training was seen as a core strategy to avoid forms of resistance by the workforce – in this case, the direct impact of technological adoption on the work process is taken into consideration. For the rest, more widespread areas of negotiation were related to production and investment plans, with attention to problems like lack of internal demand, need for product diversification, strategies to face economic downswings, and, certainly, wage negotiation.

The agreement on new forms of work organisation and the use of information rights were two instruments of contractual regulation against this trend (Nacamulli, 1982). The so-called 'OdL's (Organizzazioni del Lavoro, lit. organisations of work) were a first attempt by Italian TUs to negotiate technological innovations and the organisation of the work process. As a further tool of intervention, the collective agreement encompassed the so-called 'diritti di informazione' (lit. information rights). Thanks to these, which were obtained in the late 1970s, TUs had the right to be informed on investment programs, innovations and technologies, decisions regarding production decentralisation, horizontal and vertical mobility. Despite being included in the collective agreement, information rights were exercised to varying degrees, depending especially on firm size, industry and level of unionisation. Since the 1980s, the metalworking/engineering TUs (which, in the 1970s, were the vanguard of OdL bargaining) have also experienced a significant narrowing of the OdL negotiation possibilities at both the national and local levels (RCS Open Lab, 2021). However, the geographical region under investigation has been historically crossed by a twist of conflictual and participatory practices which led, in the early 1990s, to the formalisation of technical bilateral commissions on work organisation which are still present, as we shall see later on (Cetrulo and Moro, 2022). Overall, however, the Italian system of industrial relations was characterised by the absence of bargaining over the organisation of the work process and technological innovations (Garibaldo, 1988).

The advent of new organisational practices brought about by lean philosophy at the end of 1980s (including training, participatory practices, problem-solving, teamwork, and reward schemes) did not lead to a reversal in the aforementioned trend. Their modes of application, legitimacy, and acceptance were generally excluded from the bargaining process despite standing at the core of the lean production model which, although not so widespread, has seen a gradual adoption within the Italian manufacturing system. These practices resulted from informal applications unilaterally set by managers, rather than being properly negotiated.

The 2008 economic crisis was a turning point: firm-level agreements started to include negotiation concerning flexible production plans to cope with market fluctuations. Indeed, lean production and just-in-time demand satisfaction rely on new working arrangements, including part-time work, flexible working hours, shift rearrangement, and even teleworking (Ponzellini, 2017).

The functionalist approach (see, among others, Ponzellini, 2013) shows that negotiations on flexible organisation of the work processes are a cultural delay specific to Italian TUs—who are characterised by an conflictual ideological culture (Campagna and Pero, 2011; Ponzellini and Della Rocca, 2015). Pero and Ponzellini (2015) consider the lean manufacturing principle of employee participation (one of the pillars of the so-called 'high-performance work practices') to be a crucial element for developing a new system of industrial relations at the plant level, in which workers play a pivotal role.

1.3 Alternative perspectives on trade unions and Industry 4.0

According to the aforementioned functionalist approach, I4.0 represents a lever for accelerating the implementation of lean production, since digital technologies and cutting-edge automation allow for a higher level of intra- and inter- organisational integration on the basis of a 'pull logic' and 'total quality management' (Tortorella and Fettermann, 2018; Buer et al., 2018). Furthermore, with respect to the organisation of work, the characteristics of I4.0 technologies (in terms of data collection, processing capacity, speed of information transmission, flexibility, usability, etc.) (Liao et al., 2017) create the conditions for achieving unprecedented degrees of flexibility and decision – leading to decentralisation (Wang et al., 2016). At the same time I4.0 represents a chance to rejuvenate a sterile bargaining system, creating a new role for TUs as transmission channels of managerial decisions and as facilitators for digitalising the work process at the plant level. Challenges arise from competitive market environments, delays due to the adoption of new technologies, and tensions in the implementation of lean organisation and cultural changes which might create friction between aspirations and effective performances. On the other hand, opportunities include the urge of transforming the historical conflicting approach to be more participatory and collaborative, by allowing TUs to have an 'informative' role, therefore creating consensus. In this respect, the complete transformation of TUs is envisaged, which moves them from a general macroeconomic institution (Streeck, 1998) towards a local company-level actor.

In line with the new corporatist aspiration of TUs, a recent study focussing on the relationship between I4.0 and work councils in the German manufacturing sector (Haipeter, 2020), foresees a series of new actions on behalf of TUs based on the activation of work councils and on cooperation between employers and delegates. Given that the founding pillars of I4.0 pose serious challenges for unions in terms of employment stability, work organisation, deskilling processes, and working conditions, it is recognised that conciliatory and collaborative practices are indeed required. This project, dubbed "Work2020" (Haipeter, 2020), envisages a new strategic role for work councils, ranging from consulting with the company (identifying dissemination and new forms of digitisation), to strategy, defining problems and domains of analysis and marketing, as well as promoting plant level agreements. The Work2020 project also outlines a significant level of involvement from workers' delegates concerning the organisation of work and degrees of power and hierarchies at the plant level,

technological adoption and implementation, occupational training and working conditions (Armaroli, 2019). Overall, the workplace significantly increases its importance as a locus of negotiation in Germany. Similar efforts were made in Italy to similar shift collective bargaining from the national/sectoral level towards individual firms (Armaroli and Spattini, 2018; Harbecke and Filipiak, 2018). This requires a 'proactive' approach from work councils toward digital transformation as well as an institutional level of worker participation through the implementation of practices devoted to train workers' representatives.

Similarly, the study by Genz et al. (2019) provides empirical support on the relationship between establishment-level workforce representation and digital adoption in Germany. By making use of the IAB Establishment Panel and administrative German labour force data, they examine the effect of work councils on the implementation of digital technologies. The authors find a robust negative relationship between the presence of work councils and equipment incorporating digital technology. Additionally, work councils support the implementation of digitalisation in establishments that display a high share of workers performing physically demanding tasks. The implementation of digital technologies increases the responsibility of work councils to mediate between employers and employees.

Conversely, another group of empirical and theoretical contributions highlight that the purported participatory culture at the core of the lean production system only concerns micro-organisational tasks and does not allow employees and their representatives to be genuinely involved in managerial decisions (Antonioli and Pini, 2005); nor it is related to an increase in workers' autonomy (Cirillo et al., 2021c). These critical approaches consider I4.0 mainly as a continuation of a paradigm in which the power of TUs is weakened, and emphasise the necessity for TUs to mobilise workers and exert a conflictual role. Challenges clearly arise from technological unemployment, task intensification and/or deskilling, working time saturation, organisational changes, value chain disintegration, market pressure, change in workforce composition and related class identity. However, there is room to react to and resist new forms of exploitation brought by I4.0. Objectives like 'bargaining the algorithm', rebuilding general representation, recomposing a new and diverse workforce, massively negotiating on work organisation, technological design and implementation, are viable and should be pursued (Moore et al., 2018).

These studies usually focus on the consequences of a pervasive adoption of digitalisation on workers. Indeed, they highlight new pervasive forms of control over the work process (Moro et al., 2019; Tubaro and Casilli, 2019; Cetrulo and Nuvolari, 2019), in terms of continuous monitoring of workers' performance, reward schemes, and disciplinary usage of collected data. In this context of pervasive surveillance, Moore et al. (2018) outline forms of TU-led resistance and, more generally, TU responses. In many countries, TU have proposed guidance, policies and codes of practice on workplace digitalisation, including proposals to update workplace-specific data protection and privacy legislation. Indeed, multi-employer bargaining lacks regulation on privacy and technology use, although TUs have negotiated some forms of protection against a pervasive use of digital technology (Moore et al. 2018, pp. 33-34). In Belgium, for instance, the 2002 National Collective Agreement on the protection of employees' private lives limits the use of digital data. In 2014, Swedish TUs played a key role in obtaining a new law protecting workers against technology-related stress in the workplace. Further examples are French TUs supporting the so-called "right to disconnect" clause in the 2016 reform and Danish TUs striking an agreement concerning the introduction of new forms of control at the workplace. Apart from

being proactive, TUs have pushed to implement rules which limit monitoring and control possibilities enabled by digital technologies and exercised unilaterally by firms.

Overall, the empirical literature, both qualitative and quantitative, is quite scant and is usually more devoted to analysing the extent to which the implementation of direct and indirect employees' participation practices is associated with major technological and organisational changes at the workplace level (Addison et al., 2001, 2017). The literature thus neglects the role that TUs might play in the process of technological change, from initial concept to actual deployment. When we focus on the recent wave of technological change, the number of empirical contributions is even smaller due to the lack of adequate quantitative data and the specificities of I4.0 adoption within few large companies. Focussing on recent data on Italian companies, Cirillo et al. (2023) highlight an overall scattered adoption of I4.0 technologies. A single technology adoption approach seems to prevail over a multi-technology strategy based on simultaneous investments in complementary I4.0 artefacts. The presence of company-level agreements is positively associated with investments in I4.0, mainly in manufacturing and SMEs. However, the data does not provide information on the role of TUs in the bargaining process of new technologies, nor does it provide details on the content of second-level bargaining. The present study aims at filling this gap by providing empirical evidence on the role played by TUs in the negotiation of I4.0 technologies.

2. Research objectives and methodology

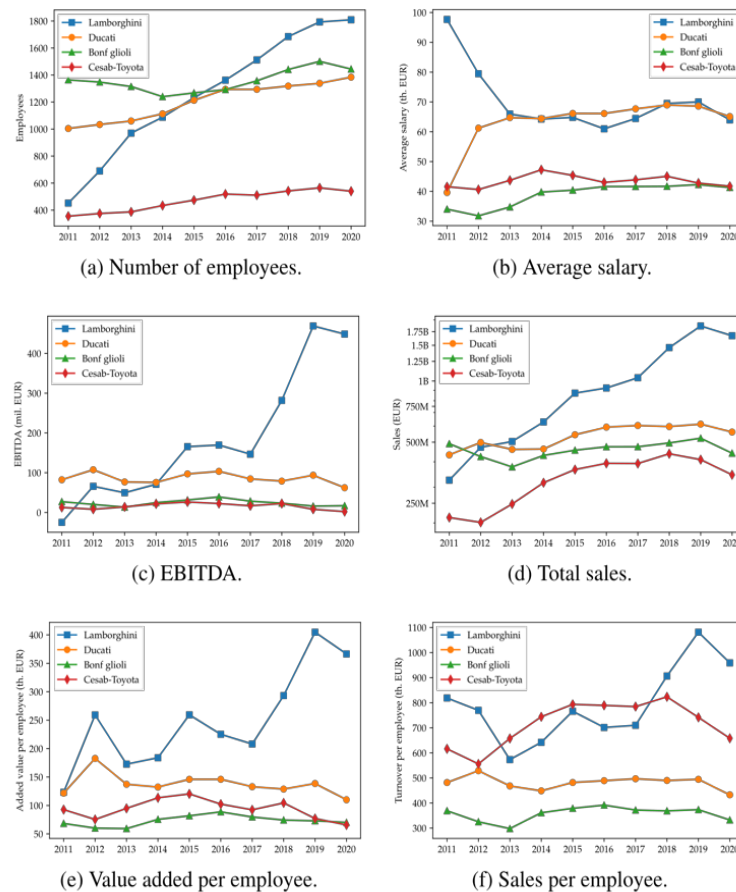
The empirical analysis is conducted with the aim of detecting the relationship between: (i) TUs and the process of technological change, distinguishing between design phase and implementation phase; (ii) TUs and organisation of work; (iii) TUs' response and attitude towards the ongoing transformation. The choice of these domains of analysis is motivated by our interest in the effective role played by TUs when facing technological and organisational transformations. Additionally, we are interested to know whether dichotomies are emerging in terms of participatory vs. conflictual practices, in terms of the real role of union delegates, whether being a transmission channel for managerial decisions or raising collective workers' claims, and the scope of actions in terms of the recomposition of a disaggregated workforce.

In Europe, the tendency is toward the decentralisation of the bargaining process – although there is some heterogeneity across different countries. Our analysis is to be understood within this context. Most European countries in the second half of the 20th century have progressively introduced a hybrid system where multi-employer collective bargaining conducted at a centralised level coexists with single-employer collective agreements signed locally at the firm level, allowing derogation to specific provisions stipulated at the central level (Braakmann and Brandl, 2016). While the 'Northern' approach has represented the archetype of promoting decentralised bargaining, with emphasis on flexicurity and agile models, the industrial relations system in Germany still sees the role of regional/sectoral level negotiation as relevant in defining industry standards, although this has been strongly eroded by derogation clauses (Doellgast and Greer, 2007). France, on the other hand, resorts to a massive usage of local bargaining, weakening the favourability principle (Béthoux and Mias, 2021). In Italy, the second-level bargaining process is consolidated particularly in big firms, representing the lowest fraction of productive activities (Leonardi and Pedersini, 2018).

2.1 Case selection strategy

Our analysis is based primarily on semi-structured interviews carried out within four automotive firms located in the outskirts of Bologna: Bonfiglioli Riduttori SpA (hereafter, Bonfiglioli), Toyota Material Handling Manufacturing Italy SpA (formerly known as Cesab, hereafter Cesab-Toyota), Ducati Motor Holding SpA (Ducati), and Automobili Lamborghini SpA (Lamborghini). The four cases represent examples of companies that adopt practices, systems, and models ranging from the Italian family business (Bonfiglioli), Japanese Toyotism (Cesab-Toyota), a mix of Taylorism and co-determination (Ducati), up to the instance most similar to the experiences of German “*Mitbestimmung*” (Lamborghini).

Figure 1 – Selected corporate performance measures (2012-2019)



Source: AIDA (BvD).

The study of these companies is part of a larger research programme (which took place between 2016 and 2018) by the Claudio Sabattini Foundation, commissioned by FIOM-CGIL (one of the leading Italian TUs) and involving researchers from several universities and research institutes. The main purpose was to understand characteristic trends concerning the organisation of work and working conditions occurred in recent years alongside the introduction of technological practices related to I4.0. In line with the general objectives and methodology of the research programme, we decided – with the support of experts, union leaders, and other scholars in the field – to select a few engineering firms deemed to be particularly technologically advanced on. These companies, called “focal firms”, give rise to the case studies analysed in this paper.

Although seemingly very different, these firms were selected because they show a high degree of comparability, apart from their geographical location, for three reasons: first, although heterogeneous, all products are high-end (Ducati and Lamborghini) or highly customised (Bonfiglioli and Cesab). Second, they all have implemented I4.0 technologies and have adopted lean production practices; all firms are large, as compared to the rest of the Italian manufacturing sector. All four firms have comparable firm-level performances in terms of salary, number of employees, profitability, sales, and value added per employee (see fig. 1). Third, they are all unionised under the same organisation, namely the FIOM, which collects almost 100% of union membership and firm delegates. The selection strategy was the result of two attributes: a high-level of TU accessibility to company premises and an actual adoption of I4.0 artefacts. The degree of comparability is demonstrated by the 6-digit disaggregation of the sectors of activity, as per NAICS codes (table 1). All firms are under the main code 33, and a low degree of within-sector variability emerges with respect to products.

Table 1 – *Naics 6-digit disaggregation of the sector of activity of the firms under study*

Company	NAICS core	Description	NAICS primary	Description
Lamborghini	3361	Motor Vehicle Manufacturing	336111	Automobile Manufacturing
			336112	Light Truck and Utility Vehicle Manufacturing
			336120	Heavy Duty Truck Manufacturing
			336213	Motor Home Manufacturing
Ducati	3369	Other Transportation Equipment Manufacturing	336991	Motorcycle, Bicycle, and Parts Manufacturing
Cesab-Toyota	3339	Other General Purpose Machinery Manufacturing	333921	Elevator and Moving Stairway Manufacturing
			333922	Conveyor and Conveying Equipment Manufacturing
			333923	Overhead Traveling Crane, Hoist, and Monorail System Manufacturing
Bonfiglioli	3329	Other Fabricated Metal Product Manufacturing	332991	Ball and Roller Bearing Manufacturing
			333612	Speed Changer, Industrial High-Speed Drive, and Gear Manufacturing

Source: Orbis BvD.

Although three out of four establishments belong to non-Italian parent companies, a strong organisation of TUs was present well before the change in ownership, as testified by the history of industrial relations in the Emilia-Romagna region (where Bologna is located), where the FIOM has been quite strong since the 1960s, which was the period of Italy's "Hot Autumn" (Cetrulo and Moro, 2022). In addition, all firms being studied are characterised by second-level bargaining, developed under comparable negotiation agreements undertaken by the local FIOM-Bologna.

2.2 Field-work analysis

The four case studies considered in this paper started with a series of discussion groups among researchers and union delegates for the aforementioned firms. The discussion groups (around 3, each consisting of about a dozen people) had the following objectives: preliminarily exploring the issues under study with union representatives; reconstructing the layout of the plant and its workflow; identifying potential interviewees; building the relevant access channels for researchers. The access of researchers to the firm premises was therefore mediated by TUs. However, the sample of interviewees was designed to also include non-unionised workers and to be balanced with respect to the various departments.

Subsequently, semi-structured interviews with the identified candidates were carried out. In this paper we analyse a set of 49 interviews with workers at the four plants, distributed according to table 2. A non-exhaustive list of topics covered during the interviews include the level of contractual framework, career paths, performed tasks and work process, technological innovation and adoption, human-machine relationship, formal and informal training, ergonomics, practices of labour management and organisation, forms of recruitment, union membership and relationship with union delegates, forms of resistance (such as strikes), content of firm-level contractual agreements. The pool of interviewed workers is heterogeneous in terms of departments, ranging from process design, R&D, assembly line, quality control, testing, logistics, purchasing and sales, and in hierarchical layers, including different levels of contractual framework (third, fourth, fifth, sixth), and functions (ordinary operator¹, team leader), encompassing both blue- and white-collar workers² with seniority ranging from 5 to 25 years. Interviews were conducted at the production plants in areas made available by the company or by union delegates. Interviews were preceded by a visit to the different areas and departments of the plant; which represented a good opportunity of directly observe the state of technology in place and the organisation of work. In parallel, 6 other interviews were conducted with managers of the companies and other technical figures, the selection of whom varied depending on the specific characteristics of the plant. The interviews also gave us the opportunity to collect business documents and other publications relevant to the current research.

¹ The term "ordinary operator" is taken from the Italian word "operatore" – worker/labourer. The term "ordinary" is meant to distinguish these workers from team leaders

² White-collar workers are actually under-represented in our sample. Transformations involving their work process usually conflate in the increasing standardisation of times and procedures dictated by the interaction with the network in which they operate, comprising of the parent-company, clients, suppliers. In the following, we mainly report findings from blue-collar workers.

Table 2 – *Classification of interviewees by firm, department, and task*

Firm	Department*	Task*
Bonfiglioli	assembly line	gearbox assembly (x2)
	mechanical machining	bolt tightening (x2)
		grinding machine operator
	logistics	warehouse management (x4)
		provider relations
		logistics
	quality control	intermediate quality control
		final quality control
		supply quality control
Cesab-Toyota	production planning	new technology integration
		assembly planning
		Production timeline and production methods
	maintenance	Machine maintenance
	claims office	claims handling
Cesab-Toyota	assembly line customisation	vehicle assembly (x2)
		installation of cabin and customisable additions
		welding of cabin
	logistics	incoming supplies handling
	warehouse	assembly line supplies
Ducati	quality control	intermediate quality control
	assembly line	engine assembly (x2)
		vehicle assembly (x4)
	process design	engine production designer
	product R&D	engine testing-room service
	quality control	process quality control
Lamborghini	testing	test drive
	assembly line	engine assembly
		vehicle assembly (x2)
	carbon fibre composites	carbon fibre lamination
		shell assembly
	pre-series center	carbon fibre process development
	process R&D	MES implementation
		human-machine interface development
	purchasing department	parts purchasing
	quality control	final quality control
	sales department	franchise and business development
	"task-force"	incoming supplies quality control
	"torque team"	control of torque wrenches
	prototypes development	process industrialisation

Notes: * at the time of the interview.

The collection of this material lasted for about one year and gave rise to a corpus of text on which, starting from the theoretical framework illustrated above, we carried out the analysis through a textual content dissection according to a 3 level coding system, shown in table 3. This entailed an iterative, rather than linear, process between our data and the emerging patterns, while also looking for relevant breakdowns that could challenge the interpretation of what was occurring in the field (Alvesson and Kärreman, 2011).

Table 3 – *The 3-level interview codification scheme*

1st level code	2nd level code	3rd level code
technological and organisational change	change in tasks	up-skilling processes de-skilling processes
	training programmes linked to I4.0 technology introduction	specific training programmes
	technology and industrial relations	role of trade unions perception of trade unions as idle and useless telework aimed at aligning the interests of employees and unions hindering unionised workers' career prospects human-machine relationship
		MES aimed at monitoring and efficiency gains
	I4.0 technology applications	IoT aimed at data collection and related risk process-product relationship collaborative robots and their ergonomics
	organisational change	change in ownership structure introduction of new production lines and products
characterisation of TL	hierarchical modularity of middle management	
	hierarchical structure and department specificities	
	multi-functionality and competition with union delegates	competencies as the basis for authority hierarchical function coaching function problem solving function evaluation function team integration function motivating function competition with union delegates

	head of department: the summit of middle management	hierarchical reference for TL recruitment function evaluation function
	multi-role workers	problem solving function
	differing frequencies	weak job rotation systems structural job rotation systems
	aims and objectives	welfare efficiency production-flow tension
job rotation	potential issues	
performance evaluation systems	contractual level upgrade as individual incentive	discretion in level upgrade attribution clarity of evaluation criteria
	influential figures	influence of the TL (not formalised)
	flexibility, monetary incentives and company welfare	uncertainty about monetary incentives company welfare and "smart working" (remote work)
	limited vertical mobility, scarce formalisation and individual negotiation	ambiguity and discretion about level upgrades appointment of TLs on a discretionary basis unclear and non-formalised vertical mobility criteria rare and challenging vertical mobility paths
mobility paths	strong vertical mobility	fast career advancements
	horizontal mobility	mobility between different departments
workers' participation devices	knowledge diffusion	formalisation of suggestions collection procedures perception of being listened to and speed of improvements implementation
	attribution of responsibilities to workers	smoothness of knowledge flow between different departments
	diffusion of teamwork practices	structure of teamwork presence of individual work among white collar workers
	worker-firm relationship	alignment of firm's and workers' objectives opinion of trade unions

As per the outlined methodology, the interviews, the collection of other informational material, and the process of analysis, did not follow a principle of statistical representativeness, but rather of concept saturation. Our aim, therefore, is not to formulate proper causal generalisations.

3. Empirical findings

In this section we present our empirical findings. We start by presenting synthetic factory-level evidence (section 3.1). We then present the empirical findings reporting worker-level evidence by means of translated excerpts from the interviews, listed according to domains of analysis, namely technology (section 3.2), work organisation and related working time (section 3.3), and general TU responses (section 3.4).

3.1 Factory-level evidence

Table 4 provides a picture of the current implementation of I4.0 technology and organisational practices within these firms at the time of the fieldwork.

Table 4 – *Specific implementation of Industry 4.0 technology and organisational practices within our case study firms*

Industry 4.0 technology			
Bonfiglioli	Cesab-Toyota	Ducati	Lamborghini
<ul style="list-style-type: none"> - MES software - AGVs - collaborative robots 	<ul style="list-style-type: none"> - digital utensils (e.g. torque wrenches) and their data analytics - digital internal communication via tablet computers - 3D printing (prototyping) - ERP software - M2M communication 	<ul style="list-style-type: none"> - digital utensils (e.g. torque wrenches) and their data analytics - partial paperless factory - 3D printing - pick-to-light - virtual configurators - AGVs - collaborative robots - M2M communication 	<ul style="list-style-type: none"> - IoT - big-data analytics (in early stage) - MES software - AGVs - collaborative robots - M2M communication
Organisational practices			
Bonfiglioli	Cesab-Toyota	Ducati	Lamborghini
<ul style="list-style-type: none"> - introduction of job-rotation - no working teams - head of department, strong hierarchies 	<ul style="list-style-type: none"> - job-rotation - <i>asaichis</i> - <i>kaizen</i> - <i>andon</i> - hierarchies: team leaders and multi-role/hybrid worker 	<ul style="list-style-type: none"> - job-rotation - briefing - processes of continuous improvement (GMK) - individual zero-error prizes - team leader, hybrid hierarchies 	<ul style="list-style-type: none"> - job-rotation - team meetings - processes of continuous improvements (management of ideas) - flexibility matrix - report card - team leader, soft hierarchies

Bonfiglioli

Bonfiglioli manufactures gearboxes and other transmission elements. As of 2019, revenues amount to 630 million euros and employees to 1,501 units. At the time of interviews, it is experiencing a phase of transition in terms of market demand satisfaction. In particular, it is moving from an old-style inventory management towards a just-in-time system. As a matter of fact, even today there is no strict takt-time enforced. The production activity entails plenty of phases with little value added, comprising the transportation of both equipment and components. The firm has experienced a long phase of stagnation since the 2008 crisis, with prolonged periods of redundancy fund, thereby reducing individual working time. In the last few years, the firm has decided to combat this decline with a new phase of investment and market demand management, with the so-called “EVO” project. The internal organisation of the firm reflects a change in ownership, which is still in the hands of the Bonfiglioli family. The initial founder – the old style enlightened master – passed on the business to his much more market-oriented and management-respondent daughter. In fact, even though there is a general constructive environment, many organisational participation practices are still rather underdeveloped. There is a strong degree of solidarity among workers, who do not appreciate potential incentive schemes fostering internal competition. Job rotation is not a standard practice: many workers have been performing the same tasks for many years. Across different manufacturing stages, workers execute repetitive and often rather arduous work, especially for women. Workers typically do not talk too much to one another and show little knowledge of the overall production process. Given this low degree of job rotation, manufacturing is heavily dependent on individual know-how, meaning that, within certain departments, the absence of a single worker might halt production. The schemes of performance evaluation are not clearly defined and a high level of discretionary practices regulates both horizontal and vertical mobility. There is no formalised practice fostering worker participation in the production process design; teamwork has just been introduced. Some workers, in particular maintenance technicians, have received vertical training consisting of formal class hours. But this is far from standard practice and strictly depends on the tasks performed by single workers and their relevance to the production process. The firm does not formally collect workers' suggestions aimed at improving the production system, and the hierarchical structure is rather strict.

Cesab-Toyota

Cesab-Toyota manufactures forklifts and other small material handling vehicles, such as hand pallet trucks and light tow tractors. As of 2019, revenues amount to 506 million euros and employees to 542 units. Since 2001, Cesab-Toyota has been a subsidiary of Toyota group. This takeover marked the introduction of the so-called Toyota Production System and the implementation of the “Toyota way” at the plant level. It also marked a wider product gamma diversification and customisation. From the organisational standpoint, a few substantial changes have recently taken place. These include the elimination of local crafting “islands” in the plant, substituted by a fully-fledged towed assembly line; a drastic reduction in inventories; the introduction of a kanban system; a complete reorganisation of workstations and the implementation of the so-called “5S” (Sort, Set in order, Shine, Standardise, and Sustain); the introduction of continuous improvement processes; a complete reorganisation of hierarchical

levels in the manufacturing division, with the introduction of the TL and of the multi-role workers. Teams vary between 10 and 25 workers, depending on the department. Another major transformation was the introduction of the concept of “tense” production flow. Currently, the plant manufactures 75 forklifts per day and the lead time (order to delivery) averages about a week. A stronger organisational integration with external suppliers (the majority of which are located within 200 km of the plant) has been crucial in providing finer product customisation and reducing overall manufacturing time. Recently, coordination teams devoted to a finer integration with suppliers and the implementation of lean principles within these latter have been set up. The tense production flow mechanism together with the Toyota Production System have been gradually reducing the takt time in the “inspection” department (as an example) from 19 minutes across 3 workstations in 2007 to 6½ minutes across 5 workstations now. Another consequence has been the overall intensification of working times and flexibility, and longer hours being required of workers.

Ducati

Ducati is a high-end motorcycle manufacturer. As of 2019, revenues amount to 744 million euros and employees to 1,339 units. Since 2012, Ducati has been a subsidiary of the Audi group, which, in turn, is a subsidiary of the Volkswagen group. The range of products includes around ten distinct models, all powered by a smaller range of 2-3 engine blocks. Both motorcycles and engines are assembled in-house. There are 4 vehicle assembly lines and 3 engine assembly lines. Older lines are the stop-and-go type, while newer ones are continuously towed. Once a motorcycle is fully assembled, two consecutive test drives and a final aesthetic check are performed. Ducati suffers from strong seasonality of orders, given that leisure driving of motorcycles peaks during warm seasons. Accordingly, manufacturing volumes vary widely over the course of the year, and can range between 140 to 410 vehicles per day. Overall, the Audi takeover has marked an increase in both production volumes and product customisation, which coincided with an intensification of working times and overall just-in-time orders fulfilment. Currently, the majority of assembly lines are organised in a modular fashion; each is composed of multiple 22 minutes long micro-phases. Whether an assembly worker continuously repeats a single micro-phase or follows the engine/vehicle along the entire line depends on contingent orders and the daily production plan. Depending on the latter, a worker may be required to assemble differently customised products in random order within the same day. The size of the teams also oscillates depending on seasonal production plans (and on department specific requirements) and typically ranges between 5 and 20 units. Along with motorcycle manufacturing, Ducati also has a fully autonomous and self-contained department, called Ducati Corse, uniquely aimed at managing the racing team, which currently competes in MotoGP and other similar events. In particular, this department includes its own R&D division, assembly and test-drive facilities, and managing team – which all act independently of the main manufacturing plant. The area it operates in is actually ‘hermetically’ sealed from view to other Ducati workers and visitors due to the secret nature of racing industrial blueprints.

Lamborghini

Lamborghini is a luxury sports car manufacturer. As of 2019, revenues amount to 1.87 billion euros and employees to 1,685 units. Since 1998, Lamborghini has been a subsidiary of

the Audi group, which, in turn, is a subsidiary of the Volkswagen group. Traditionally, the product range has included two 2-seat sports car models, as well with the convertible version. Both target the very high-end segment of the market, although one is advertised as superior and is priced twice as high. Every few years a brand-new model is launched and immediately replaces the one in its associated tier. Since 2018, Lamborghini manufactures a third model, a luxury SUV which caters to a family audience, expected to double overall production volumes. At the time of our field work, production of the SUV had yet to commence. Each model comes with innumerable customisation options and has a dedicated assembly line (L-shaped for the superior model and U-shaped for the inferior). The inferior sports car model has both the engine and the aluminium shell prefabricated by external providers. The superior model, which enjoys a more 'handcrafted' reputation, both the engine block and the carbon-fibre shell are produced in house, the former in a dedicated assembly line and the latter in a fully autonomous and self-contained department. The CFK (Carbon Faserverstärkter Kunststoff, German for carbon fibre reinforced polymer) employs 200 people and acts as a firm-within-the-firm, in that it consists of dedicated entities which regulate R&D, industrialisation methods and timekeeping, and is tasked with the whole transformation of raw carbon filaments into vehicle shells and other parts (such as spoilers and rear mirrors). The process is complex and entails cutting, pressing, bonding, sandblasting, and lamination. Work is organised in teams in virtually all departments. The quality check and the trim department usually has small teams of 4-6 people, while the assembly line teams reach around 15 employees, including a TL and a multi-role worker. The Audi group takeover marked the passage to a more serialised and procedurally standardised production, from a process which previously was more artisanal and 'piece-by-piece'. In particular, assembly lines have been progressively computerised and cycle times have been strictly fixed. Working times have intensified in the last decade as production volumes have steadily increased (for example, manufacturing of the superior sport car model doubled from 3 to 6 vehicles per day between 2010 and 2018). However, compared to other automotive companies, takt times remain fairly flexible (37 minutes for the vehicle assembly work stations and 75 minutes for engine assembly). Synergies have also been established with the parent group, especially regarding the supply of pre-assembled components.

3.2 Trade unions and technology

In terms of their role in influencing the process of technological change in the design phase, TUs manifest a general acceptance of the ongoing process of transformation. They seem to play little role in the design phase overall (e.g. no interaction with the R&D department) and tend to consider technology as a given.

One might ask whether it is legitimate to require TUs to intervene in the phase of technological design which, arguably, should be firmly in the hands of the management. Nonetheless, TUs have rather been pivotal in influencing the process of technological adoption at the macro scale. Indeed, they exert a crucial role in promoting huge investment plans involving complete technological upgrading, together with the development of new products. This seems to have occurred in all our firms except Cesab-Toyota. At Lamborghini, TUs have been able to obtain an investment plan of 50 million euros to locally manufacture a brand-new SUV model (known as URUS) instead of at an Audi plant in Bratislava, Slovakia. Similarly, at

Bonfiglioli, TUs have strongly pushed for the recent EVO project, foreseeing massive I4.0 adoption (still under development at the time of the interviews). TUs have also played a major role in promoting investment in innovation and new product lines at Ducati. Overall, whenever technology assumes its labour-augmenting nature, say, whenever it entails expansionary investments, construction of new productive capacity, elimination of old vintages, and new product lines, TUs have manifested a clear proactive role in the firms under study.

Their role in the implementation phase is even more pronounced. In fact, TUs recognise the importance of participating there in this process, as demonstrated by the presence of technical bilateral commissions called “New products and new processes”. These commissions are a typical, long-lasting trait of the forms of organisation of TUs in Emilia Romagna. Within all firms, technical bilateral commissions are either established to oversee work organisation and technology or explicitly mentioned in contractual agreements to be activated later on. In some establishments, respondents report that technical bilateral commissions were already in place since the 1990s. Bilateral commissions, composed by TU delegates and white collar workers from the timekeeping department have informative, consultative and, in some cases, proactive roles. Additionally, by means of the active role exercised within the aforementioned commissions, TUs have explicitly reacted to the adoption of I4.0 technologies. At Bonfiglioli, a contractual agreement explicitly set limits on the use of MES (Manufacturing Enterprise System) software, ruling out the possibility of collecting data on individual rhythms of production and individual performance, and their use for disciplinary purposes.

As a trade union, we are not able to design technologies since we don't have skills, but we are able to set limits to the use of technologies and their repercussions on the social system. For instance, the MES helps in making the production process more efficient and we favour it, but we oppose its use for other objectives, such as pervasive surveillance (TU delegate).

Overall, TUs have demonstrated some ability to negotiate on technological implementation, making progress on possibility of “bargaining the algorithm”. Indeed, TUs acknowledge the underlining threats of deskilling related to the introduction of I4.0 technologies.

The introduction of new technological systems has implications on the organisation of labour, especially when it comes to increasing production saturation. The goal is something akin to the “Elementary Technological Unit” of FIAT (an Italian automotive manufacturer), the latter being characterised by the proceduralisation and fragmentation of complex activities into simple tasks, therefore exposing workers to the possibility of substitution. As a TU, we lag in the analysis of organisational flexibility and the consequences on contractual practices. From the point of view of the effects, we have tried to limit the social control of the worker, from surveillance to performance evaluation, without objecting to the introduction of technology (TU delegate).

3.3 Trade unions and work organisation

In terms of organisational change, our research material points at the role of four relevant domains of analysis, namely: training activities, general high-performance work practices (HPWPs), career paths, and evaluation procedures.

In all contractual agreements, TUs have obtained the formal recognition of educational achievements, such as diplomas, bachelor's and master's degrees. This recognition consists both of monetary awards and time off to attend class. With respect to informal, on-the-job-training, at Cesab-Toyota and Bonfiglioli no mention appears in the contract, while at the two

'Audi' firms – Ducati and Lamborghini – specific internal training programs and even dedicated places on the factory floor have been created. Additionally, in the latter firms, TUs have been active in launching and promoting internship programs aimed at young students. Many interns complete a training period and are later hired by the company. This initiative, known as DESI (Dual Education System Italy) is the result of the typical German vocational training system as well as regional and state initiatives promoting active educational programs.³

The deployment of HPWPs – namely job-rotation schemes and participatory practices such as suggestions for improvement, team meetings, teamwork, and kaizens – vary across firms, from widespread and generally formalised to informal and scattered activities (see table 4).

They listen to you, however, in order to get [a specific type of cart], it took 5 years and only half of the problem was solved. I wrote on the register at the end of the line, but the sheet has disappeared. One of my proposals was [to introduce this cart] for that and another location, where it did not arrive because, they say, that otherwise they would steal it. They had given us a kind of hook that was almost worse. It went better with a type of grease that was really smelly and irritating: my mouth and respiratory tract were irritated. I prepared a safety sheet, the union endorsed me and the grease was replaced. Maybe I should have insisted more. But even if you are backed by the TU it is not easy, even though the company that has always ¹¹⁰ accommodated me (assembly line worker, Bonfiglioli).

In general, organisational practices stand at the core of Tus negotiations when drafting the content of the contractual agreement, as demonstrated by the existence of a technical bilateral commission on "work organisation". For instance, Tus at Ducati are pushing to obtain transparent and formalised criteria when acknowledging operators' versatility and multi-functionality, which arise when operators are able to execute tasks at different phases of manufacturing. Continuous improvement systems are established at Lamborghini, while *asaichi* and *andon* are present in Cesab-Toyota. However, when HPWPs are less formalised or still in development, as is the case of Bonfiglioli, Tus seem to lack the ability to intervene and their influence is limited. For instance, job-rotation practices have been acknowledged to be important by managers at Bonfiglioli, but their implementation has not been shared with workers. It appears that the negotiation phase can start only after the organisational decision has already been taken.

I created a file in which each production location lists the operators able to use the underlying machines. If one or more operators stay at home, I can't to replace them. The machine must always be on. I have some areas where we are not covered. If an operator is absent, we have to leave the machine idle. We're trying to put side-by-side training in place, so as to increase workers' versatility. This is costly because one works and the other does nothing. Learning is a cost, and it doesn't always end well. Some take one month, others take three months. We have a versatility plan because if someone is at home, I don't want to slow down production. Currently, some areas are critical. As soon as we have reached optimality, we will see if manpower is necessary or not. We might end up removing some workers (timekeeper, Bonfiglioli).

The negotiation of assessment procedure' and career paths is characterised by a more passive role of TUs at Cesab-Toyota and Bonfiglioli, while a more active role characterises TUs in the two German cases. One distinctive element is the introduction of the Audi workers chart,

³ The current DESI call for applications, in Italian, is available here: <https://bur.regione.emilia-romagna.it/bur/area-bollettini/bollettini-in-lavorazione/luglio-periodico-parte-seconda-2a-quindicina.2018-07-24.9634416374/approvazione-schema-di-intesa-fra-regione-emilia-romagna-ufficio-scolastico-regionale-per-lemilia-romagna-ducato-motor-holding-s-p-a-automobili-lamborghini-s-p-a-per-la-realizzazione-del-progetto-dual-education-system-italy-iii-desi-iii-attraverso/allegato-2>

which is helpful in formalising the latter's schemes, at least in the contractual agreement. Despite clear similarities between Ducati and Lamborghini in terms of their industrial relations system and proximity with HR department, the two firms sharply differ in their effective internal organisation. Indeed, their respective contractual agreements are almost identical, but the way the contract is implemented at Ducati is slightly less stringent. In fact, on the one hand, TUs have negotiated and continue to monitor the assessment and career systems based on hard skills and seniority, such as professional integration skills, job management skills, versatility, and continuous improvement skills. On the other hand, TUs have no say in the introduction of specific assessment systems (e.g. evaluation cards with grades A, B, C). These systems are introduced by managers and are focussed on soft skills, which may aid career prospects – the latter also being influenced by team-leaders.

All case studies show a generalised intensification of working time. Takt-time and dead time have been generally reduced. This is the result of the introduction of the just in time principle of production and of the general tendency to keep the production flow 'tense'. Although there is no explicit mention of the issue of saturation of working time in the contractual agreement, at Bonfiglioli there is a process of information sharing between the timekeeping department and assembly line workers: times and methods of execution, when introduced for the first time, are formally explained to the workers involved in a given assembly line, with the presence of TU delegates. Then, a summary written chart is also provided. The timekeeper finds it useful to have this informative process because this prevents possible complaints later on. It seems to be an effective way of managing and eventually neutralising potential conflicts.

Initially, I was a little hesitant and I saw that they were very attentive to many things which I took for granted as being ok. Initially, they considered me almost like a slave driver, too harsh with the workers. Then I had to change my attitude a little. The union takes care of workers. In the company where I was before, I didn't have any kind of disagreement; they almost didn't care. I was a little hesitant when I came here and saw that the union was very involved and wanted to scrutinise all our work, in order to supposedly take care of workers. Then I saw that we work well and we get a result, with no complaints because the work has been shared and socialised. On the other hand, in my previous workplace I was keeping times and workers did not question it, and I didn't know why. More than improving efficiency, it improves connection; I had to change my mind. I'm now used to listening to them, because working all day on the assembly line, they are the only ones who know the ins and outs of the machines. I can stand for 20 hours in front of a machine but maybe I don't notice things that happen once a month, and when they happen, a lot of time is wasted. The mood has improved a lot. Previously, they thought they had to blindly trust me. Here, they made me understand that everyone has to be made aware. In my previous company, it wasn't required. If workers know everything, they will not tell you if you are making them do something wrong (timekeeper, Bonfiglioli).

TUs exhibit a low degree of bargaining power when it comes to relaxing internal working times (i.e. the relationship between working hours and activities that take place therein, namely: pace, saturation, rhythm, etc.), meaning that the general trend towards increasing saturation, detectable at all firms except Lamborghini, is hardly counterbalanced. At Ducati, TUs had to negotiate for the lunch break, colloquially called "pausa saponetta" (lit. soap break), not to be deducted from the working shift time.

External working time (i.e. the duration of shifts and overall hours worked) has also increased. However, as opposed to internal working time, it has been characterised by a stronger level of negotiation. At Lamborghini and Ducati, for instance, TUs have negotiated to better achieve flexibility and work-life balance by introducing in the contractual agreement the

possibility of remote work (known as “smart working” in Italy) for white-collar workers – which took place well before the beginning of the COVID-19 pandemic in 2020, entry and exit flexibility, seasonal working time (summer working time reduction), holiday redistribution, possibility of substitution of extra time with a hourly flexibility package, extension of the ‘bank of time’ (to 50 hours per year). Working shifts are a major topic of bargaining since there is a clear tendency of increasing time saturation, rather than hiring more workers. Shifts have been reorganised recently at Ducati and Bonfiglioli. Workers typically prefer individual, voluntary extra-time rather than compulsory, equal for all, longer shifts.

3.4 Trade unions and representation

In terms of union coverage, contingent and temporary workers present specific needs (Lautsch, 2002; Vidal and Tigges, 2009) which is, at times, in apparent conflict with the rest of the workforce, as the former typically tend to rush the takt-time to signal efficiency and tend to refrain from strikes, under the threat of dismissal. In this respect, the use of contingent employment might be due to cost-compression strategies aiming at managing the volatility of demand (Houseman and Osawa, 2003) and leverage vertical disintegration in order to reduce the power of unions amid the emergence of a core-periphery structure (Doellgast and Greer, 2007). Additionally, union coverage might be also driven by institutional considerations relative to sheer work organisation and the coverage by TUs of temporary workers (Osterman, 2011 and 2018).

With respect to our empirical findings, TUs are working to bridge the traditional gap between blue- and white-collar workers, the newer gap between permanent and temporary contracts, as well as the systemic gap between the parent company and its subcontractors in the industrial network (Greer, 2008). TUs at Lamborghini have actively worked to reduce the separation between blue and white collar workers, with the former increasing in terms of membership (Russo et al., 2019), and with a growing number of new contractual elements more directed towards white collar workers, especially regarding teleworking. Indeed, in the most knowledge-based firms, TUs are working to blur the traditional blue collar vs. white collar worker divide. However, the by-product is that TUs are manifesting an increasingly corporatist behaviour, in line with the general tendency towards the growing importance of decentralised bargaining and the proactive role advocated for work councils within the functionalist approach to deal with I4.0. It is important to consider that Lamborghini is more the exception than the norm, in terms of both product segment and internal industrial relations system. It is hardly conceivable for the latter to be extended nationwide, given the backward industrial structure characterising Italian firms and the reticent approach towards forms of collaborative working practices (Cetrulo et al., 2020). Additionally, the German experience of vertical disintegration in the automotive sector, even for luxury products, proves that the system is not stable in perpetuity (Greer, 2008).

At the opposite end of the spectrum, Bonfiglioli is still characterised by a ‘rough’ worker consciousness, and the separation between blue- and white-collar workers remains quite strong.

It's a company that has never been afraid of going on strike. It is not easy to compare it with Lamborghini, which is a jewel. Hyper-protected models lead to very dangerous corporatist dynamics. At Bonfiglioli, corporatist dynamics are not high. By corporatist dynamics, we mean a

union that makes excellent contracts but never conflicts with the company. [...] There is a sense of belonging. Workers here are a little more rough (TU delegate).

In this firm, workers exhibit solidarity, and the permanent vs. temporary workers dichotomy is not overly strong. The new ones are a Romanian, a Sardinian. They are temporary. I have an excellent relationship with them. They work on a different type of machine, but they are in close proximity to me. If we go on strike, they are terrified. They cannot. If there's an assembly, they ask if they can come. [...] We have done a nice thing with the internal contract: prizes are awarded to new workers. I went to the head of the department told him not to let them go. And in fact, they renewed their contract first from February to March, then from March to June, then until December. We try to cheer them up. New workers are all temporary (Mechanical machining worker, Bonfiglioli).

Despite the relatively underdeveloped level of horizontal practices, the degree of unionisation is rather strong and cohesive: many workers have reported that they participated in strikes, and have resisted outsourcing and relocation of some production units in other plants. The single union representation is showing a particular ability in managing this new technological wave, with particular attention on preventing use of the MES as a form of control. In general, the degree of overlap between workers' and managers' objectives is scant. Union delegates always refer to the firm using the third person "them", as opposed to "us", which is instead widely used at Lamborghini and Ducati. However, although more corporatist, generational differences are strong at Ducati, where interviewees report that temporary workers tend to work more and "compete", in the hope of getting hired permanently. This creates some tension between the two groups and challenges for TUs, which, to our understanding, have yet to fully grasp the stress generated by the vertical part-time system both on full-time workers and newcomers.

I see that the union is very active. So far I haven't joined because I don't yet feel the need to, and since I'm part time and work 6 months a year, I am waiting for the union to support us. In August I'll go home and I'll have to look for another job. I also have a mortgage in Bologna, with the help from my parents. There should be more action on this issue. If the company has kept me for 5 years, there must be a reason. My goal is to work. If I work until the end of July and then I find myself out on the street, I'm forced to look elsewhere (Assembly line worker, Ducati).

4. Discussion: the Italian "third way" to industrial democracy

In line with the existing literature (Haipeter, 2020), our results confirm that when the workforce is organised by means of a cohesive TU, their scope of action enables the firm to better appropriate the gains of technological and organisational improvements. Generally, the TU's negotiating role is significant during the phase of technological implementation (e.g. by opposing the introduction of intrusive forms of workers' surveillance) and related organisational change. However, in all cases studied, we detect some important limits to the underlying bargaining process (e.g. in the absence of negotiation over internal working times and saturation) and a lack of the involvement of TUs in the design phase of I4.0 artefacts, regardless of the degree of digitalisation and robotisation in progress. At the same time, our results highlight the presence of rather heterogeneous responses of local TU councils to I4.0. We do find that, in the most digitalised firms, TUs show traits of managerial corporatism, although still within a key role played by the national TU federation. Additionally, within these firms, I4.0 constitutes an opportunity to recompose old forms of dualism between white- and blue-collar workers, with the requests of white-collar workers gaining more traction in the

bargaining process. Nevertheless, new gaps emerge between core, specialised, permanent workers, and less-specialised, often temporary ones.

Since the late 1970s, the Italian way of bargaining on work organisation and, more generally, on industrial democracy (see Müller-Jentsch, 2008 for a historical appraisal of industrial democracy), has been defined as conflictual participation, substantiated in two directions: on the one hand, participation was primarily exerted by means of information rights, such as the communication of the business plan or in changes in the organisation of the production process, which constitute the possibility to externally influence managerial decisions. The conflictual dimension was instead the freedom to exercise rights – including wildcat strikes – independent of corporate interests, therefore not subordinated to managerial acceptance and out of the sphere of negotiation (Gambilonghi, 2020). Indeed, as outlined at the beginning, information rights essentially represent the unique space to exercise some forms of negotiation over technology. No other formal role was envisaged – neither in the law nor in party agreements – for work councils or other intermediate worker groups, such as the *commissioni tecniche bilaterali* (lit. technical bilateral commissions). This Italian way toward industrial democracy is quite different from both the Swedish and the German models, which is also due to the more conflictual and hostile relationship with the employer confederation when compared to other continental and Nordic countries. This has been one of the most relevant factor in driving the overall abstention of negotiation over technology.

Among the three alternative factors driving heterogeneity in TU responses (outlined in section 1.1), the macro-level institutional setting of the industrial relations system has slowly diminished the role of TUs in debating and bargaining over technology. However, against this macro-level context of TUs retrenchment, some geographical areas maintained strength and capacity of intervention for historical path-dependency, but also of manufacturing in an overall deindustrialising country. Indeed, over the past 30 years the Emilia-Romagna region has kept its pivotal position in the geography of European manufacturing, with high-level integration with Germany, particularly for the provision of parts, components, and capital equipment, as a way to attract investments and acquisitions by foreign companies. Inside a resilient manufacturing system, the local culture of metal-worker TUs has been able to resist and counteract the trend of de-unionisation, particularly with newly hired employees. The FIOM Emilia-Romagna has been able to ensure a gradual absorption of non-standard workers, hired first on a temporary basis and progressively stabilised. Such attention to maintaining cohesion among old and new worker generations, together with a general pro-active attitude of local TUs, has favoured both the creation of a responsive and aware labour force to firm-level organisational changes, and to some extent also to technological ones. Notably, the industrial district under study is more an exception rather than a norm, both in terms of innovative advancements and trade unions recognition.

Corporate ownership and firm-level culture play a crucial role, shaping the entire organisation of the workforce, particularly in terms of the high-performance work practices adopted and put in place. In addition, corporate culture might play a role in influencing workers' identity, in creating a sense of belonging to the organisation and, more generally, in shaping the relationship with peers, superiors, and subordinates. Particularly within manufacturing firms, what is produced plays a role in mediating eventual attachment/detachment/alienation. If the prevalent idea of blue-collar workers in automotive is still one of humans performing highly standardised and repetitive processes and activities, this is not entirely true and becomes decreasingly detached from the reality of blue-collar

workers once the complexity of the product increases. This is the case of our firms, producers of high-end or alternatively highly customised products, which record (more or less) prevalent forms of attachment from workers (e.g., shop-floor identity).

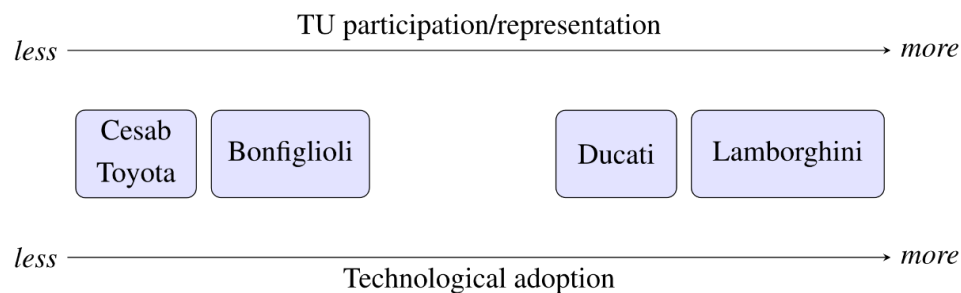
If company-level attributes are important in defining the workplace culture, they are also relevant to influencing the industrial relations system at work. In our case studies, however, a strong and cohesive factory-level system was in place well before foreign acquisitions; therefore, parent companies had to somewhat adapt to the existing forms of work organisation. Indeed, neither of the parent companies (Audi and Toyota), are known to be ex-ante hostile to labour force participation to the production process; in fact, it is quite the opposite. This has positively mediated TU participation in the technological adoption process.

To summarise, we can identify two alternative responses by TUs to the introduction of Industry 4.0 technology, either reactive/conflict-oriented or proactive/corporatist-oriented. Interestingly, the higher the level of technological innovation already present, the higher the degree of union participation in the deployment of such technologies. A proactive/corporatist-oriented attitude applies in particular to Ducati and Lamborghini. At Lamborghini, the role of TUs is considered fundamental, even by white-collar workers, when introducing technological innovations. Indeed, this circumstance may have been inherited by their shared parent company, Audi, which is known to introduce a “workers chart”, which defines the standard of work organisation in all its subsidiaries. However, this is coupled with the pre-existing system of industrial relations typical of the Bologna area.

Without support from the trade union, nothing can happen here. Neither organisational, nor technological change (Technologist, Lamborghini).

On the other hand, a more reactive/conflict-oriented attitude is discovered at Cesab-Toyota and Bonfiglioli, where TUs display a lower degree of participation in managing the process of technological adoption. Specifically, at Bonfiglioli, TUs have been able to limit the potential surveillance threat of the MES software in the contractual agreement.

Figure 2 – *Illustrative positioning of our case studies by degree of TU participation/representation and I4.0 technological adoption*



It is generally the case that, the higher the level of technological adoption, the higher the degree of TU participation in the different phases. Fig. 2 provides an illustrative sketch of how

the case study firms distribute along the two dimensions of TU's participation and representation, and of Industry 4.0 technological adoption. However, we refrain from drawing any deterministic or causal implications on the relationship between TU participation/representation and technological adoption, and we limit ourselves to documenting the coexistence of a similar direction between the two factors. Indeed, the evidence presented so far confirms the presence of hybrid and mixed configurations of workplace structures (Burowoy, 1985).

Besides the evident clustering therein, Cesab-Toyota and Bonfiglioli to the left, and Ducati and Lamborghini to the right of the picture, some findings characterise all the studied firms, in line with the Italian "third way" of industrial democracy, to the institutional setting (see above) and the convergent turn toward weakening organised labour power. In particular:

The technological design phase is outside the scope of Tus' power: we have not detected that they have a pivotal role in influencing the technological design phase; however, they have been rather crucial in promoting investment plans.

The internal working time is rarely bargained, and it resides firmly in the hand of managers: in all our firms, the internal working time has largely intensified, without being put under scrutiny by Tus. In none of the studied firms do we find bargaining or agreement on this domain.

This shared trait appears, even with such heterogeneous responses, because TU participation and technological adoption – which are particularly relevant in defining the spaces of TUs actions – remain outside their sphere of influence. However, the findings parallel previous research on the matter. Our results, which highlight the heterogeneity in practices and convergence across I4.0 factories (Moro and Virgillito, 2022), clearly align with Rutherford's (2004) findings on labour power disembedding brought by lean systems, and in our case, by Industry 4.0. According to the author, "disembedding and convergence tendencies are associated with lean production's increased ability to compare productivity and quality across different work sites. Combined with the relative weakening (in terms of labour) of national industrial relations systems, this means that company-specific regimes are emerging across national boundaries" (Rutherford, 2004, p. 440). These considerations largely apply to our findings, even within a single country.

5. Conclusions

We analyse the role played by trade unions with respect to technological adoption and work organisation spurring from the Industry 4.0 wave of innovation, with workers' representation being a tangential domain of interest. Our case studies all highly unionised workplaces, where trade unions overall pave the way for Industry 4.0 adoption and implementation, although they still largely represent the 'old labour aristocracy', prioritising the defence of claims by senior/permanent, national workers, and possibly feeding schisms between the workforce (e.g. part-time vs. full-time, internal vs. external, junior vs. senior workers). Bargaining over technology becomes a new crucial area of negotiation, which has been dismissed, for historical reasons, for a long time. In this respect, I4.0 technology paves the way to a revitalisation of TUs.

Overall, our research findings, in contrast with standard labour economic predictions (Grout, 1984), revitalise the importance of trade unions and, in general, of workers'

organisations as both a channel to favour transformative processes – say technological or organisational innovations – and the only remaining collective protection against forms of pervasive control, excessive saturation of working time, and overtime activities. Indeed, the active role of trade unions is even more necessary after a pandemic, where firms need to reorganise the work process, rearrange shifts, and potentially reshape their network of commercial flows, with the overriding problem of how to turn working from home into a sustainable, non-disruptive solution for those who can, and how to ensure sanitary and safety conditions for workers performing physical tasks on the factory floor.

Against a pure functionalist approach, our study reveals that even in the absence of a strong corporatist culture, trade unions can improve working conditions and direct technical change towards more inclusive and less predatory methods of implementation. Indeed, trade unions should not forget their institutional macroeconomic role in counterbalancing managers' power, inequality, and hierarchies, and in guaranteeing not only workers' rights, but also social rights as a whole. This is especially crucial during times of disintegration of the power of political parties, in which trade unions represent one of the last remaining forms of collective organisation.

With respect to the importance of our findings and their degree of generalisation, the emerging proactive attitude of trade unions towards Industry 4.0 has been empirically recognised in Germany, which indeed tends to confirm the new corporatist-local trait of trade unions (see the Work2020 programme in Haipeter, 2020), even in a country historically characterised by centralised bargaining. It seems that I4.0 plans are accelerating the transition toward local-level bargaining processes, recalling the debate about the defeat of the Swedish model, which in the 1980s faced a transition from a state-level solidarity approach to a company-level managerial corporatism.

Within the context of the Italian industrial system, our findings paint a picture of neodualism, envisaged in recent contributions adopting large scale firm-level datasets and showing the presence of a growing divide between a large population of laggard firms and a tiny fraction of leaders (Costa et al., 2021). Our work has focused exactly on this small section of big, technologically advanced, and in generally dynamic firms. Size and complex organisational structures tend to coexist with an organised labour force, which is also in terms of second-level contractual agreements. Indeed, and in line with our findings, the presence of second-level bargaining has been found to positively correlate with I4.0 adoption, also beyond selected case-studies (Cirillo et al. 2021b). However, large-scale data analysis lacks the fine-grained details about the attitude, practices, and phases of intervention of trade unions vis-à-vis technology. This paper meant to help bridge that gap.

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