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INTRODUCTION

This thesis explores the interplay among technological change, training for workers' upskilling, and labor market institutions which presents some theoretical ambiguities and empirical shortcomings that need to be fulfilled in the scientific literature to also contribute to the policy debate.

Industry 4.0 processes, fueled by digital technologies and tools, are deeply changing the nature and organisation of work, requiring the workforce to acquire new competences and to perform new tasks and, therefore, forcing firms to hugely invest in human capital to maintain high levels of competitiveness and of employment. This is the starting point of the dissertation, which is articulated in three chapters and uses mixed methods to conduct the analysis.

The first chapter grounds the basis of the analysis through a literature review. Given the fact that the relation between technological change and employment is a controversial issue, what emerges is the primary importance of institutions and policies capable of reabsorbing the technological unemployment which tends to be stronger where the industrial relations are more adversarial than co-operative. Nonetheless, the direction of influence of trade unions on firm innovation and strategic investments in staff and technology is perceived as very ambiguous. The review of the theoretical mechanisms and country-level empirical evidence suggests that those mechanisms act differently across-countries, and the variance must be interpreted in interaction with the different industrial relations systems. Hence, the essay includes a comparative international analysis of collective and workplace bargaining tools about digital innovation, and consequently organization of labour and training. By describing employees' representatives' rights of information, consultation and co-determination across Italy, Germany, United Kingdom, and Sweden, the goal is to assess the existence of common patterns beyond the differences, which emerges in the increasing shift towards establishment-level bargaining, with potential interesting effects on the extent of the space of negotiation on technology adoption.

The second chapter offers a quantitative analysis about the moderating role of employees' representatives on gender biased training incidence and makes use of an intersectional perspective about discrimination in accessing training activities. In fact, recent studies have contributed to the exam of the relation between trade unions and training with respect to temporary and permanent workers also in cross-countries comparative perspective; on the other side, gender has always been a key-variable in human capital theory, due to the different investment horizons that men and women predict for themselves. Labour market segmentation models highlight the effects of employment flexibilization on career perspective of different subgroups; a key-point to address is whether gender-unbalanced distribution of part-time contracts, widespread among women, has created an additional gender discrimination in the segment of non-standard employees. In this scenario, employees' representative can exert a moderating role on training incidence, being associated with the increasing in the probability for an employee of being trained regardless of gender and employment

status. Furthermore, ER can counteract inequalities and discrimination in the skills provision also when training is employer provided.

The third chapter concludes the dissertation presenting a qualitative analysis aiming to describe the firm-level space of negotiation on technology adoption and implementation through the case study of Enterprise Resource Planning systems. The aim is to assess whether ER are involved in the digital organization of labour, by exploring some critical issues that emerge from the literature review about ERP and Information Systems and are also coherent with the conceptual framework built in this thesis.

The study depicts a lack of employees' representatives' involvement on the matter that derives from the narrow expectations in terms of impact on labour organization and job content that both ER and, mostly, employers have on digital technology. In fact, innovation appears to be mostly exogenous driven and related to some obligations to comply with.

Since this trend related to ERP technology itself seems to be widespread, results from this study can be of common interest, regardless of the geography and the traditional industrial context. Even a strong collaborative experience of second level bargaining as the one placed in Bologna has shown all the limits for unions and employees' representatives in interpreting the widest potential of digital technology.

Conclusively, this thesis aims at usefully contributing to the research stream investigating the impact of Industry 4.0 on labour market, employment composition and the necessity of huge investments in training for employees' upskilling. Through the three chapters and the use of mixed methods, the attempt has been to deepen intersectionality between country- and firm-level bargaining, technology adoption and labour restructuring, employment status and gender discrimination from training access. This has been done because of the awareness that I4.0 processes impact on our society can only be addressed with a holistic approach, where unions and employers cooperate to overcome the challenge of innovation and accompany change in the best way for the most possible.

CHAPTER 1

Trade Unions and employee representatives: do they foster or counter firm investments in training and digital equipment?

Abstract

'Industry 4.0' (I4.0) processes, fueled by digital technologies and tools, are deeply changing the nature and organisation of work, requiring the workforce to acquire new competences and to perform new tasks and, therefore, forcing firms to hugely invest in human capital to maintain high levels of competitiveness and of employment. Some authors believe trade unions (TU) to be capable of shaping firms' strategic investments in staff and technology, but the theoretical framework that depicts the direction of their influence on such firm performance is perceived as very ambiguous. Therefore, moving from describing the theoretical mechanisms of the influence of TU on firm innovation (section 2), the aim of the following chapter is to offer an overview of the existing literature and the main ambiguities about the effect of the trade unions and the employee representation (ER) on shaping workplace training (section 3) and firm investments in digital equipment (section 4). The review shows that ultimately theoretical mechanisms act differently across-countries, and the variance must be interpreted in interaction with the different industrial relations systems. Hence, shifting from micro-level to country-level analysis (section 5), we describe ER rights of information, consultation and co-determination about digital innovation, and consequently organization of labour and training, by comparing the cases of Italy, Germany, United Kingdom, and Sweden - known for their very different industrial relations - looking for the existence of common patterns beyond the differences.

The general picture emerging from this chapter challenges the theoretical framework and questions its ambiguity in favour of an overall positive effect increasingly supported by the country-specific empirical evidence. Nonetheless, to assess this conclusion, this study calls for further empirical analysis especially in international comparative perspective.

1. Introduction

Digital technologies - including among others autonomous robotics, smart factories, industrial internet of things, analysis tools with big data, cloud services or online platforms, artificial intelligence, augmented reality, additive manufacturing, and cybersecurity - represent automated capital sources available to firms. Robots (autonomous programmable machines) are sets of tangible capital, while digital tools (which analyze data through the production process based on automated information gathering) are intangible sets. Tangible and intangible technologies are subject to convergence and recombinatory adoption among technology users: in the policy debate this cluster is often referred to as 'Industry 4.0' (I4.0) to capture the convergence of digital

techniques and capabilities (Kagermann et al. 2013) under a new production paradigm (Dosi 1982) based on frontier internet-driven IT.

The use of these advanced technologies at the workplace has significantly improved in recent years (Haenlein and Kaplan 2019) finding wide applications in many industries (Graetz and Michaels 2018; Acemoglu and Restrepo 2020); still there is lack of evidence regarding the actual human-machine relationship entailed by the technological innovation (Cirillo et al. 2021). I4.0 technologies are potentially capable of transforming communication and cooperation employees, facilities, logistics, products, and customers, deeply changing the nature and organisation of employment. For these reasons, management must be capable of making human and technological factors co-exist and not put one in opposition to the other: in fact, the impact of I4.0 on the labor market is firstly and foremostly feared because of the potential huge employment loss due to substitution of workers by robots and computer algorithms.

The relationship between technological change and employment is a controversial issue that has been deeply investigated by scholars, with particular attention to skills and training policies, because of the impact of numerous waves of innovation and digitalization of the last decades on the composition of the workforce. Starting from the 1970s technological change has been the major cause of the increasing demand for high-skilled workers (Bound and Johnson 1992; Katz and Murphy 1992; Freeman and Katz 1994; Berman et al. 1994; Machin and Van Reenen 1998; Lawrence and Slaughter 1993; Berndt et al. 1992; Autor et al. 1998; Haskel und Heden 1999), which occurred in parallel with the rapid expansion of educational attainment. In the late 1980s the advent of computerisation implied larger displacement effects for routine jobs, which are vulnerable to capital-labour substitution (Autor and Dorn 2013, Goos et al. 2009); this induced workers to shift to either manual or cognitive tasks in Germany (Spitz-Oener 2006), Japan (Ikenega and Kambayashi 2010), Sweden (Adermon and Gustavsson 2011), the UK (Goos and Manning 2007), the US (Autor et al. 2003; Autor et al. 2006), and in other European Countries (Goos et al. 2009, 2014; Oesch and Rodríguez Menés 2011). After a peak during the phase of large investments into ICT technologies, since the year 2000 we have witnessed a decline in relative demand for high-skilled workers (Beaudry et al. 2015) who began to be often employed in positions requiring lower skills.

Recent literature highlights how machines can substitute for tasks (displacement effect) that can be codified easily and which follow certain routines - such as exchanging information, selling or manual tasks - while tend to complement tasks that need analytical and interactive skills - such as abstract thinking, creative work, problem-solving and negotiating (Arntz et al. 2017, Frey and Osborne, 2016, Martin, 2018). Nonetheless, machines became increasingly able to also perform high-skilled tasks (Arntz et al. 2016b): it has been estimated that up to two thirds of all workers in 2026 will have general cognitive capabilities below the level of proficiency reached by computers (Elliott 2017). Therefore, I4.0, with its cluster of technologies, challenges firms in an original way to perform human capital investments adequate to reap all the returns from technological progress and to maintain high levels of competitiveness and of employment.

Process innovation is the ability of producing the same amount of output using a smaller quantity of production factors, therefore job destruction is, by definition, a direct effect of technological. Nonetheless, some economic forces can counterbalance - at least partially - the initial labor-saving impact (Piva and Vivarelli 2018). In fact, innovation is typically accompanied by huge restructuring in labour and product markets and economic theory underlines the existence of indirect compensation mechanisms for initial job losses: new jobs typically are created to serve production innovation, which requires new machines (Say 1964); the prices of the machines will be lowered by the reduction of the unit costs of production, because of the huge supply of labour consequent to the technological change, so the demand for production and employment will increase (Steuart 1966); if the second effect will be delayed, positive profits may be accumulated by the innovative entrepreneurs and be invested later, creating new productions and job opportunities with a lag (Marshall 1961; Hicks 1973; Stoneman 1983) while in the short-term structural technological unemployment will raise. Therefore, once adjustment processes between firms and sectors have been considered, economic theory predicts technological change mostly to lead to positive effects on net aggregate employment (Goos et al. 2019).

Estimates about massive employment loss in the near future - e.g, Frey and Osborne (2017) forecasted a loss of 47% of the total employment in the U.S. in the next 20 years - have been found out to be controversial because they seem to be biased upwards neglecting the very possibility of workers to adapt and switch tasks (Autor et al. 2003; Arntz et al. 2017; Dengler and Matthes 2018). Furthermore, nowadays those estimates suffer from two principle limitations: there are economic, ethical and legal issues to be tackled about the latest technologies, as well as there is also a lack of data as measure of latest digital technologies, hence the literature has up to now used the diffusion of industrial robots and its impacts for calculation of potentials to substitute workers for the German labor market (Dengler and Matthes 2015; Arntz et al. 2016b; Dauth et al. 2017), the U.S. labor market (Acemoglu and Restrepo 2017), and several OECD countries (Graetz and Michaels 2016). Also, little is known about the diffusion process of digital technologies across establishments (Genz et al. 2019; Belloc et al. 2022) even though huge heterogeneity in technology adoption has been registered. One of the first studies which captures the usage of digital technologies in Germany (Arntz et al. 2016a) reveals that 31% of the establishments have not even considered digital technology yet, while they are used by the 50% of the establishments.

Depending on institutional, social and economic contexts, compensation in reabsorbing the technological unemployment can be more or less prompt and victorious. Structural employment change has followed a significant diversity of patterns across European countries (Eurofound's European Jobs Monitor 2014) reflecting that country-specific institutions and policies mediate the labour-market consequences of technological change (Fernández Macías and Hurley 2016; Oesch 2013; Tahlin 2007). Job displacement tends to be stronger where the industrial relations are more adversarial, such as the USA and the UK, than cooperative, i.e. Continental Europe and Japan (Hirvonen et al. 2021; Aghion et al. 2021). In fact, employment representatives' presence can facilitate job redesign, reducing workers' exposure to job automation risk,

enabling greater labor-technology complementarity (Belloc et al. 2022) due to the cross-influence each factor exerts on the profitability of the other; they can also tackle potential workers' hostility towards technology adoption; eventually, they can favour the selection of efficiency-enhancing robots and advanced digital tools, which at the same time improve working conditions.

From the management perspective, digital technologies adoption requires to innovate also human resources matters such as staffing, training, and employee involvement which have been shown to influence firms' capacity to innovate (Wang et al. 2022) in a sustainable way through practices built on stability and commitment ('patient capital'; Hall and Soskice 2001). On the contrary, we have witnessed a tendency for firms to focus on maximisation of short-term profits (Grady and Simms 2019), for example by acquiring skilled workforce from the external labor market (Kriechel et al. 2014; Wintersberger 2017). The short-term profit orientation encouraged by 'impatient' capital has also led to the deterioration in people management regimes (Dundon and Rafferty 2018) and to increased job insecurity (Chung 2019; Wang et al. 2021).

In principle, trade unions can also counteract such short-term practices to some extent mostly by forcing longer term strategic investments in staff and technology. Still, the theoretical framework on the effect of TU and ER on firm innovation investments is ambiguous and ultimately the sign and direction of the union effect is an empirical question: this is the reason why it is crucial to deepen the analysis on the change processes associated with I4.0 technology adoption. Section 2 presents the theoretical framework; then, the chapter focuses on two subjects, namely TU and ER effects on shaping workplace training (section 3) and firm investments in digital equipment (section 4) with the aim of offering an overview of the existing literature and the main ambiguities. Given the variance of the effect of TU and ER mechanism among countries due to the diversity of industrial relations systems, ultimately the focus shifts from micro-level to country-level analysis (section 5): we describe ER rights of information, consultation and co-determination about digital innovation, and consequently organization of labour and training, by comparing the cases of Italy, Germany, United Kingdom, and Sweden looking for the existence of common patterns beyond the differences. Section 6 concludes.

2. Trade Unions and firm innovation

Theoretical framework about the influence of unions on firm investments in innovation is ambiguous, not only if considered as a whole but looking at almost all the theoretical arguments taken individually (Menezes-Filho et al. 2003): (§2.1) direct effects, (§2.2) profitability, (§2.3) relative price effects, and (§2.5) strategic R&D. Only (§2.4) the 'hold-up' mechanism always predicts a negative effect.

2.1 Direct effects: 'Luddism' or 'collective voice'?

Historically, taking back to “Luddism”, unions have often opposed the introduction of new technologies because of the fear of job losses, organizational change and work intensification following new technology adoption. This strategic orientation is also likely to depress R&D activities from the beginning, because some companies look to use their inventions in their own establishments, and a potential block might discourage their investments upstream.

On the contrary, unions may be able to boost productivity making the introduction of new technology more attractive in unionized settings: in fact, unions provide a ‘collective voice’ (Freeman and Medoff 1984) for individual grievances as well as for workers' contributions to productivity; moreover, unions may be instrumental in improving morale, organization and training at the workplace (Blau and Kahn 1983; Freeman and Medoff 1984) and in reducing staff turnover. It is often remarked that unions take a more pro-productivity stance in Continental Europe and Japan where industrial relations are co-operative than in countries that have more adversarial industrial relations (such as the USA and the UK).

2.2 Unions and profitability

There is a consensus in the empirical literature that unions, on average, reduce profitability (e.g. Menezes-Filho 1997) and there are two routes by which this occurs: first, and most importantly, unions increase the overall compensation for their members and, second, unions may lower the level of productivity through featherbedding, industrial action and by creating more adversarial industrial relations.

However, recalling the “collective voice” argument, the productivity impact of unions is more ambiguous as unions may exert a positive influence for example by discouraging turnover (see Freeman and Medoff 1984). Furthermore, if unions merely redistribute excess profits from shareholders to workers, then there may be no effect on R&D.

2.3 Relative factor price effects

In the standard competitive model, considering a two-factor economy where there is a choice for firms between labor and new technological capital, the impact of a wage increase on the demand for the two production inputs can be divided into two effects: the price effect (negative) and the substitution effect (ambiguous) (Booth 1995).

An increase in the relative price of labor (unions mark-up) makes wages pushed above the competitive level (price effect), causing substitution of high-tech machines for workers for a given level of output (with a shift along an isoquant).

On the other hand, a unions-driven increase in labor costs will cause higher average production costs, causing lower overall production (a shift to a lower isoquant) and therefore less need for all factors, including labor. Therefore, if the substitution effect dominates the scale effect, ER may induce firms to adopt automated capital at a faster rate as a way to substitute away costly labor (Denny and Nickell 1991).

2.4 'Hold-up' problem

Conventional views in the economics literature suggest that unions and other forms of ER exert a negative impact on capital formation and technology adoption via the 'hold-up' mechanism, according to which higher incidence of workplace ER counter employer investments in capital goods, including those related to automation. In fact, unions are believed to behave according to strategic opportunism, seeking to benefit employees by strengthening their capacity to extract rents (Simon 1944). Workers' rents benefit from owners' investments which pushes productivity; therefore, employers might be tempted to reduce investments in technology.

One of the indirect ways in which ER may discourage the use of these technologies is by imposing delay costs, impeding firms to respond to profitable market opportunities in a timely manner (Freeman and Lazear 1995).

2.5 Strategic R&D

A body of theoretical literature which highlights that R&D is mainly performed by large firms who operate in oligopolistic industries has casted doubt on the robustness of the negative impact of unions on R&D through the 'holdup' mechanism.

Ulph and Ulph (1994, 2001) have found two interesting results in the case of 'ex post' bargaining, in which unions bargain over wages and sometimes employment after the investment by the firm: when the unions bargain only over the wage there is an unambiguously negative effect of union power on R&D (a generalization of the Grout result (1984)) while, when the union bargains over employment and the wage, an increase in union power can increase R&D.

In the second scenario, the first effect of an increase in union power is to increase employment and therefore market share. enhancing the incentive to do more R&D due to the threat of losing this high share. Some of the empirical literature has found support for this prediction (e.g., Menezes-Filho et al., 1998b).

Given the ambiguity of the theoretical framework about the effect of unions and ER on firm innovation investments, ultimately the sign and direction of the union effect is an empirical question. Useful

considerations about the heterogeneous performance of different industrial relations regimes also emerge from this section. In particular, in countries with co-operative systems it comes to light that unions take a more pro-productivity stance. Also, in presence of information and consultation rights of ER about every change in the work modalities that might affect employment and job content, and given the potential impact of I4.0 on those dimensions, ER become crucial counterparts for the management in the firm digitalization process.

3. Trade Unions and training

Coherently to section 2, theoretical mechanisms of unions and ER influence on training returns are ambiguous; in the following section, those mechanisms are presented and discussed also in view of empirical evidence.

Traditionally, Human Capital theory predicts unions to distort incentives (§3.2) for agents, both employer and employee, to invest in training. Firm productivity and employees' wages are the key determinants of agents' choices, and unionism affects them by altering the structure of the labor market.

Most models of union behavior assume union utility is increasing in the wages and job security of its members: with this purpose, unions will bargain (§3.1) for training provision, exerting a positive influence. Also, labor turnover is expected to decrease (§3.3). However, due to the so-called "insider-outsider issue" trade unions have traditionally shown to focus on workers with standard employment contracts who are also likely to remain members of the union (§3.4), therefore TU and ER effect can be limited.

3.1 Training and union bargaining

Most models of union behavior assume union utility is increasing in the wages and job security of its members: with this purpose, unions may directly intervene in training provision, for example by making sure that workers' skills are deepened or kept up to date through more training.

Starting from the 1980s, trade unions have been attempting to develop an agenda for bargaining and consultation (e.g. in Britain), yet, for the most part, managers continued to regard training as an area for their own decision-making, apart from collective bargaining (Millward et al. 1992). There is, however, some contrasting evidence that unions may be having an informal role in training matters in some workplaces, and that this role may not always be recognized by management (Heyes 1993; Stuart 1994). Even where unions do not bargain directly over training, their presence could condition the whole character of employee relationships in establishments, thereby affecting the extent of training: employees may feel less threatened by the changes in work practices that often inspire training courses. Furthermore, the formality a union presence engenders may encourage managers to set up more formal procedures for identifying training needs and defining skill levels required. From all these points of view, it is arguable that the presence of active trade unions in the

workplace may lead both to a greater level of training and to a more developed training infrastructure within the establishment and the company (Claydon and Green 1994; Kennedy et al. 1994).

3.2 Training, wages, productivity and the degree of competition in the labor market

Standard Human Capital theory (HCT) developed by Becker (1964) assumes perfectly competitive labor markets in which agents, both the employer and the employee, look to the future for the justification of their decisions about training which, just like other investments, respond to economic incentives.

For the employee, investing in training depends on the expectations about its productivity, traditionally measured as salary increases through earnings functions. On the other hand, for firms gains are higher when the trained workers become more productive as a result of training, but given the fact that training is embodied in the worker, who could leave at any time to another job where she would be equally productive, the employer would never finance training if he thinks he has poor chances of maintaining the work relationship long enough to reap the returns from his investment. Consequently, firms have no incentives to finance general training since the employee might offer her skills to any other employer, making the returns to the firm potentially zero or negative (Akgunduz and van Huizen 2015:p. 510).

Therefore, HCT predicts that, in perfectly competitive labor markets where wages are set to facilitate training investments, workers will pay for general training by receiving low wages and reap the returns to this investment by collecting higher wages afterward (see Sweetland 1996, and Fleischhauer 2007 for reviews). On the contrary, specific training is by definition only valuable to the firm providing the training: typically both parties would contribute to its financing and this sharing mechanism ensures they will both have the incentive to continue the employment relationship. Nonetheless, according to Hashimoto (1981) the requirements of efficient turnover for skilled workers will induce the firm and the worker to agree to share both the costs of and returns to the investment in general training.

The orthodox human capital model has been challenged by removing the assumption that labor markets are characterized by perfect information and by defining both “otherwise competitive” and “imperfectly competitive” markets (Booth et al. 2003).

If the labor market is perfectly competitive except for union presence, then it is considered as “otherwise competitive” and unionism is predicted to negatively impact training incidence. Because unions act to reduce wage dispersion, they will not accept wages to be lowered during training and increased after training, workers won't bear the costs of general training (Mincer 1981) and so will also the firm (Duncan and Stafford 1980). Furthermore, the pay returns to training will be lower for union-covered workers than for non-covered workers. On the other side, if the labor market is characterized by some degree of oligopsony, which may arise through search frictions or workers' preferences for firms, then it is labelled as “imperfectly competitive”: workers receive wages below their marginal product, thus their incentives to invest in general training will be lowered; on the contrary, some of the returns to training will accrue to the firm, whose incentives to invest are increased,

also because wage compression - induced by the presence of the unions as well as by a minimum wage - implies that post-training productivity increases at a faster rate than wages. Therefore, the effect of unionism on the pay returns to training is ambiguous.

Hence, when productivity increases more than wages the effect is that both training intensity and firm profits increase. A more compressed wage structure is likely to increase the provision of training when firms bear the training cost (Acemoglu and Pischke 1999): unions set wages, the firm determines training and also finances it even if it is transferable. However, the pay returns to union-covered workers may be still lower than non-covered workers if the direct (adverse) effect of unions on wages is stronger than the indirect effect through more training.

In contrast, Booth, Francesconi, and Zoega (2002) modelled the source of wage compression as workers' preferences for different firms or heterogeneous mobility costs. By internalizing the friction and bargaining directly over training and wages, unions can extract a share of the surplus and give it to workers in the form of more training and higher wages. Consequently, industry-wide unionism will be associated with more transferable training and with higher pay returns from such training. Union-covered workers are significantly more likely to receive training (between 5 and 9 percentage points) and to receive longer training (between 3 and 4 days) than their non-covered counterparts (Booth, Francesconi, and Zoega 2003). Moreover, the effects of training on wages are found to vary positively with union coverage. Union workers who receive any training earn roughly 6 percent more than their uncovered counterparts, half of which is the simple union premium. The effect of training duration is small although the interaction of intensity and union recognition is again positive and statistically significant. Finally, gaining coverage is much more important for earnings growth than receiving training or obtaining longer training without gaining union coverage. In short, there is little evidence that unionism is associated with lower returns to training or lower wage growth.

It is still not possible to conclude that the productivity of training in union plants is higher than in non-union establishments (Dearden, Reed, and Van Reenen 2000) the course of earnings reflects not only value marginal product development but also It is therefore necessary to supplement the earnings function approach with a more direct measure of productivity than the wage. Indeed, testing modern theories of wage compression and training require such data (the share principle covering training investments, effort motivating career wage profiles, product market imperfections, and indeed other types of training investments (principally informal types of training on which the standard data sets are silent). to test the implication that productivity increases faster than earnings.

3.3 Training, labor turnover and “collective voice” argument

Unions could positively affect training through their influence on job tenure and, consequently, on the level of employee turnover. A decrease in labor turnover, and a reduced risk of losing highly productive trained

workers, encourages firms to estimate longer returns of the investment in training. Consequently, union covered firms may have greater incentives than non-covered firms to provide training (Booth, Francesconi, and Zoega 2002). Therefore, unionism may be associated with increased productivity as well as higher wages. This theoretical mechanism represents an application of the “collective voice” argument, with the ultimate effect of making workers more willing to engage in training, including multi-skilling. It also might tackle a potential ‘hold up’ problem from the part of employers which arises when firms under-invest in human capital. Here, unions could act to prevent the hold-up problem by making the firm honour its commitments, improving contract execution (Menezes-Filho et al. 2003).

3.4 Dual labor markets: the effect of non-standard labor

Employers may choose either to invest in the whole workforce or to focus exclusively on strategic subgroups, i.e., the permanent workers, with the result of generating disadvantages for temporary workers (Forrier and Sels 2003). Limited training opportunities are associated with poorer career prospects and may be particularly harmful for temporary workers who tend to be younger, less skilled, less experienced, and at higher risk of unemployment (McTier and McGregor 2018). Hence, temporary employment is an important dimension of social inequality (DiPrete et al. 2006; Barbieri 2009).

However, employers may use temporary contracts as screening devices (Gagliarducci 2005): temporary workers may have higher chances for training compared to permanent workers, because employers will be willing to invest in temporary workers as they aim to retain these workers and upgrade their contractual arrangement.

Through workplace presence and bargaining activity, unions can affect the incidence and distribution of training across groups of workers (Dieckhoff et al. 2007); however, due the so-called “insider-outsider issue” trade unions have traditionally shown to focus on workers with standard employment contracts — full time workers in long-term work — who are likely to remain members of the union, and to continue to pay membership fees (Gumbrell and McCormick 2011: p.297). Hence, the impact of ER in the workplace on the access to training among temporary workers may be limited. Actively reducing inequalities in training opportunities for workers with temporary contracts could be one way of attracting new members for unions: therefore, trade unions could respond to the increased number of temporary workers on the European labor market by calling for improved representation for the whole workforce (Mustchin 2012).

Sociological research on non-standard employment has been inspired by the labor market segmentation theory, which suggests that the labor market includes different segments and that individual workers face unequal working conditions, career opportunities, and wages depending on which segment they belong to (Doeringer and Piore 2020; Kalleberg and Sorensen 1979): the primary segment is characterized by relatively secure jobs with high wages, good working conditions, and good career prospects, while the secondary segment is characterized by insecure jobs with low wages and poor working conditions (Giesecke and Groß 2003).

Workers can find it difficult to move from one segment to another, however, the opportunities and barriers to mobility vary depending on the societal context. In Southern Europe, there is a two-tier labor market with new entrants, women, and immigrants overrepresented in the secondary segment (Barbieri 2009); in continental Europe, segmentation is primarily skill based (Gebel 2010); in the UK, labor market is less segmented as the protection of permanent contracts is lower (Scherer 2004), thus training opportunities may be less dependent on the type of contract.

Several single-country studies indicate that temporary employment has a negative effect on employer-provided training (e.g., see Forrier and Sels 2003; Hoque and Kirkpatrick 2003; Albert, Garcia-Serrano and Hernanz 2005; Akgunduz and van Huizen 2015). However, systematic analyses of cross-country differences in access to employer-paid training among temporary and permanent workers are scarce. Arulampalam, Booth, and Bryan (2004) found a negative relationship between temporary employment and training opportunities in five countries but the analysis did not consider cross-country heterogeneity due to differences in the institutional context. Cutuli and Guetto (2013) examined the chances of receiving training among temporary workers across different welfare state regimes, showing that temporary workers have a substantially lower probability of participating in training than permanent workers; however, when controlling for firm-level, job-related, and individual characteristics, the effect was found to be statistically significant only in the Nordic countries. The study analysed all forms of training and did not distinguish between employer-funded and other forms of training; in addition, the authors did not identify the specific aspects of institutional settings that contributed to differences in access to training among the two subgroups.

Regarding the impact of ER and union coverage on overall access to training, the conclusions are mixed; we also know little about whether the benefits are similar for temporary and permanent workers. Because ER takes different forms and plays different roles depending on the country context, a cross-country comparative perspective is crucial, as Adolfsson et al. (2022) did using data from 2015 European Working Conditions Survey (EWCS): the impact of ER is considered (i) at the individual level, measured by access to representatives of a trade union or a work council at the workplace; and (ii) at the country level, measured by union coverage (Visser 2003). In line with previous research, they find that temporary workers receive less employer-paid training than permanent workers and this association can be generalized across European countries. This confirms that employers are less willing to invest in workers with temporary contracts than in workers with permanent contracts. This calls for developing other investments in training, and for policies that encourage employers to treat workers with different types of contracts more equally. Moreover, Adolfsson et al. (2022) find evidence on the interaction effects between employment contracts and union coverage. The positive impact of union coverage on employer-paid training was substantially smaller for temporary workers than for permanent workers. Greater union coverage means more bargaining power in negotiations with the government and with other social partners when amending laws and regulations.

Furthermore, they find that the probability of receiving training was substantially higher in countries with higher levels of union coverage, confirming previous findings on the positive impact of union power at the country level (Vogtenhuber 2015).

3.5 Empirical Analysis: shortcomings, ambiguities and preliminary conclusions

Among the variables used to measure *union presence* (unionization) there is *union coverage* (membership); however, membership is only an imperfect measure of the extent and impact of union activity (Disney et al. 1995), because there are many employees for whom pay and conditions are effectively negotiated by a union, but who choose not to become members. Thus, a measure of whether a union is recognized for some bargaining purposes is likely to be a superior measure of unionism (*union recognition*). Lastly, another useful metric is *union density*, defined as the percentage of non-agricultural wage and salary employees (including public sector employees) who are union members (Hirsh et al. 2001).

Empirical studies of the field are mostly country-focused while the corpus of cross-country analyses is less rich; in this section we will make use of a comparison between the UK and USA: these two countries have been examined at length about training issues, moreover they are both systems of adversarial industrial relations but often with different results.

Past British research on the determinants of training has generally reported a positive correlation between work-related training incidence and measures of union presence (Booth 1991; Greenhalgh and Mavrotas 1993; Arulampalam et al. 1995). Green (1993) reported a positive, statistically significant coefficient for union membership participation in training in small workplaces (with fewer than 25 employees) and a statistically insignificant coefficient for larger workplaces. Booth et al. (2003) also examined the relationship between union coverage and work-related training, suggesting that - contrary to the predictions of standard human capital theory - union-covered workers and firms might face greater incentives to invest in work-related training than do not-covered workers. Green, Machin, and Wilkinson (1999) reported instead training incidence to be positively related to union recognition, which leads to an increased length of training; moreover, in their analysis both the incidence and duration of training are unaffected by the structure of bargaining (presence at the workplace of multiple unions that bargain separately or jointly).

The evidence for the United States is more mixed: some studies found a negative impact of unions on training (Duncan and Stafford 1980; Mincer 1981); however, others have found that the probability of receiving on-the-job training and the amount of work-related training received are higher for unionized workers than for non-unionized workers. Lynch (1992) reported a positive coefficient on union variables in probit models of on-the-job training and a statistically insignificant union coefficient in off-the-job training probit; Veum (1995) considered seven different forms of training (two on-the-job, five off-the-job) and obtained positive coefficients of on-the-job training determinants (company training and apprenticeships) and statistically insignificant coefficients on the union variable in the off-the-job training equations. In establishment-level

studies, both Osterman (1995) and Frazis et al. (1995) found a statistically significant positive effect of union presence on formal training. Lastly, Lynch and Black (1998), using data from a 1994 representative survey of U.S. establishments, reported no statistically significant impact of unionization on either the provision of formal training or the proportion of workers receiving it.

Given the above review, we can conclude that empirical evidence does not highlight a negative impact of unionization; the results are somewhat mixed but the signals of a positive influence are promising.

Looking for further research, According to Green et al. (1999), there are two important shortcomings to consider about empirical analyses. Firstly, previous studies have not examined the effect of TU and ER on the length of training for the recipient workers: unionism could, for example, reduce the probability of receiving training but increase the quantity of training received. Secondly, most existing research concentrates on individual-based data, therefore there is limited information about the nature of industrial relations at workplaces, including what type of union is active (if at all). Nonetheless, various issues arise from the difficulty of measuring informal workplace training, the lack of reliable cost data on formal training as well as the differences in labor markets for comparative analysis.

Further research, if more specific data will be available, should also focus on distinguishing between firm-specific and general training as well as variation in country-level factors, i.e. within- and between countries (Barbieri and Cutuli, 2016; Barbieri, Cutuli and Passaretta, 2018); also, it should investigate the extent to which specific policies prevent employers from making unequal investments between permanent and temporary workers.

Undoubtedly, comparative studies should be encouraged.

4. Industrial relations and firm investments in digital equipment

Through the following section we will investigate how work councils and ER mechanisms shape the adoption process of digital technology. Firstly, we look at the theoretical mechanisms and then we discuss empirical evidence (§4.4).

Together with the already exposed negative effect generated by the ‘hold-up’ mechanism (§4.1) - which we analyze below together with other classical theoretical union effects, in a more ambiguous framework - Belloc et al. (2022) identify two main mechanisms through which, on the contrary, ER can positively affect investments in advanced technologies: institutional frictions (§4.2) and work organization (§4.3). Those mechanisms are conditioned by other features of the employment relationship such as labor market regulation, task composition, and the industrial relations context; therefore, they cannot be taken *per se* but must be analyzed in interactions with those features.

4.1 ‘Hold-up’ problem and other classical theoretical unions effects

According to the hold-up mechanism, ER may discourage technology adoption by delaying management decisions through the imposition of time-consuming consultations (§2.4) (Freeman and Lazear 1995; Genz et al., 2019).

At the same time, however, ER can affect technology adoption through alternative channels leading to opposite favourable predictions. For instance, in the standard competitive model, ER can raise wages above the market level, inducing (under certain conditions) the replacement of labor with automated capital (§2.3). The same effect may show up if the presence of ER is aimed at protecting insiders through rigid and conflicting employment relationships (Fornino and Manera 2022; Presidente, 2020).

Alternatively, ER may enable the adoption of advanced technologies through its effect on information flows, labor-management cooperation, and work organization (Freeman and Lazear 1995) (§2.2). In particular, the more ER favour work systems that allow for information sharing, retraining as well as the targeting of unhealthy and unpleasant task replacement, the more ER will be positively associated with deeper use of complementary advanced technologies.

4.2 Institutional frictions

The presence of ER can be associated with a set of institutional frictions (we referred above to the substitution and scale effects (§2.3)). If the elasticity of substitution between labor and automated capital is sufficiently high to allow one productive input to substitute the other, it is possible to assume that advanced technologies are labor saving (Sachs and Kotlikoff, 2012; Berg et al., 2018; Sachs et al., 2015; Nordhaus, 2015). In fact, in this scenario ER lead to higher rate of technology adoption to the extent to which it creates frictions (i.e. higher wages, less flexible employment contracts, more conflicting employment relations) which raise incentives to replace workers with automated capital. This assumption is common to the whole literature stream following here. According to Fornino and Manera (2022), the flexibility of employment contracts makes labor better suited than automated capital to cope with idiosyncratic shocks faced by firms and, therefore, represents the distinctive comparative advantage of the workforce. Hence, if strong ER oppose flexible employment in order to protect insiders (Heery, 2004; Salvatori, 2012; Visser, 2002) such advantage disappears, allowing factor substitution to proceed faster. As a result, we should expect the presence of ER to be associated with positive investments in robots and advanced digital tools and possibly higher labor displacement, especially in contexts where employment protection legislation is the strictest.

Whenever ER bodies are combined with highly conflicting industrial relations, the use of robots and other advanced digital tools will rise: technological choices are interpreted as responses to given power relations, and not only economic convenience (Gintis 1976; Marglin 1974; Bowles 1985; Skillman 1988; Duda and Fehr 1987; Pagano 1991). Recently, Presidente (2020) surprisingly documented a positive association between

strike activity and industrial robot adoption in presence of strong workers' bargaining power. This particularly emerges in sunk-cost intensive industries with higher vulnerability to hold-up problems, necessarily under the condition that robots are not exposed to the same risk as non-automated capital; otherwise, capitalists would be discouraged from investing in robots.

4.3 Work organization

Finally, ER may affect technology adoption via its direct effect on work organization. This is especially relevant in the presence of organizational complementarities, i.e., situations in which distinct organizational practices exert an influence on the profitability of the others (Brynjolfsson and Milgrom 2012). Hence, ER can positively affect complementarity in three main respects.

Firstly, ER favour the internal transmission of information in a way that complements information processing based on automated capital such as robots and other advanced digital tools, with potentially positive effect on the reorganization of production processes (see, e.g., Wu et al. 2019, 2020). Precedent works show that the presence of ER bodies may facilitate the internal flow of information to top decision makers (Kaufman and Levine 2000; Belloc et al. 2020). This mechanism reminds of the 'collective voice' argument (§2.1).

Secondly, unionization is often associated with higher investment in training. This can be explained by the fact that unions have strong preferences toward gains in competitiveness through productivity compared to labor costs (§3.2) (Martins 2019). Also, training can be incentivized by more compressed wage distributions in unionized firms compared to non-unionized ones (Dustmann and Schönberg 2009); the higher frequency of training in firms with ER implies they may be more accustomed to bear some of the fixed costs (e.g organization of training sessions) associated with the acquisition of new skills that are complementary to advanced technologies, thus being more inclined toward their adoption.

Lastly, workplace governance systems based on ER can be complementary to job redesign, reducing workers' exposure to job automation risk and enabling greater labor-technology complementarity (Belloc et al., 2022), tackling potential workers' hostility towards technology adoption. This may in turn favour the selection of efficiency-enhancing robots and advanced digital tools, which at the same time improve working conditions. In this context, the adoption of advanced technologies may not necessarily be accompanied by employment losses for workers.

Taken together, these three different effects suggest that, in the presence of ER, high adoption rates of robots and advanced digital tools can go together with relatively cooperative industrial relations that promote processes of organizational restructuring.

4.4 Empirical findings and preliminary conclusions

Looking at the German case, a recent qualitative study on the relation between works councils and digital devices (Georg et al. 2017) shows that works councils doubt whether new technologies might affect the workforce and which role they can take over in the creation of a new work organization. Conversely, Ahlers (2018) finds out that 40% of the works councils he asked in his survey associate the use of new digital technologies with potentials to improve employment conditions of the workforce.

The study by Genz et al. (2019) is the first quantitative contribution, aiming to explain the effect of firm-level industrial relations on heterogeneity in the implementation of digital equipment on establishment-level: works councils' presence is associated with statistically significant lower firm digital equipment levels but it also seems to foster digital equipment in establishments employing a high share of workers conducting physical demanding job activities. Thus, this study points out the importance of establishment-level workforce representation for the digital adoption process. This is in line with the recent literature which highlights the importance of works councils as representatives of workers' interests in the digital world (Ahlers 2018). Works councils should exploit their co-determination rights in the transformation process towards a digitalized world and make active use of their information and veto rights granted in the WCA. However, a recent study has demonstrated that works councils do not utilize their scope of action for the co-determination in training programs grounded in the WCA (Iller et al. 2016). Thus, the self-understanding of works councils and their willingness to cooperate with the management will be of crucial importance for the effectiveness of works councils in the digital transformation process.

Belloc et al. (2022) conduct two different quantitative analyses. First, they make use of a cross-sectional sample of more than 20,000 European establishments from 26 European countries documenting a positive association between shop-floor employee representation (ER) and the utilization of robots and other advanced digital tools. The analysis suggests a positive effect of ER on investments in advanced technologies around the firm size cut-off, although the results are sensitive to the type of technology and specification choices. They also document positive effects on training and process innovation and no evidence of changes in the composition of employment. Rather, ER seems to influence workplace practices that enhance the complementary between labor and new advanced technologies. They conclude that the more frequent use of advanced technologies in establishments with ER seem to favour certain work systems and practices, such as training, working time management and information sharing, that are complementary to the adoption of new technologies.

Their second analysis is conducted as a quantitative case study over a panel of Italian firms finding no evidence of ER effects on robot acquisitions. In turn, ER presence increases the acquisition of advanced digital tools significantly, the training rate and greater incidence of process innovation with no employment effects around the cut-off. The Jobs Act (reform of Italian Labor Law 2015) reduced the level of employment protection above the 15-employee threshold by introducing the open-ended contract¹ but only in the case of workers hired

¹ contratto a tutele crescenti

after the legislation came into force. Thus, a substantial share of the workforce (i.e., older workers) remained under the previous and stricter employment protection legislation regime. In settings in which firms are less free to fire they might have an incentive to implement technologies preserving the productivity of older workers. Therefore, their estimates might represent the joint effect of employment protection and ER.

These results suggest that granting institutionalized channels of employee voice on average may favour the adoption of advanced technologies at the workplace.

5. Workplace representation and industrial relations²

In the previous two sections we have examined theoretical arguments and country-level empirical findings about the influence of TU and workplace ER on firms' performance in providing training and in investing in digital equipment. We have observed how different degrees of incidence of worker voice contribute to explain across-countries variance in job displacement due to automation technologies.

In the context of more adversarial industrial relations, ER bargain to raise wages above the market level, inducing the replacement of labor with automated capital; therefore, the presence of ER is associated with positive investments in technology but also with job losses. But when the industrial relations are co-operative, ER can promote processes of organizational restructuring due to technological change and counterbalance employment downturns.

In most European contexts ER have information and consultation rights about job displacements, work safety, employee supervision and monitoring, that is to say every change in the work modalities that might affect employment and job content, dimensions that are all affected by I4.0 technologies. Therefore, ER are crucial counterparts for the management in the firm digitalization process.

In the following section we will make use of four different countries for our comparative analysis, namely Italy, Germany, United Kingdom, and Sweden, known for their very different industrial relations regimes. According to the taxonomy proposed by Visser (2009)³, when it comes to employee representation Germany is defined as a dual system, where free collective bargaining coexists with works councils, with high coverage; Sweden and UK are both union based systems, characterized by weaker workplace representation, with high coverage in the former case and small in the latter; finally, in Italy ER in firms are merged with the unions but based on statutory rights.

² For this section, updated information about national industrial relations has been consulted on ETUI - European Trade Union Institute website: <https://www.worker-participation.eu/National-Industrial-Relations/Countries>

³ Visser, J. (2009). Industrial relations in Europe 2008 pag. 49 tab. 2.2

For each country of our sample, we will describe the main features of collective and workplace bargaining as well as the union recognition mechanism. We will illustrate, when present, unions rights of formation, information, consultation and co-determination applied to the topics of training and technology adoption, - looking for the existence of common patterns beyond the differences.

5.1 Germany

The German system of industrial relations is marked by its dual nature, based on two pillars. The first one is free collective bargaining regulated by the Act on Collective Agreements (1969), according to which unions and employers have the exclusive right to bargain and to settle agreements on a broad spectrum of issues. There are three kinds of collective agreement: pay agreements - fix the level of pay and periodic increases; framework agreements - specify payment systems; and 'umbrella' agreements - regulate all other conditions of employment (e.g. working time, overtime, holidays). The second pillar is the Works Constitution Act (WCA)⁴ (1972), which provides workforces the right to establish works councils at plant, enterprise, company and group levels and to elect the members of these representational bodies; it also sets out their information, consultation, and co-determination rights. Works councils most important right is to conclude agreements with the employer on all items that are either not covered by collective agreements or were delegated to them by the social partners.

Since the 1990s a crisis of sectoral collective bargaining has risen, due to the massive decrease of the coverage rate of industry-level agreements (Hassel 1999); on the contrary, works councils spread has been high. Works councils are purely employee bodies but legally independent of both the employers and the unions; they cannot consider just the interest of the employees because their legal basis is to work together with the employer "in a spirit of mutual trust and in co-operation with the trade unions and employers' associations for the good of the employees and the establishment" (§ 2, para. 1 WCA). Works councils are not directly trade union bodies, but the unions have a major influence on their operation, generally also in terms of the results of the elections.⁵ The formation of works councils is voluntary and depends on employees' initiative. According to the WCA, it requires more than 5 permanent employees to elect a works council. However, it is present in very few exceptions of small establishments. Ellguth and Kohaut (2017) draw a comprehensive picture about the presence of works councils in Germany: in 9% of West Germany private establishments eligible to establish works councils this employee representation is constituted in the year 2016. Works councils covered 90% of employees in workplaces with more than 500 employees in West Germany, but only 8% of employees in workplaces with fewer than 50 workers (ibidem: table 5).

⁴ Betriebsverfassungsgesetz

⁵ Trendreport Betriebsratswahlen 2014: Zwischenbericht, by Ralph Greifenstein, Leo Kißler and Hendrik Lange, Hans-Böckler-Stiftung, August 2014 http://www.boeckler.de/pdf_fof/S-2014-695-2-1.pdf (Accessed 16.04.2015)

A separate statutory structure for union workplace representatives is not legally prescribed. Their rights and duties are normally fixed by the unions, although in some industries their position is also regulated by collective agreements. In an ideal situation union workplace representatives exist alongside the works council; in practice there is often no separate specific structure, and the members of the works council will take over their tasks.

The law provides the works council with a range of rights, which can be divided into four main categories: information – where the works council must be informed; consultation – where the works council’s views must be listened to; opposition and refusal of consent – where the works council can block the employer’s plans, although this opposition can be set aside by a decision of the labor court; and enforceable co-determination – where the works council must agree before the employer can go ahead, unless the employer can persuade the “conciliation committee” to accept his or her proposals.

The precise rights of the works council vary from area to area, being strongest in the social area – organisation of hours, holidays, methods of payment and so on – and weakest in relation to economic issues.

When it comes to staff planning and training, the employer is required to inform the works council of overall staffing needs and discuss these with it. The works council has a general right to be consulted on training and, where workers need to be re-trained, the issue is subject to enforceable co-determination. Decisions on the implementation of training, such as the practical experience of trainees, the selection of trainees and the introduction of workplace examinations, are also subject to enforceable co-determination, although not whether training takes place at all. The works council also can veto the appointment of trainers if it thinks they are unsuitable.

Besides the rights that are formally provided by the law, works councils draw their greatest strength from the practice of a cooperative industrial relations regime in which not the employment contract but consultation and dialogue between the counterparts is at the core of the system, applicable to the organization of labor and digitalization issues.

5.2 Italy

In Italy collective bargaining depends on mutual recognition by the social partners. Collective agreements are not legally binding: the law has primacy over collective agreements, and collective agreements over individual agreements (Leonardi et al. 2018). Furthermore, statutory rights and conventional minimum standards cannot be derogated *in pejus*, but only *in mejus*.

If more than one industry-wide agreement is signed in the same contractual unit, the Courts tend to favour the one signed by ‘comparatively the most representatives.

The institutions of shop-floor ER are disciplined by Law n. 300/70, also known as “Statuto dei Lavoratori” (Workers’ Statute), which in Article 19 grants the presence of unions at the workplace through the creation of democratically elected bodies called “Rappresentanze Sindacali Aziendali” (RSA). To obtain an RSA

establishment, workers must request it from the employer: approval is mandatory in firms with more than 15 employees.

Originally, RSA could be formed and voted only by union members but in 1993 a new Protocol Agreement introduced an alternative ER body called “Rappresentanza Sindacale Unitaria” (RSU), which can be elected also by non-union members. RSAs are entirely trade union bodies, chosen by union members and acting on their behalf; RSUs, in contrast, are elected by the whole workforce, but remain union committees. RSA and RSU can coexist but only if related to different unions.

Whether workers are represented through RSUs or RSAs, it is the trade unions that play the central role. Figures from the ISTAT survey for the period 2012-13 show that 12.1% of companies with at least 10 employees had an RSU and 11.8% had an RSA. Both bodies were less common in smaller companies and found more frequently in larger ones. There are also sectoral differences, for example in manufacturing RSUs were more common than RSAs.

Both RSA and RSU are granted a series of rights to adequately perform their function. Workers’ Statute empowers RSUs to set up sub-committees on particular issues, among which work organization, new technology or job classification.

Possibility to bargain with the employer has been given both to RSU and RSA, following the introduction of the 1993 Protocol signed by the Government, the General Confederation of Italian Industry (Confindustria) and the unions: the right of bargaining applies to a set of issues directly pertaining to the organization of work, including workloads, vocational training, and the split of productivity increases between firms and workers.

Most of the RSUs rights to be informed and consulted on specific issues depend on agreements reached at industry and sometimes company level. For companies with at least 50 employees, there is the right to be informed about company’s “activities and economic situation” and the right to be informed and consulted about the “situation, structure and probable development of employment” as well as about “decisions likely to lead to substantial changes in work organisation or in contractual relations”. Therefore, normally, industry and company-level agreements require the employer to provide information and consult on topics such as changes in working methods, the introduction of new technology, equal opportunities and training.

5.3 United Kingdom

Starting from the 1980s, British trade unions have been attempting to develop an agenda for bargaining and consultation which, because of the trend toward the decentralization of bargaining, might include those issues negotiated at the company or establishment level (Millward et al. 1992). In fact, the examination of establishment-level data from the UK Workplace Industrial Relations Surveys (WERS) of 1980, 1984, and 1990 shows that the proportion of British establishments that recognized unions for collective bargaining over pay and working conditions fell by almost 20% between 1980 and 1990 (Disney et al. 1995).

For the employer there is no legal requirement to negotiate with the union except where there has been a legally binding decision that the unions should be “recognised” for bargaining. Union recognition means that the employer has agreed to consult or negotiate with the union or unions over issues affecting the workforce: unions usually negotiate on pay and conditions but there are some cases where they are only recognised by the employer for individual grievances and disciplinary cases. A survey carried out for the Trade Union Congress (TUC) in 2019 and 2020 found that supporting individual union members in disciplinary and grievance procedures was the task that workplace union representatives spent most time on.

Until 1999, union recognition was a matter of the balance of power between the unions and the employer, with the employer legally able to refuse to recognise a union, no matter how many members the union had. However, legislation passed in that year (Employment Relations Act) provided a legal mechanism which can compel employers to recognise unions. Unions must prove to an independent body - the Central Arbitration Committee (CAC) - that most employees (at least 21) in a “bargaining unit” - which can be a workplace, several workplaces, or part of a workplace - want a union to represent them.

The obligations of workplace union representatives are limited to union members; therefore, they have no responsibility for other employees.

If the unions are recognised, they have certain rights. The standard provisions of the Information and Consultation of Employees (ICE) Regulations, which apply if no further agreement is concluded, state, among the others, that representatives must be informed and consulted about decisions likely to lead to substantial changes in work organisation, as it could be the case of an investment in I4.0 technology.

Most non-union workplaces have no employee representation, but employers must still consult employees on some issues. The Workplace Employment Relations Study 2011 (WERS11) survey found that training was the issue on which the largest number of non-union representatives were involved – 58% said they had spent time on this in the previous year.

3.4 Sweden

Sweden used to have a centralized and coordinated bargaining system, but following an employer offensive in the 1990s, it moved to sectoral and company bargaining with weaker coordination (Doellgast and Benassi 2020). In the Swedish model key aspects of industrial relations are determined directly between employers and trade unions, with limited involvement by the state.

Although there is no legal obligation to set up employee representation at the workplace in Sweden, the results of Eurofound’s 2013 and 2019 European Company Surveys show it is found widely: in 2013, 54% of establishments in Sweden with at least 10 employees had a trade union representative, well above the EU28 average for employee representation of 32%.

The structure of employee representation at work is underpinned by three pieces of legislation, which were passed in the 1970s, although they have subsequently been amended: the Co-determination in Working Life

Act (MBL) (1976); the Position of Trade Union Representatives in the Workplace Act (FML) (1974); and Work Environment Act (AML) (1977).

The MBL is much less prescriptive than comparable legislation in other countries, leaving the details to be decided between the employer and the union. The employer is obliged to initiate negotiations with the union before taking “any decision regarding significant changes in its activities” or “regarding significant changes in working or employment conditions”. Judgements by the labor court have defined these “significant changes” as including changes in work organisation and methods as well as structural change.

Furthermore, Section 12 of the MBL affirms the union’s right to request additional negotiations be opened before the employer “takes or implements a decision that concerns a member of the organisation”.

However, although the employer has an obligation to negotiate, there is no obligation for these negotiations to end with an agreement, and unions have no veto powers over the employers' plans.

Trade union rights at the workplace vary depending on whether the union has signed a collective agreement with the employer. In the presence of the collective agreement, negotiations in the workplace are normally divided into three main blocks. Dispute negotiations are useful to interpret and apply agreements and legal rules that have already been reached (Section 10 MBL); with negotiations of interest the counterparts seek to reach an agreement on a local issue which has not previously been agreed (Section 10 MBL); and through co-determination negotiations the union seeks to influence the employers’ decisions (Sections 11 and 12 of the MBL).

Several agreements on co-determination were reached in the 1980s, the most notably being the agreement on efficiency and participation, known in Swedish as the UVA (1982)⁶, which provided further suggestions on the type of information that could be provided to the unions such as the introduction of new technology and work organisation.

If the union does not have a collective agreement with the employer, its rights are more limited.

6. Conclusions

Industry 4.0 processes, fueled by digital technologies and tools, are deeply changing the nature and organisation of work, requiring the workforce to acquire new competences and to perform new tasks and, therefore, forcing firms to hugely invest in human capital to maintain high levels of competitiveness and of employment. In fact, the impact of I4.0 on the labor market is firstly and foremostly feared by workers for the potential huge employment loss due to their substitution by robots and computer algorithms. Furthermore, temporary workers feel even more threatened by the fact that employers invest less in their upskilling with respect to permanent workers, and also unions happen to favour insider workers with standard employment contracts.

⁶ Utvecklingsavtalet

Trade unions can have the power to counteract short-term practices to some extent, mostly by forcing longer term strategic investments in staff and technology. But the theoretical framework about the effect of the influence of unions on firm investments in innovation is ambiguous, not only if considered as a whole but also considering the majority of the theoretical arguments taken individually. Therefore, ultimately the sign and direction of the union effect is an empirical question.

Empirical evidence about the effect of TU on training incidence is overall positive, but also suffers from some limits. For example, various issues arise from the difficulty of measuring informal workplace training, from the lack of reliable cost data on formal training as well as the differences in labor markets for comparative analysis. Furthermore, most existing research concentrates on individual-based data, therefore there is limited information about the nature of industrial relations at workplaces, including what type of union is active (if at all). Further research, if more specific data will be available, should also focus on distinguishing variation in country-level factors, i.e., within- and between countries.

Also looking at the topic of technology adoption, granting institutionalized channels of employee voice on average may favour the adoption of advanced technologies at the workplace. In the presence of ER, high adoption rates of robots and advanced digital tools can go together with relatively cooperative industrial relations that promote processes of organizational restructuring. In fact, given the potential impact that I4.0 process can have on work modalities, employment, and job content, by exerting their information and consultation rights ER gain the power of limiting the freedom of action of the management.

From the comparative analysis among Germany, Italy, UK and Sweden, we saw that since the 1990s there has been a general trend toward increased company or establishment-level bargaining, even where sectoral agreements remain dominant. Furthermore, even if among our sample workplace ER have very different levels of bargaining power, there is a tendency toward widening the subjects on which the employer must at least observe ER information rights in such a way to usually include training, changes in work organization and technology adoption.

In conclusion, the picture emerging from this review challenges the theoretical framework of TU influence on firm innovation activity, questioning its ambiguity in favour of an overall positive effect increasingly supported by the country-level empirical investigation. Nonetheless, to assess this conclusion, this study calls for further empirical analysis especially in international comparative perspective.

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CHAPTER 2

The moderating role of labor market institutions on gender biased training incidence: an inquiry about Italy

Abstract

The following inquiry is focused on assessing the moderating role of labor market institutions on gender biased training incidence in Italy. Using data from the IV wave of the *Quality of Labor* survey (2015) carried out by the National Institute for Public Policy Analysis (INAPP), the purpose is to examine the ability of institutional factors such as employee representatives (ER) and employment protection legislation (EPL) to interfere in the gender-related inequalities in the provision of skills. Exploring the shortcomings of standard Human Capital theory, our hypotheses are that (A) the gender gap in training incidence cannot be decoupled by the employment status but must be interpreted in interaction with that, thus revealing the intersectionality of discrimination; (B) with ER presence the probability for an employee to undergo training activities increases regardless of gender and employment relationship, thus reducing inequalities among employees . Therefore, by rejecting a gender-related occupational segregation hypothesis relying only on the productive sector of employment, the results from logistic regression are coherent with labor market segmentation models, showing that the probability for an employee to be trained decreases with part-time contracts above all - widespread contract type among Italian women - and increases when ER are present at the workplace. Through a multinomial regression, conclusions about ER are reinforced with an increasing probability of training even when it is funded by the employer to the advantage of non-standard workers, those in the weaker position with an atypical or part-time contract.

1. Introduction

Long-life learning strategies for workers are central to economic performance and growth and for employers to take advantage of modern technological opportunities (Mincer 1981). A large portion of human capital accumulation, in the form of on-the-job (OTJ) training, takes place inside firms (Acemoglu and Pischke 1998); formal training programs could provide employees, previously denied equal education - for reasons which analysis go beyond the scope of this work - with an equalizing factor in employment qualifications or worker productivity. Also, it is well-known that labor markets are characterized by different types of discrimination against workers due to age, gender, ethnicity, and employment relationship (for a review see e.g., Cain 1986) regarding a bunch of dimensions as salary, glass-ceiling in career paths as well as access to workplace training.

Research has provided consistent evidence of an unequal distribution of employment opportunities and socioeconomic rewards between men and women in the economically active labor force (Dieckhoff et al. 2011). Gender biased access to continuing training has been recognized by scholars as a key potential contributory factor to the persistence of gender inequalities in labor market outcomes (e.g. Olsen and Sexton 1996; Tam 1997; Tomaskovic-Devey and Skaggs 2000; Evertsson 2004; Havet and Sofer 2008); in their seminal study, Mincer and Polachek (1974) attribute a major fraction of the gender pay gap to the difference in OTJ training opportunities. Therefore, gender biased training incidence has been deeply investigated with respect to various aspects of training such as incidence, duration, source of financing, general/specific and on-the-job/off-the-job nature.

The reference for the subject is the analytical framework of Human Capital theory (HCT), as developed by Becker (1964), which is an application of standard capital theory to certain economic phenomena seen as investment rather than consumption (Blaug 1976): the decision-maker looks to the future for the justification of present actions, so do both the employer and the employee for training decisions which, just like other investments, respond to economic incentives. HCT predicts, among others, that, *ceteris paribus*, training is more likely to occur (i) to an employee who is young, already has good educational qualifications, is mainly assigned to higher-level occupations and is more committed to paid labor than family caring responsibilities, and (ii) in large firms - operating in expanding industries or industries with greater technological change where the labor process is more subject to change - where the company can both reap economies of scale in training provision and be more certain of retaining the trainee (Green 1993).

According to standard HCT, holding the hypothesis of perfectly competitive labor markets, workers will pay for general work-related training (although it could be provided by the firm) by receiving low training wages and will reap the returns to this investment by receiving higher wages afterward (see Sweetland 1996 and Fleischhauer 2007 for reviews). The reason is that training is embodied in the worker, who could leave at any time to another job where he/she would be equally productive. No firm would ever finance such training since its returns to the firm are uncertain and could well be zero or negative. In contrast, specific training is, by definition, only valuable to the firm providing the training and typically both parties would contribute to the financing of such training. This sharing mechanism ensures that both firm and worker have the incentive to maintain the relationship after training and thereby to reap the returns.

Therefore, HCT predicts that a woman may receive less training than a man either because she spends more time out of employment or because even while employed she is less likely to be trained, or for both these two reasons or eventually because of market discrimination. Discrimination in training occurs when male and female employees, having identical personal characteristics, have different chances of getting trained (Green 1993) because, before and during the work life cycle, opportunities are structured in such a way as to hinder women in acquiring skills.

When it comes to Italy, according to the most recent available data (Istat 2017) men are more involved than women in training activities: in 2015 the discrepancy was more than 5% in favour of men, by 2 percentage points wider than in 2010. Yet the corpus of cross-sectional analyses has not produced a general agreement

about gender-related causal effect on who receives more training according to all the examined dimensions (Brown 1990; Dieckhoff et al. 2011).

In fact, despite HCT predictions about women, since the 1990s empirical evidence turned out to be ambiguous showing a positive effect of female gender on numerous occasions.

Some authors have investigated an “occupational segregation” hypothesis (Estévez-Abe 2005 and 2006; Gronlund 2011): because women are in charge of parental and house care and very likely to have a discontinuous work career, they are generally employed in lower skilled jobs, those that have been more impacted since that decade by the technological revolution (e.g. introduction of computer technologies) and forced to invest in work-place training.

The hypothesis may seem outdated in a time when women’s educational attainments in most OECD countries are on a par with or even exceeding those of men; however, it may still be relevant in relation to on-the-job training, an employer investment very sensitive to within-household specialization.

We may expect female training incidence to be even higher were it not for the fact that so many women work part-time, an employment status that encourages neither employer nor worker to invest in training and marks a discrimination against women even among full-time workers (Green and Zanchi 1997; Shields 1998; Evertsson 2004; Jones 2008). In 2019, in Italy women with a part-time contract accounted for one third of the female workforce while men for less than one fifth of their share of the employed population (ISTAT 2020).

According to labor market segmentation models, the labor market includes different segments and individual workers face unequal working conditions, career opportunities, and wages depending on which segment they belong to (Kalleberg and Sorensen 1979; Doeringer and Piore 2020). Employers may choose either to invest in the whole workforce or to focus exclusively on strategic subgroups, i.e., the permanent workers (Forrier and Sels 2003); limited training opportunities are associated with poorer career prospects, thus an employer’s decision to invest only in particular subgroups of workers could exacerbate the already existing inequalities in the labor market.

Since the 1990s, European countries have implemented labor market reforms aiming at fostering the diffusion of flexible contracts as a mean to increase the employment rate (Guidetti and Pedrini 2015): as a result, flexibilization of the labor market originated a *dualization*, implying ‘that policies increasingly differentiate rights, entitlements and services provided to different categories of recipients’ (Emmenegger et al. 2012). Yet scholars have reported that stronger employment protection legislation (EPL) may increase labor productivity, such as through a positive impact on innovation (Koeniger 2005; Acharya et al. 2014; Griffith and Macartney 2014) or investments in firm-specific training (Belot et al. 2007).

Institutional and labor market segmentation models are built on the assumption that institutions, e.g. national legislation and unions, play an important role in determining who is hired, fired, and promoted, and how much they are paid. By assuming competitive labor markets, standard HCT predicts trade unions to have a negative effect on training provision, considering their activity as a market friction; but when labor markets are non-competitive (Acemoglu and Pischke 1998), institutionalized employment practices that influence wage

compression are likely to increase the provision of training, firms bearing the training cost (for a review about the effect of unions and employee representative on training incidence see Sorrentino 2022).

By making use of the IV wave of INAPP Survey, the purpose of this inquiry is twofold. Firstly, the aim is to examine the moderating role of the labor market institutions, namely the employment protection legislation (EPL) and the employees' representatives (ER), on the gender biased training incidence by assessing if ER is positively associated with the chance to be trained regardless of gender and employment relationship. Secondly, the focus shifts on who finances the investment in training (between the employer and the employee) checking for the moderating role of ER on employers' propensity to invest for the non-standard employees specifically. In Section 2 we review the literature about the gender gap, presenting the standard human capital theory predictions and the two explanatory theories of occupational segregation and labor market segmentation and formulate our hypotheses. In Section 3 data are presented, together with the variables of interest and control. In section 4 analyses run through logit and multinomial regressions are shown and results are discussed. Finally, in section 5 conclusions are summarized and policy implications are presented, offering some inputs about further useful research.

2. Conceptual framework

2.1 Human Capital theory predictions on female training incidence

HCT predicts that women receive less training than men: women often choose to avoid employment in jobs requiring further training and employers prefer not to offer these jobs to female candidates (Becker 1964; Polachek 1981). During the 1980s empirical works published about gender biased training incidence unanimously show a market discrimination against women. For example, studies about the United Kingdom report that, *ceteris paribus*, males were more likely to undergo training daytime (Greenhalgh and Stewart 1987) as well as for a higher number of days (Booth 1989); women with children were disadvantaged (Booth 1990) and male-female differences were particularly pronounced among the young and the better-educated (Booth 1991). Moving from that evidence, Green (1991) attempt was to 'estimate a measure of market discrimination in access to training analogous to conventional measures of market discrimination in pay': using data from the 1985 Labor Force Survey she confirmed that younger women were discriminated against in access to training. A good number of researches published since the 1990s still find significant gender differences in access to continuous training to the disadvantage of women in Australia, Germany, Sweden, UK and USA (e.g. Haber 1991; Altonji and Spletzer 1991; Lynch 1992; Barron et al. 1993; Schömann and Becker 1995; Arulampalam and Booth 1996; Blundell et al. 1996; Royalty 1996; Evertsson 2004; O'Halloran 2008) with some specifications and details emerging in the general picture; e.g, the incidence of training was slightly higher among women than among men, but the amount of training was higher among men (Altonji and Spletzer, 1991). Partial explanation of the persistent wage gap between males and females was assumed to rely on the

fact that women are much less likely to receive training within a firm either through an apprenticeship or other forms of OTJ training (Lynch, 1992); also, while training intensity during the first three months of employment is similar in positions filled by males and females, females are employed in positions that have a shorter duration of OTJ training (Barron et al. 1993). Workers with a lower quit probability tend to be concentrated in positions offering more training, a lower starting wage but higher in perspective; women participation in further education is more likely if they have a strong foothold in the labor market (Schömann and Becker 1995).

Therefore, the question that scholars have investigated is: do women voluntarily sort themselves into positions with less training (Polachek 1981) or would they prefer better positions, but employers simply refuse to hire them for highly trained jobs?

In his study titled “The chicken or the egg”, Gronau (1988) states that “it is not that women do not want to invest in their careers, but that they are not given adequate opportunities to do so. Employers who expect women to drop out of the labor force when they have children are reluctant to admit them to positions that involve investment. Consequently, women are confined to jobs which promise little wage promotion. Once they have children, they do not (given the nature of their job) find it worthwhile to stay in the labor force, thus confirming their employers' expectations and creating a vicious circle they cannot break”.

Evertsson (2004) proposes a two-step model for predicting gender inequality in OJT training and tests it with cross-sectional data from Sweden: results show that, first, women are less likely than men to take part in OJT and, second, once women do get the more remunerative training, they are not rewarded for their new skills to the same extent as men are. Furthermore, women are more likely than men to take part in industry-specific training, but men are more likely to participate in general training, the form that significantly raises their annual earnings; hence, she argued that this gender inequality is partly due to employers' discriminatory practices. An Australian study by Miller (1994) shows gender biased incidence depending on the training modality, with women undertaking more external training than men but disadvantaged for in-house activities; his interpretation is that the gender effect reflects both the discriminatory attitudes held by firms and the greater propensity to train among women.

2.2 The Segregation hypothesis

Evidence of the opposite trend also emerged in the 1990s from the United Kingdom and Australia: researchers in several studies measured the incidence of training for women as equal to or greater than that for men. Some research even finds women more likely to train than men in the UK (inter alia, Dearden et al. 1997; Gibbins 1994; Green and Zanchi 1997; Greenhalgh and Mavrotas 1993; Shields 1998; Jones et al. 2008), Australia (Miller 1994; Wooden and VandenHeuvel 1997) and the USA (Simpson and Stroh 2002). Arulampalam et al. (2004), using European Community Household Panel data for 1994–1999, report that women are substantially more likely to start training each year in Denmark, Finland, Italy, and Spain.

A possible explanation is the improvement in women's labor market status, especially through women moving into new types of jobs and occupations (Greenhalgh and Mavrotas 1993; Green and Zanchi 1997; Wooden and VandenHeuvel 1997). Since the 1960s and 1970s the labor-force participation rate of women (and in particular married women) has continued to increase, a change accompanied by a decline in the labor-force drop-out rate of married women with young children; nevertheless, there has been no obvious decline in the wage gap (Gronau 1988). During the 1980s and 1990s we have witnessed massive participation of women in the workforce (Jacobsen 1997; Blau, Simpson, and Anderson 1998) who happened to make up the greater share of new entrants in many occupations (Green and Zanchi 1997); women also made some progress in moving into occupations in which they were previously underrepresented. For example, within the United Kingdom and Australia, equal pay, anti-discrimination, and affirmative action policy laws have been passed and women have moved into new types of jobs and occupations since the 1970s; the labor force participation rate and average labor force tenure for women have increased since the 1980s; finally, both countries have seen an expansion of government initiatives to increase the incidence of workplace training (Miller 1994; Green and Zanchi 1997; Wooden and VandenHeuvel 1997).

The pattern of training in the UK labor market was changing at the end of the 80's with a substantial increase in the proportion of employees involved in work-related training in any four-week period (Training Statistics 1996): most of this increase was due to rises in participation for workers in all sectors of the economy, rather than to structural economic shifts between sectors (Shields 1996), but the four-week participation rate of women did indeed rise faster than that of men by 1989 (Greenhalgh and Mavrotas 1993; Gibbins 1994). Women were then over-represented in the sectors with the highest propensity to train, meaning the expanding-sector jobs, and employers may have been motivated to offer more training opportunities than previously in female occupations, especially those experiencing dynamic technological changes (Greenhalgh and Mavrotas 1993). The rapid diffusion of computer technologies into pink-collar occupations as sales, clerical, household, and service, may have also had implications for the type of training subsidized by employers; this is important because computer training tends to be more general in content than other types of training and also to occur in off-the-job settings (USA Today 1999).

Wooden and VanderHeuvel (1997) compare Australian data collected as part of the 1993 Survey of Training and Education with similar data for 1989 and highlight a marked change in the pattern of training in favour of women. Data were collected on the amount of time spent attending OTJ training and reveal that, while women do spend less time on average on such courses, and while the mean length of such attendances declined between 1989 and 1993, the extent of this decline was greater for men than for women; thus, the evidence on training hours also points to a convergence in the training experiences. The results suggest that the greater part of the gender gap derives from differences in characteristics, among the most important being occupation, industry, and sector.

Feminist researchers have examined how enduring patterns of occupational segregation or dynamic patterns of resegregation significantly influence women's labor market experiences (e.g., Reskin and Roos 1990;

Badgett and Folbre 1999) as well as have criticized the conventional human capital model for being static in its understanding of the effects of occupational segregation (Anker 1997).

The roots of segregation lie in parental and house care burden. No matter who performs it, caring labor is expensive (England and Folbre 1999): a parent who devotes time and energy to "family-specific" activities typically experiences a significant reduction in lifetime earnings (Joshi 1990 and 1998; Waldfogel 1997) and acquires a less transportable human capital than that of a partner who specializes in market work (Braunstein and Folbre 1999; Weitzman 1985). Furthermore, employees in caring occupations are typically paid less than others, even controlling for a large list of other personal and job characteristics (England et al. 1994). Women are disproportionately concentrated in these jobs: employers expect women to have discontinuous working careers because of their task specialization within the family (Gronlund and Edlund 2008) and, even if women are more educated than men, they come to be generally excluded from jobs requiring more OTJ training (Estevez-Abe 2005 and 2006; Gronlund 2011).

Simpson and Stroh (2002) have been the first researchers to empirically examine the relationship between a comparatively greater incidence of training for women and occupational segregation in the USA. They primarily argued that factors such as new technologies and modified labor demand conditions resulted in an escalation in training incidence within female-intensive occupations in the 1990s; they then estimated that occupational segregation accounted for more than one-third of the gender differences in training in 1995 and for more than 40 percent in on-the-job and employer-supported off-the-job training categories. Overall levels of training participation were higher for women than for men in 1995; further, when training is broken down by type, women also participated more than men did in the three possible categories: on-the-job training, employer-supported off-the-job training, and off-the-job training without employer support.

2.3 Labor market segmentation models

Using data from European Community Household Panel Survey 1994–2001, Mussida and Picchio (2013) confirm the occupational segregation hypothesis in Italy but they also add an important element to the analysis: men are more likely to be in full-time employment than women. This is true for employees with tertiary education, but the gender difference is especially large for low educated workers: while 57.6% of low educated men are working full-time, only 15.6% of low educated women have the same contract. Furthermore, Zizza (2013), using data from Bank of Italy's Survey on Household Income and Wealth over the period 1995-2008, estimates that nearly 40% of women work less than 36 hours, compared with less than 10% of men, and concludes that, apart from individual preferences, this gap reflects the occupational segregation in sectors, occupations and types of contracts characterized by shorter working hours.

Maestriperi and León (2019) investigate the extent to which the process of de-standardisation in labor contracts - any contract that deviates from the full time permanent dependent contract that is taken to be the standard

(Bosch, 2006) - has turned part-time work into a form of precarious employment in Italy and Spain rather than a way to ease work–family conflict.

Applying labor market segmentation models, we can then consider labor market to be dualized in two segments: temporary, atypical, and part-time workers belong to a second segment that make them to face unequal working conditions, career opportunities, and wages than standard employees of the primary segment who hold relatively secure jobs with high wages, good working conditions, and good career prospects (Anker 1997; Giesecke and Groß 2003). Workers can find it difficult to move from one segment to another, however, the opportunities and barriers to mobility vary depending on the societal context: in Southern Europe, labor market entrants, women, and immigrants are overrepresented in the secondary segment (Barbieri 2009).

In Italy, part-time employment is right at the heart of this process of differentiation between categories of workers with unequal access to social and employment rights: low educated workers are the most exposed to part-time contracts and the incidence of involuntary part-time work is much higher among women than men (Maestripieri and León 2019).

Firms' investment in workforce training depends on their expected gains which are lower for temporary workers because they usually remain employed at the same firm for a shorter period (Forrier and Sels 2003; Akgunduz and van Huizen 2015). Employers may choose to focus exclusively on strategic subgroups of employees, i.e. the permanent workers, to fund for temporary employees mainly job-related training with short-term payback (e.g. initial training).

Several single-country studies indicate that temporary employment has a negative effect on employer-provided training: for example, this has been the case in the UK (Arulampalam and Booth 1998) and the Netherlands (Oosterbeek 1996; Delsen 1998; De Feyter et al. 2001).

It is not just the employment protection legislation that has a huge impact on the chances for a worker to be trained, also the effect of trade unions and employee representatives has been much investigated by scholars. Due to the so-called “insider-outsider issue” trade unions have traditionally focused on workers with standard employment contracts — i.e., ‘full time workers in long-term work’ — who are likely to remain members of the union, and to continue to pay membership fees (Gumbrell and McCormick 2011: p.297). Thus, the impact of the employee representation in the workplace on the access to training among temporary workers may be limited. For example, using data from the 2015 European Working Conditions Survey, Adolfsson et al. (2022) find evidence that the positive impact of union coverage on employer-paid training is substantially smaller for temporary workers than for permanent workers.

2.4 Aim and Hypotheses

The purpose of this inquiry is twofold. First (i), the aim is to examine the moderating role of employees' representatives (ER) on gender biased training incidence by assessing if in presence of ER the probability of being trained for employees increases regardless of gender and employment relationship. Secondly (ii), the focus shifts on who finances the investment in training (between the employer and the employee) checking for the moderating role of ER on employers' propensity to invest for the non-standard employees specifically, given the great incidence of female part-time employment.

To formulate the following hypotheses that will be tested on section 4, the reference is the three-part theoretical framework previously exposed. Firstly (A), we move from HCT predictions about the association between gender and ER with training incidence. Secondly (B), we explore the horizontal segregation hypothesis by making use of a job classification built on the level of qualification required. Thirdly (C), we go through labor market segmentation models, stressing the intersectionality of discrimination between gender and employment status (with particular attention to part-time contracts) and, therefore, highlighting the moderating role of EPL on gender-biased training incidence. Lastly (D), the research question about the moderating role of ER is deepened, particularly with regard to the training funded by the employer.

A. HCT predictions: gender biased training incidence in Italy and the role of ER

According to HCT predictions (Becker 1964; Polachek 1981) the chance of being trained is not gender neutral. *Ceteris paribus*, women are discriminated against in access to training both in terms of daytime (Greenhalgh and Stewart 1987) and number of days (Booth 1989), either through an apprenticeship or other forms of OTJ training (Lynch, 1992). Women are disadvantaged by parenthood (Booth 1990) and are employed in positions that have a shorter duration of OTJ training (Barron et al. 1993). Male-female differences are particularly pronounced among the young (Green (1991) and the better-educated (Booth 1991).

When it comes to Italy, last data from ISTAT (2017) about gender biased training incidence show a wider discrepancy that disadvantages women: in 2015 the discrepancy was more than 5% in favour of men, by 2 percentage points wider than in 2010.

Hypothesis A.1: In Italy the probability for an employee to be trained decreases because of female gender

By assuming competitive labor markets, standard HCT predicts trade unions to distort incentives to invest in training for both the employer and the employee: growth perspectives of productivity for the former and of wages for the latter are the key determinants of agents' choices, and unionism affects them by altering the structure of the labor market and acting as a market friction (see Sweetland 1996, and Fleischhauer 2007 for reviews).

Hypothesis A.2: the probability of being trained decreases with the presence of ER

B. Female segregation in low-skilled demanding jobs

Because women are in charge of parental and house care they are very likely to have a discontinuous work career (Reskin and Roos 1990; Badgett and Folbre 1999). Even when women are more educated than men, they come to be generally excluded from jobs requiring more OTJ training and, therefore, they are generally employed in lower skilled jobs (Estévez-Abe 2005 and 2006; Gronlund 2011). Making use of the job classification from ISTAT (2013), the level of qualification required by job classes is assigned between higher-skilled and lower-skilled demanding jobs (see Table 1).

According to the gender segregation hypothesis, in the 1990s training incidence for women has become as equal to or greater than that for men: female participation in the labor market dramatically increased and women moved into new types of jobs (Greenhalgh and Mavrotas 1993; Green and Zanchi 1997; Wooden and VandenHeuvel 1997); “pink-collar occupations” experienced dynamic technological changes (Greenhalgh and Mavrotas 1993) because of the massive advent of computers, which forced employers to provide general training.

Nowadays the impact of Industry 4.0 technologies on occupations across industrial sectors follows a very different path with respect to the overturning of the 1990s. In fact, robots and digital tools form a cluster of technologies which are subject to convergence and recombinatory adoption, calling for long-life learning investments in the upskilling of the employees (Kagermann et al.2013; Sorrentino 2022). Therefore, the female occupational segregation to low-skilled demanding jobs (confirmed in Italy by Mussida and Picchio (2013)) is preventing women from continuous training.

Hypothesis B: training probabilities decrease when the employment position is in low-skilled jobs

C. Labor market segmentation models, non-standard employment contracts and the intersectionality of discrimination

According to the labor market segmentation models, workers face unequal working conditions depending on which segment they belong to (Doeringer and Piore 2020; Kalleberg and Sorensen 1979). Employers may choose either to invest in the whole workforce or to focus exclusively on strategic subgroups, i.e., the permanent workers (Forrier and Sels 2003), thus exacerbating the already existing inequalities in the labor market.

Table 1 – Level of qualification required by job classes

JOB classification from ISTAT (2013)	Qualification required
Legislators, Entrepreneurs and Senior Management	Higher skilled
Intellectual, scientific, and highly specialised professions	
Technical professions	
Executive professions in office work	Lower skilled
Professions qualified in commercial activities and services	
Craftsmen, skilled workers, and farmers	
Plant operators, stationary and mobile machinery workers and vehicle drivers	
Elementary workers	
Armed forces	

Flexibilization of the European labour market through the diffusion of non-standard employment contracts (nor permanents or full-time) originated a dualization, with increasingly differentiated services provided to different categories of workers (Emmenegger et al. 2012). On the contrary, stronger employment protection legislation (EPL) may positively impact investments in firm-specific training (Belot et al. 2007).

Hypothesis C.1: training probability decreases in presence of a non-standard employment contract

The widespread use of female part-time work marks a gender discrimination even with respect to full-time workers (Green and Zanchi 1997; Shields 1998; Evertsson 2004; Jones 2008, Maestripieri and León 2019). In 2019, in Italy women with a part-time contract accounted for one third of the female workforce while men for less than one fifth of their share of the employed population (ISTAT 2020). Given this gender-unbalanced distribution, it is useful to assess if part-time has created an additional discrimination against women in the segment of non-standard employees.

Hypothesis C.2: among the non-standard employment contracts, part-time is the one in presence of which the probability of being trained for a woman decreases more

D. The moderating role of employees' representatives on the gender gap in training incidence and the employer's investment

If markets are non-perfectly competitive, HCT predictions that unions and employee representatives are negatively associated with training incidence does not hold. On the contrary, according to Acemoglu and Pischke (1998), in this scenario institutionalized employment practices that influence wage compression are likely to operate as an equalizer in the chances of being trained between temporary and permanent workers (see also Dustmann and Schönberg 2009). Through workplace presence and bargaining activity, unions can affect the incidence and distribution of training across groups of workers (Dieckhoff et al. 2007).

Hypothesis D.1: for an employee the probability of being trained increases in presence of ER regardless of gender and employment relationship

Unionization is often associated with higher investment in training. This can be explained by the fact that unions have strong preferences toward gains in competitiveness through productivity compared to labor costs savings (Martins 2019). Nonetheless, when the training is employer provided temporary workers receive less training than permanent workers and this association can be generalized across European countries (Adolfsson et al. 2022).

Hypothesis D.2: when training is funded by the employer, the probability of being trained for an employee increases when the employment relationship is standard.

3. Data, variables of interest and control

3.1 Exploratory Analysis

To estimate the incidence of training we make use of the IV wave of INAPP Quality of Labor survey (2015), which collects 15,076 interviews to Italian employees randomly selected among different economic sectors. The reference population is composed of adults (>18 years old) employed in the Italian territory (N = 22.456.000). It is a sample survey with interviews taken in late spring/early summer of 2015 conducted on an individual basis through CATI methodology.

We drew a selected sample⁷ of 9,690 employees from the survey which is quite gender balanced (46,2% of the employees are women); on the contrary, age classes are highly unbalanced in favour of the older people, likely reflecting the unbalanced Italian market of labor (youth unemployment rate - age 15-24 - at 29,7% (ISTAT 2021) (see Table 2). Therefore, our analysis will much more draw a picture of long-life learning as opposed to early-stage training. Frequencies among age classes are quite gender neutral.

When it comes to productive sectors, 79% of workers are employed in the tertiary sector and the group is equally split by gender. Women employed in the tertiary sector account for 88% of the total number of women, while men for 72%. Women are less represented than men in the secondary sector. As it could have been supposed, female part-time incidence strongly emerges among low-skilled jobs in each productive sector, but it is overrepresented in the high-skilled jobs of the secondary sector, the class in which women are less numerous in relative terms (see Table 4).

3.2 Variables of interest

The outcome variable of this analysis (*trained*) is a dichotomous dummy variable that takes on the value 1 if the worker has been trained over the 12 months preceding the survey, and 0 otherwise. The original question of the survey from which the information is taken depicts four cases: one in case of no training and three in case of training, distinguishing if the training has been paid entirely by the worker, entirely by “others” or both. For the purpose of this inquiry, we assume “others” to be referred entirely to the employer.

The first explanatory variable has, of course, to reveal the effect of being a female employee on training incidence (*women*).

Then, there are three variables useful to check for the occupational segregation hypothesis: as mentioned above, level of skills required by jobs has been assigned to the job classes indicated by ISTAT (*high skilled jobs vs low skilled jobs*); also, the dataset provides the opportunity to check if the employee thinks to be more skilled than necessary, adequately, or insufficiently skilled for the current occupation; finally, the number of children go from 0 to 5.

To assess the moderating role of labor market institutions, variables for temporary, atypical, and part-time work are created; *employee representatives* is a binary variable that takes on the value 1 when a union, works council, or similar committee representing employees is present at the workplace; and it takes a value of zero otherwise.

⁷ A table with descriptive statistics (Cramer's V and chi-square test) can be found in the appendix (Table 7).

Tab. 2 - Frequencies among gender and age classes

AGE CLASSES	FEMALE	MALE	TOT
age 18-24	141 (3,1%) *	226 (4,2%)	367
age 25-34	798 (17,8%)	894 (17%)	1652
age 35-44	1012 (22,6%)	1027 (19,5%)	2039
age 45-65	2500 (55,9%)	3065 (58,6%)	5565
age 66-100	25 (0,6%)	42 (0,7%)	67
TOT	4476	5214	9690

Percentages are calculated on the total number of women or men respectively

Regarding the level of education, frequencies for both men and women are higher in correspondence of middle education, which counts for 45% of the sample; on average, women are better educated than men (Table 3).

Tab. 3 – Frequencies among gender and degree of education

DEGREE OF EDUCATION	FEMALE	MALE	TOT
LOW	1062 23,72%*	1681 32,24%	2743
MEDIUM	2055 45,91%	2355 45,17%	4410
HIGH	1359 30,37%	1178 22,59%	2537
TOT	4476	5214	9690

*Percentages are calculated on the total number of women or men respectively

Individual as well as workplace characteristics that may affect the probability of being trained are controlled for. We distinguish five age categories: 18-24; 25-34; 35-44; 45-65 and over 65. To control for educational attainment, a variable depicts the cases of low education (middle school), middle education (high school diploma); high education (University degree or further).

We also control for workplace characteristics: the logarithm of the number of employees is used for firm size; also, there are three classes related to the productive sectors (primary, secondary, and tertiary); finally, the geographical position of the economic activity among North Italy, Central Italy and South and the Islands.

Individual characteristics inserted in the model are the net monthly wage expressed in euro in 5 categories (less than 900; 900-1550; 1500-2500; 2500-4500; more) and the job tenure in the current economic activity expressed in years of employment (0; 1-3; 4-10; 11-21; 22-33; 34-45).

1. Results

To pursue the stated aims of this inquiry (§2.4), two regression models have been run: firstly, a logistic model to predict gender biased variations of the probability of receiving training focused on the moderating role of labor market institutions (see Table 5); secondly, a multinomial logistic regression to analyze the shifts in the likelihood of being trained due to who bears the costs of training between the employer and the employee in person (see Table 6).⁸

Model I results contradict HCT predictions: female gender and the presence of employee representatives are associated with an increase of the chances of being trained (Hypotheses A.1 and A.2 are rejected); on the other side, training incidence decreases when the employment position is in low-skilled jobs (Hypothesis B is accepted).

In Model II variables related to non-standard employment contracts are inserted: having a temporary or atypical contract is not significant, while in presence of part-time labor the likelihood of being trained declines (Hypotheses C.1 is accepted). Model III analyzes the interaction terms between female gender and employment contracts, checking for the intersectionality of discrimination: the declining in probability of training incidence carried by part-time contract is now translated to the interaction variable between part-time and female gender (Hypotheses C.2 is accepted).

Finally, in Model IV interactions with employee representatives are inserted: being they all not significant, the conclusion is that in presence of employee representatives the probability for an employee to be trained increases, regardless of gender and employment status (Hypothesis D.1 is accepted).

⁸ The coefficients reported in the tables are the odds ratios.

Tab. 4 – Productive sectors, skills-required job classification, gender, and part-time contracts

		SKILLS-REQUIRED JOB CLASSIFICATION						
		High-skilled jobs				Low-skilled jobs		TOT
P R O D U C T I V E S E C T O R	PRIMARY	26				143		169
	Female	Male	Female	Male	Female	Male		
	54	115	6	20	48	95		
	31,95%	68,05%	23,1%	76,9%	33,6%	66,4%		
		Part-time		Part-time		Part-time		
	15	17	1	2	14	15		
	28%**	14,8%	17%	10%	29%	15,8%		
	SECONDARY	369				1497		1866
	Female	Male	Female	Male	Female	Male		
	512	1354	67	302	445	1052		
	27,44%	72,56%	18,2%	81,8%	29,7%	70,3%		
		Part-time		Part-time		Part-time		
	153	60	23	6	130	54		
	30%	4,43%	34%	2%	29%	5,13%		
TERTIARY	3317				4338		7655	
Female	Male	Female	Male	Female	Male			
3910	3745	1762	1555	2148	2190			
51%	49%	53,1%	46,9%	49,5%	50,5%			
	Part-time		Part-time		Part-time			
1200	402	336	112	864	290			
31%	10,73%	19%	7,2%	40%	8%			
				Female	4476			
				Male	5214	9690		

* Percentages are calculated on the total number of workers for each productive sector.

** Percentages are calculated on the total number of women or men respectively for each productive sector.

To summarize the results of the logistic model: the probability of being trained increases for an employee who is a woman and in workplaces where ER are present; nonetheless, probability decreases for a woman employed part-time or in a low-skilled requiring job class. Therefore, we reject the segregation hypothesis and accept the segmented labor market hypothesis only partially, being temporary and atypical contracts not significant.

To assess Hypothesis D.2, we make use of a multinomial logistic regression through which comparing the existence of gender biased training incidence in both the cases the employee pays for the training, or the training is funded by the employer. Being a woman is always related to an increasing in the likelihood of being trained with respect to a man, but the likelihood is higher when she shares the investment in training. A woman with a part-time contract will be less likely to be trained in both the cases, but especially if she must invest; we can see the same variation in probability for a woman employed in a low-skilled requiring occupation, meaning the employer will not fund her training and she even hardly will do it in his/her place. Finally, the presence of the employees' representatives makes the probability of training higher when it is funded by the employer with respect to an investment by the employee. In this scenario, being an atypical worker is related to a decline in training incidence as well as for a woman with a part-time contract, but employees' representatives exert a moderating role on giving to atypical and part-time workers more opportunities of being trained. We conclude that in case of employer-paid training employees' representatives have a stronger association with an increasing incidence for temporary workers than permanent workers (Hypothesis D.2 is rejected); furthermore, looking at the odds ratios of the set of explanatory variables taken in exam, the moderating role of ER could explain the increase in probability of being trained that is related to being a woman when the training is employer provided.

Tab. 5⁹ - logit model | The moderating role of labor market institutions on the gender gap in training incidence

	Model I		Model II		Model III		Model IV	
<i>trained</i> (pseudo R ²)	0.0975		0.0981		0.1021		0.1024	
	Coef	S.E	Coef	S.E	Coef	S.E	Coef	S.E
Women (men = ref.)	1.102**	.05	1.12**	.054	1.77***	.143	1.72***	.2
Employee representatives (ER) (no presence = ref.)	1.787***	.09	1.77***	.093	1.75***	.092	1.63***	.12
Low skilled job (LSJ) (high skilled job = ref.)	.614***	.03	.615***	.033	.81***	.06	.80***	.06
Temporary (permanent = ref.)			.954214	.08	.992	.11	.97	.13
Atypical_work (permanent = ref.)			.863	.01	.92	.13	.84	.14
Part-time			.832***	.06	1,1	.12	1.00	.13
I: Women X LSJ					.563***	.05	.57***	.05
I: Women X Temporary					.9	.13	.91	.13
I: Women X Atypical					.83	.16	.85	.17
I: Women x Part-time					.7***	.09	.67***	.09
I: Female X ER							1.03	.1
I: Temporary X ER							1.04	.15
I: Atypical X ER							1.3	.3
I: Part-time X ER							1.18	.14
secondary sector (primary = ref.)	YES	YES	YES	YES	YES	YES	YES	YES
tertiary sector	YES	YES	YES	YES	YES	YES	YES	YES
n1 children (no one = ref.)	YES	YES	YES	YES	YES	YES	YES	YES
n2 children	YES	YES	YES	YES	YES	YES	YES	YES
n3 children	YES	YES	YES	YES	YES	YES	YES	YES
n4 children	YES	YES	YES	YES	YES	YES	YES	YES
n5 children	YES	YES	YES	YES	YES	YES	YES	YES
net monthly wage (nmw) < 900 (nmw > 4500 = ref)	YES	YES	YES	YES	YES	YES	YES	YES
nmw 900 – 1500	YES	YES	YES	YES	YES	YES	YES	YES
nmw 1500 – 2500	YES	YES	YES	YES	YES	YES	YES	YES
nmw 2500 – 4500	YES	YES	YES	YES	YES	YES	YES	YES
age 18-24 (> 65 = ref.)	YES	YES	YES	YES	YES	YES	YES	YES
age 25-34	YES	YES	YES	YES	YES	YES	YES	YES
age 35-44	YES	YES	YES	YES	YES	YES	YES	YES
age 45-65	YES	YES	YES	YES	YES	YES	YES	YES
low education (mid = ref)	YES	YES	YES	YES	YES	YES	YES	YES
high education	YES	YES	YES	YES	YES	YES	YES	YES
job tenure 0 y (>45 = ref.)	YES	YES	YES	YES	YES	YES	YES	YES
job tenure 1-3 y	YES	YES	YES	YES	YES	YES	YES	YES
job tenure 4-10 y	YES	YES	YES	YES	YES	YES	YES	YES
job tenure 11-21 y	YES	YES	YES	YES	YES	YES	YES	YES
job tenure 22-33 y	YES	YES	YES	YES	YES	YES	YES	YES
job tenure 34-45 y	YES	YES	YES	YES	YES	YES	YES	YES
size_firm (log)	YES	YES	YES	YES	YES	YES	YES	YES
routine_work	YES	YES	YES	YES	YES	YES	YES	YES
complex_tasks	YES	YES	YES	YES	YES	YES	YES	YES
insufficient skills (more than needed = ref.)	YES	YES	YES	YES	YES	YES	YES	YES
adequate skills	YES	YES	YES	YES	YES	YES	YES	YES

⁹ The table with coefficients and s.e. of all included variables has been inserted in the Appendix (Table 5b).

Tab. 6¹⁰ - Multinomial regression | Impact of LMI relying on who finances the investment in training

Pseudo R ² = 0.1091	Training payed by THE EMPLOYEE fully or in part		Training payed by THE EMPLOYER	
Women (men = ref.)	.95***	.20	.43***	.12
Employee representatives (ER) (no presence = ref.)	.40 **	.16	.50***	.07
Low skilled job (LSJ) (high skilled job = ref.)	-.83***	.14	-.14*	.07
Temporary (permanent = ref.)	.26	.25	-.08	.15
Atypical (permanent = ref.)	.38	.27	-.41**	.19
Part time (full-time = ref)	.84 ***	.22	-.22	.14
I: Women x LSJ	-1.03***	.19	-.42***	.99
I: Women x Temporary	-.13	.25	-.14	.16
I: Women x Atypical	-.27	.33	-.15	.22
I: Women x Part-time	-.86 ***	.24	-.27**	.14
I: Women x ER	.12	.20	.00	.10
I: Temporary x ER	.23	.25	.00	.16
I: Atypical x ER	-.37	-.37	.51**	.23
I: Part-time x ER	-.46**	.23	.33**	1.3
Secondary sector (primary = ref.)	YES	YES	YES	YES
Tertiary sector	YES	YES	YES	YES
n1 children (no one = ref.)	YES	YES	YES	YES
n2 children	YES	YES	YES	YES
n3 children	YES	YES	YES	YES
n4 children	YES	YES	YES	YES
n5 children	YES	YES	YES	YES
Net monthly wage (nmw) < 900 (nmw > 4500 = ref)	YES	YES	YES	YES
nmw 900 – 1500	YES	YES	YES	YES
nmw 1500 – 2500	YES	YES	YES	YES
nmw 2500 – 4500	YES	YES	YES	YES
age 18-24 (> 65 = ref.)	YES	YES	YES	YES
age 25-34	YES	YES	YES	YES
age 35-44	YES	YES	YES	YES
age 45-65	YES	YES	YES	YES
Low education (mid = ref)	YES	YES	YES	YES
High education	YES	YES	YES	YES
job tenure 0 y (>45 = ref.)	YES	YES	YES	YES
job tenure 1-3 y	YES	YES	YES	YES
job tenure 4-10 y	YES	YES	YES	YES
job tenure 11-21 y	YES	YES	YES	YES
job tenure 22-33 y	YES	YES	YES	YES
job tenure 34-45 y	YES	YES	YES	YES
size firm (log)	YES	YES	YES	YES
routine work	YES	YES	YES	YES
complex tasks	YES	YES	YES	YES
insufficient skills (more than needed = ref.)	YES	YES	YES	YES
adequate skills	YES	YES	YES	YES

¹⁰ The table with coefficients and s.e. of all included variables has been inserted in the Appendix (Table 6b).

1. Conclusions

The purpose of this inquiry was twofold. First (i), the aim was to examine the moderating role of employees' representatives (ER), by assessing if ER is positively associated with the chance of being trained regardless of gender and employment relationship. Secondly (ii), the focus shifted on who finances the investment in training (between the employer and the employee) checking for the moderating role of ER on employers' propensity to invest for the non-standard employees specifically.

First and foremost, through the analysis run with logistic and multinomial regression models, we conclude that women are always more likely than men to be involved in training activities and employees' representatives exert a strong positive effect on training incidence, two results that both contribute to deeply challenging standard Human Capital theory predictions.

The main question that arises from the analysis is the interpretation of the increase in the probability of being trained that is related to female gender. In fact, through the logistic regression we reject the occupational segregation hypothesis because the interaction between being a woman and employed in low-skilled jobs decreases the training incidence (contrary to the evidences of the 1990s as reviewed in §2.2).

Looking at the multinomial regression results, it seems reasonable to interpret the employees' representatives exerting a moderating role capable of explaining the increasing probabilities for a woman to be trained, stronger in case of employer-funded training.

Even though previous analyses have shown employees' representatives perpetuate the insider-outsider scheme, by favouring standard employees also in accessing employer provided training, our results show a moderating positive relation with workers employed through atypical or part-time contracts, taking permanent and full-time contract respectively as reference.

Conclusively, female gender and employees' representatives are associated with an increasing training incidence, and so does the interaction between ER and non-standard contract types except for the case of a woman employed part-time. Hence, our conclusion is that the increasing probability to be trained for women with respect to men is driven by the employees' representatives, which are associated with more training incidence for all the workers but stronger for women, atypical and part-time employees, acting as an equalizing factor for the intersectionality of discrimination.

Some policy recommendations can be derived from this analysis. Negative effects of segmented labor markets are confirmed, stressing the necessity of guaranteeing equal opportunities for all the employees: if the employers want to extract most value from the technological revolution, they need a well, homogeneously, and continuously trained workforce. Furthermore, the diffusion of part-time contracts among women, often involuntary, could easily represent a new discrimination gender-related segment of the labor market, while at the opposite policy intervention tackling gender inequalities are more and more frequent, especially among the European countries.

Further research would be useful to investigate in depth our results. Firstly, we are lacking a comprehensive review of the empirical evidence of the economics of training in the Italian context, which would be an

important asset to study a labor market that has been so dramatically impacted by flexibilization processes, as well as is marked by deeply gender discrimination relating to various aspects of the career path. Secondly, INAPP data were collected in the first half of 2015, therefore not able to register the effect of the *Jobs Act* law approved at the end of 2014, which reduced employment protection for workers in larger firms while leaving small firms essentially untouched. An inquiry about labor market institutions and the incidence of training in Italy cannot prescind from this temporal comparison.

APPENDIX

Table 7: Measures of association

obs: 9690	Correlation with <i>trained</i> Cramer's V	Test chi ²
Women (men = ref.)	0.0134	Pearson chi2(1) = 1.7448 Pr = 0.187
Employee representatives (ER) (no presence = ref.)	0.2088	Pearson chi2(1) = 422.4679 Pr = 0.000
Low skilled job (LSJ) (high skilled job = ref.)	-0.2379	Pearson chi2(1) = 548.5259 Pr = 0.000
Temporary (permanent = ref.)	-0.0589	Pearson chi2(1) = 33.6428 Pr = 0.000
Atypical_work (permanent = ref.)	-0.0755	Pearson chi2(1) = 55.2630 Pr = 0.000
Part-time	-0.1234	Pearson chi2(1) = 147.5467 Pr = 0.000
I: Women X LSJ	-0.1515	Pearson chi2(1) = 222.2839 Pr = 0.000
I: Women X Temporary	-0.0398	Pearson chi2(1) = 15.3289 Pr = 0.000
I: Women X Atypical	-0.0614	Pearson chi2(1) = 36.4740 Pr = 0.000
I: Women X Part-time	-0.1120	Pearson chi2(1) = 121.4950 Pr = 0.000
I: Women X ER	0.1361	Pearson chi2(1) = 179.4742 Pr = 0.000
I: Temporary X ER	0.0096	Pearson chi2(1) = 0.9009 Pr = 0.343
I: Atypical X ER	0.0033	Pearson chi2(1) = 0.1075 Pr = 0.743
I: Part-time X ER	0.0010	Pearson chi2(1) = 0.0093 Pr = 0.923
secondary sector (primary = ref.)	-0.1409	Pearson chi2(1) = 192.2554 Pr = 0.000
tertiary sector	0.1499	Pearson chi2(1) = 217.6713 Pr = 0.000
n1 children (no one = ref.)	0.0107	Pearson chi2(1) = 1.1007 Pr = 0.294
n2 children	0.0423	Pearson chi2(1) = 17.3415 Pr = 0.000
n3 children	0.0204	Pearson chi2(1) = 4.0328 Pr = 0.045
n4 children	-0.0063	Pearson chi2(1) = 0.3805 Pr = 0.537
n5 children	-0.0055	Pearson chi2(1) = 0.2914 Pr = 0.589
net monthly wage (nmw) < 900 (nmw > 4500 = ref)	-0.1578	Pearson chi2(1) = 241.3007 Pr = 0.000
nmw 900 – 1500	-0.0486	Pearson chi2(1) = 22.8440 Pr = 0.000
nmw 1500 – 2500	0.1283	Pearson chi2(1) = 159.5692 Pr = 0.000
nmw 2500 – 4500	0.0921	Pearson chi2(1) = 82.1875 Pr = 0.000
age 18-24 (> 65 = ref.)	-0.0398	Pearson chi2(1) = 15.3847 Pr = 0.000
age 25-34	-0.0499	Pearson chi2(1) = 24.1225 Pr = 0.000
age 35-44	0.0045	Pearson chi2(1) = 0.1957 Pr = 0.658
age 45-65	0.0542	Pearson chi2(1) = 28.4620 Pr = 0.000
low education (mid = ref)	-0.1863	Pearson chi2(1) = 336.3398 Pr = 0.000
high education	0.1812	Pearson chi2(1) = 318.0260 Pr = 0.000
job tenure 0 y (>45 = ref.)	-0.0952	Pearson chi2(1) = 87.7883 Pr = 0.000
job tenure 1-3 y	-0.0388	Pearson chi2(1) = 14.5979 Pr = 0.000
job tenure 4-10 y	-0.0151	Pearson chi2(1) = 2.1995 Pr = 0.138
job tenure 11-21 y	0.0059	Pearson chi2(1) = 0.3404 Pr = 0.560
job tenure 22-33 y	0.0896	Pearson chi2(1) = 77.7465 Pr = 0.000
job tenure 34-45 y	0.0121	Pearson chi2(1) = 1.4200 Pr = 0.233
routine_work	-0.1189	Pearson chi2(1) = 137.1032 Pr = 0.000
complex_tasks	0.1535	Pearson chi2(1) = 228.3850 Pr = 0.000
insufficient skills (more than needed = ref.)	-0.0350	Pearson chi2(1) = 11.8709 Pr = 0.001
adequate skills	0.0543	Pearson chi2(1) = 28.5421 Pr = 0.000

Tab. 5b (complete) - logit model

	Model I		Model II		Model III		Model IV	
<i>trained</i> (pseudo R ²)	0.0975		0.0981		0.1021		0.1024	
	Coef	S.E	Coef	S.E	Coef	S.E	Coef	S.E
Women (men = ref.)	1.102**	.05	1.12**	.054	1.77***	.143	1.72***	.2
Employee representatives (ER) (no presence = ref.)	1.787***	.09	1.77***	.093	1.75***	.092	1.63***	.12
Low skilled job (LSJ) (high skilled job = ref.)	.614***	.03	.615***	.033	.81***	.06	.80***	.06
Temporary (permanent = ref.)			.954214	.08	.992	.11	.97	.13
Atypical_work (permanent = ref.)			.863	.01	.92	.13	.84	.14
Part-time			.832***	.06	1.1	.12	1.00	.13
I: Women X LSJ					.563***	.05	.57***	.05
I: Women X Temporary					.9	.13	.91	.13
I: Women X Atypical					.83	.16	.85	.17
I: Women x Part-time					.7***	.09	.67***	.09
I: Female X ER							1.03	.1
I: Temporary X ER							1.04	.15
I: Atypical X ER							1.3	.3
I: Part-time X ER							1.18	.14
secondary sector (primary = ref.)	.70**	.12	.71**	.12	.72*	.13	.73*	.13
tertiary sector	1.26	.21	1.27	.22	1.29	.22	1.3	.22
n1 children (no one = ref.)	1.09	.06	1.09	.06	1.11*	.07	1.11*	.07
n2 children	1.13**	.06	1.14**	0.66	1.16**	.07	1.15**	.07
n3 children	1.07	.11	1.08	.17	1.08	.11	1.08	.11
n4 children	.78	.20	.80	0.21	1.08	.11	.81	.21
n5 children	.76	.43	.77	.44	.81	.21	.76	.43
net monthly wage (nmw) < 900 (nmw > 4500 = ref)	.36***	.11	.42***	.13	.37***	.12	.38***	.12
nmw 900 – 1500	.55**	.17	.56*	.17	.48**	.15	.48	.15
nmw 1500 – 2500	.68	.21	.68	.21	.60**	.18	.61*	.18
nmw 2500 – 4500	.90	.29	.90	.28	.87	.28	.87	.28
age 18-24 (> 65 = ref.)	3.53***	1.11	3.56***	1.12	3.45***	1.08	3.43***	1.08
age 25-34	2.64***	.77	2.61***	.78	2.58***	.76	2.57***	.76
age 35-44	2.55***	.74	2.52***	.73	2.49***	.73	2.48***	.72
age 45-65	2.41***	.69	2.38***	.68	2.36***	.68	2.36***	.68
low education (mid = ref)	.78***	.04	.78***	.04	.76***	.04	.77***	.04
high education	1.21***	.07	1.21***	0.07	1.19***	.07	1.19***	.07
job tenure 0 y (>45 = ref.)	.88	.67	.92	.70	.85	.65	.86	.65
job tenure 1-3 y	1.25	.94	1.30	.97	1.21	.92	1.23	.93
job tenure 4-10 y	1.32	.99	1.34	1.00	1.24	.94	1.26	.95
job tenure 11-21 y	1.29	.96	1.30	.97	1.21	.92	1.22	.92
job tenure 22-33 y	1.47	1.1	1.48	1.11	1.37	1.04	1.39	1.05
job tenure 34-45 y	1.16	.87	1.17	.88	1.09	.83	1.11	.84
size_firm (log)	1.01	.01	1.00	.14	1.00	.014	1.01	.01
routine_work	.87**	.05	.87	.05**	.88	.05	.88**	.05
complex_tasks	1.42***	.07	1.41***	.07	1.41***	.07	1.41***	.13
insufficient skills (more than needed = ref.)	.86	.13	.85	.13	.85	.13	.85	.13
adequate skills	1.22***	.07	1.22***	.07	1.23***	.07	1.23***	.07

Tab. 6b (complete) - multinomial regression

Pseudo R ² = 0.1091	Training payed by THE EMPLOYEE fully or in part		Training payed by THE EMPLOYER	
Women (men = ref.)	.95***	.20	.43***	.12
Employee representatives (ER) (no presence = ref.)	.40 **	.16	.50***	.07
Low skilled job (LSJ) (high skilled job = ref.)	-.83***	.14	-.14*	.07
Temporary (permanent = ref.)	.26	.25	-.08	.15
Atypical (permanent = ref.)	.38	.27	-.41**	.19
Part time (full-time = ref)	.84 ***	.22	-.22	.14
I: Women x LSJ	-1.03***	.19	-.42***	.99
I: Women x Temporary	-.13	.25	-.14	.16
I: Women x Atypical	-.27	.33	-.15	.22
I: Women x Part-time	-.86 ***	.24	-.27**	.14
I: Women x ER	.12	.20	.00	.10
I: Temporary x ER	.23	.25	.00	.16
I: Atypical x ER	-.37	-.37	.51**	.23
I: Part-time x ER	-.46**	.23	.33**	1.3
Secondary sector (primary = ref.)	-1.09***	.38	-.26	.18
Tertiary sector	.06	.35	.27	.18
n1 children (no one = ref.)	.08	.12	.11*	.06
n2 children	1.13	1.09	.15**	.06
n3 children	.33**	1.68	.04	.10
n4 children	-.64	.56	-.16	.26
n5 children	.03	1.12	-.31	.58
Net monthly wage (nmw) < 900 (nmw > 4500 = ref)	-.58	.50	-1.06***	.32
nmw 900 – 1500	-.59	.48	-.78**	.31
nmw 1500 – 2500	-.27	.48	-.56*	.31
nmw 2500 – 4500	.20	.50	-.20	.32
age 18-24 (> 65 = ref.)	1.79***	.60	1.15***	.33
age 25-34	1.10*	.57	.92***	.31
age 35-44	1.08*	.57	.89***	.30
age 45-65	.97*	.56	.85***	.30
Low education (mid = ref)	-.29**	.14	-.28***	-.06
High education	.71***	.10	.05	.06
job tenure 0 y (>45 = ref.)	-.83	1.02	.22	.91
job tenure 1-3 y	-.71	1.02	.64	.90
job tenure 4-10 y	-.85	1.01	.70	.90
job tenure 11-21 y	-.92	1.01	.66	.90
job tenure 22-33 y	-.72	1.01	.78	.90
job tenure 34-45 y	-.98	1.01	.56	.90
size_firm (log)	-.02	.03	-.01	.01
routine_work	-.31***	.09	-.10	.05
complex_tasks	.58***	.11	.31***	.05
insufficient skills (more than needed = ref.)	-.11	.32	-.16	.16
adequate skills	-.02	.10	.24***	.06

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CHAPTER 3

Union involvement into digital organization of labor: how the adoption of an ERP software impacts employees training activities, organizational change and industrial relations.¹¹

Abstract

For firms facing investments in digitalization the impact can be often lower than its potential. In fact, firms' decision of adopting digital technologies may happen to be mostly exogenously driven, reflecting the fact that employers don't look at them as means to transform labor organization, hierarchical structure as well as production processes. When this strategic orientation emerges, it can be the case that also trade unions and employee representatives do not interpret digital tools as matters of their core interest, even in those industrial relations systems where labor organization is subject of negotiation. This seems to be the case of a digitalization tool common to firms of every type all around the world, namely the Enterprise Resource Planning (ERP) systems. To explore the degree of opening of the space of negotiation related to the ERP and to investigate the reason why workers seem to not take advantage of it, a qualitative analysis has been conducted with interviews to a sample of IT managers and metalworkers' unions in the Emilia-Romagna region. By focusing on the role of trade unions and employees' representatives, this study offers an original contribution to the literature about critical success factors in Information Systems (IS) implementation as well as to the field of industrial relations in the framework of digitalization, proposing a reflection centred on the interpretation of ERP from both the parties that can be potentially transferable to different contexts.

1. Introduction

Innovation is “the intentional introduction and application within an organisation of ideas, processes, products or procedures, new to the unit of adoption, designed to significantly benefit the organisation or wider society”, West and Farr (1990:9) say.

According to Dosi and Nelson (2010), the ultimate focus of analysis must be on the interaction between technological adoption and human involvement in the production process procedures and admissible acts,

¹¹ I thank Emanuela Corradini and Matteo Vicini from Sygest Srl and Professor Renato Gaeta from University of Parma not only for having provided me with the contacts of IT managers willing to be interviewed, but also for having guided me in understanding the management and consultancy point of view on the adoption process of an ERP, helping me in the construction of the questionnaire surveys. I thank, therefore, all the people I had the chance to interview from ACMI S.p.A.; Bardiani Valvole; Clivet S.p.A.; Duna Corradini S.p.A.; Emmegi S.p.A.; Gea Procomac S.p.A.; Rodolfi Mansueto S.p.A.; Schlegel Giesse S.p.A.; and Sitbrush S.p.A.. Finally, I thank Massimo Mazzeo (Secretary of FIM-CISL Bologna) and Michele Bulgarelli (Secretary of FIOM-CGIL Bologna) for having shared the point of view of the metalworkers' unions on this study.

required to build an *artefact*, a recipe which embodies a degree of codified knowledge and non-codified or tacit knowledge: the production of artefacts also implies a process of coordination between members of the organisation (Cirillo et al. 2021). This characterisation of technology links the design, adoption (integration), and use phases within the organisational process (Masino 2011), avoiding the risks of “reification” (i.e. the vision of technology as a datum and not as a choice) and the temptation to alienate technology from the organisational process, or to consider it a mere background element. However, organisational change is clearly bounded by what is actually feasible in terms of the production process itself (Marengo and Scazzieri 2014). Therefore, innovation in a firm context requires involvement and participation of employees to make employer investment successful and fully exploited. For example, the existence of formal and agreed communication channels that enable workers to speak up is one mechanism for employee-inspired innovation (Burriss 2012): ‘the more an individual feels they are listened to and taken seriously, the more effort they put into having their suggestions implemented’ (Clegg et al. 2002: 419). Furthermore, the presence of effective trade unions at the workplace can lead employees to believe that their views will be taken into consideration and employees are more likely to participate in employee involvement initiatives when they believe their union will protect their employment security (Levine 1990).

Hence it appears relevant to assess whether firms have succeeded in developing the ability of linking the adoption and implementation of technology with innovative organizational practices fueled by well-used internal communication channels and best practices in employee formal and non-formal participation. Given this purpose, *Enterprise Resource Planning* (ERP) systems are a promising case study: being likely one of the most important evolutions of business IS in the second half of XX century (Davenport 1998), they are nowadays widespread and are characterized by a continuous development (Kraemmerand et al., 2003). Nonetheless, nowadays ERP softwares are adopted by firms of all sizes - while in the past they were generally thought to be applicable only to large firms (Esteves 2009) - and represent a digital tool potentially used by all the business functions, testing firms’ ability to engage the whole workforce in the innovation path.

ERP softwares are Information Systems for business designed to integrate real-time information flows within organizations in order to control business processes by improving efficiency and effectiveness and reducing transaction costs (Davenport, 1998), boosting supply chain performances (Koh et al. 2006) and reducing the production cycle times. ERP systems are software packages composed of several modules equivalent to the business functions, providing cross-organization integration of data through embedded business processes; the packages can be customized to cater for the specific needs of an organization (Parr and Shanks 2000).

The advantages derived for firms by using ERP softwares are only partially related to the technology itself; to the same or greater extent ERP adoption must be associated to an organizational change: new business processes and work procedures; the alignment of the organizational structure; the centralisation of operational and administrative tasks; the standardization of company processes. These all are factors which should lead firms to organizational improvements supported by technology (Hedman and Borell 2003).

Moreover, the adoption of ERP software is the most challenging and the most expensive IT investment the firms can make with the major impact on a great number of employers and business processes (Chang et al.

2008). The implementation of ERP systems causes greater change with broader impacts on employees, fundamentally changing the nature of tasks, workflows, and, by extension, the jobs themselves (Morris et al. 2010).

However, despite the growing number of studies that focus on user experience in all the sociological dimensions of the relationship with the ERP systems, it seems that research has not been investigated yet the potential role of unions and employee representatives to mediate between the interest of the management and the resistance of the users regardless of the industrial relations context. Therefore, to explore the potential space of negotiation related to the ERP and to investigate the reason why workers seem to not take advantage of it, a qualitative analysis has been conducted with interviews to a sample of IT managers and metalworkers' unions in the Emilia-Romagna region.

This essay is structured as follows. In Section 2, a conceptual framework about sociological and organizational aspects of ERP implementation is depicted to describe the key-role of end-users participation and to enhance the research gap about the role of unions in the process; in light of the literature review and the previous knowledge about trade unions and industrial relations, three crucial issues representative of different degrees of opening of the space of negotiation emerge as fundamental to be investigated. In Section 3, the methodology of the qualitative analysis is exposed, together with the results of the interviews conducted with IT managers and unions' representatives. Finally, in Section 4, conclusions are offered about the value of this study in a local and comparative perspective.

2. Conceptual framework

2.1 State of the art about implementation of ERP project studies and research gap

Scholarly literature on ERP softwares within the IS field of study emerged at the end of the 1990s. In the first review on the topic by Esteves and Pastor (2001) the authors classify ERP studies through a lifecycle-based framework structured in phases, following their proper articulation previously proposed (Esteves and Pastor 1999): adoption decision; acquisition; implementation; use and maintenance; evolution; and retirement phase. They noticed that most of the research was focused on the implementation phase: in fact, numerous big companies were in the implementation phase with their ERP and were preparing to move to post-implementation phases at the beginning of the new millennium (Botta-Genoulaz et al. 2005); therefore, the research interest about ERP shifted from technological to sociological aspects (variables describing the human experience related to ERP) in the early 2000s, given the achieved awareness that implementation does not end with the adoption of the technology but requires a long path of system optimization. In those years, definition of successful ERP project was at the discussion: "IT actors generally talk about success when the project respects budgets, delays and/or when the new information system "works"; but success is achieved when the

organization is able to better perform all its business processes and when the integrated information system can support the performance development of the company.” (ibidem).

ERP usefulness emerged as one of the research directions to explore optimization processes: many information strategies fail by ignoring that IT cannot by itself influence the productivity of a company, because the main efficiency factor lies in the way people use these technologies. Unfortunately, many chief executives seem to view ERP as simply a software system and the implementation of ERP as primarily a technological challenge, neglecting that ERP may fundamentally change the way in which the organizations operate (Woo 2007). “The ultimate goal should be to improve the business – not to implement software” (Umble et al. 2003) and the implementation should be business driven and directed by business requirements and not the IT department (Chew et al. 1991; Minahan 1998).

Denial, resistance and chaos will be predictable consequences of the changes created by the ERP implementation, if employees are not properly prepared for the imminent changes. To embrace the opportunities provided by the new system, the company should be flexible enough to take full advantage of all the available information, making more improvements attainable than at first seemed possible (Sherrard 1998). Nonetheless, other literature reviews about ERP (Dery et al. 2006; Moon 2007) conclude that researchers still focus mostly on the implementation phase and little attention is put on the impact of digitalization on the nature of work and organizations. Also, studies adopting the employee perspective tend to be output focused: for example, users’ satisfaction is often analyzed through the technology-acceptance model by Davis et al. (1989), whose major focus is the perceived usefulness and ease of use rather than job content, quality and satisfaction (Venkatesh et al. 2007). The importance of those dimensions of end-user experience relies, for example, on the fact that during the implementation phase employees' motivation and satisfaction are negatively impacted by reorganization and increase in tasks: many look at the redesign of the business processes as increasing difficulties and, consequently, stress (Jones et al. 2011), whereas others state they feel less reward because of the standardization of processes and loss of decision-making autonomy.

Poor attention is also put into possible benefits of good communication in the post-implementation phase to understand the need of further support and training. Saatçioğlu (2009) has investigated the relationship between user-satisfaction and their expectations: resistance to change derives mostly from the lack of clear understanding of perceived benefits with respect to the new system, as well as from inadequate training. Therefore, it’s necessary to open communication channels through which employees can express their expectations and can receive explanations adequate to their questions.

2.2 End Users: resistance, involvement, training

After the implementation of an ERP software, there will be many social and technological system changes that might generate one of the biggest challenges in large-scale information systems implementations: end users' reluctance to interact with a new system (Haddara et al. 2017). Kim and Kankanhalli (2009: p. 568) define

user resistance as “opposition of a user to change associated with a new IS implementation”; similarly, for Klaus and Blanton (2010: p. 627) it is “the behavioural expression of a user’s opposition to a system implementation during the implementation”. It is crucial for organizations to understand the reasons why users resist ERP, in order to plan for strategies and communication activities to reduce or overcome resistance (Aller et al. 2001; Klaus et al. 2010).

Jiang et al. (2000) suggest three theoretical perspectives for user resistance: people-oriented; system-oriented; and, interaction-oriented. According to the people-oriented approach, internal factors to individuals or groups - e.g. age, gender, background, traits, values and attitude toward the new system - can cause users to resist a technology. The system-oriented approach suggests that resistance emerges because of external factors in the system, such as performance, user-interface, ease of use, reliability and realization of requirements. Finally, the interaction-oriented approach attributes user resistance to the interaction between individuals and the system, change in social structure, power relationships and/or job structure.

User involvement - both in the stage of definition of the organization’s ERP system needs and in the implementation phase (Zhang et al. 2002) - is the critical success factor in ERP implementation projects that happens to increase user satisfaction and acceptance (Katzell and Thompson 1990; Harter et al. 2002; Xia, Zhang, and Zhao 2016) by developing realistic expectations about system capabilities (Al-Fawaz et al. 2008). User resistance is also understandable because ERP implementations frequently involve some form of job redesign to better align processes with system functionality and affects the facets of an employee’s job content (Huang et al. 2004); for example, tasks that were independently performed before ERP implementation then become interdependent (Gattiker and Goodhue 2005). Work redesign is best achieved when interpersonal relationships and decision-making processes are managed, inclusive, and transparent (Hackman and Oldham 1980).

Realizing ERP benefits requires a huge investment in training (Wortmann 1998) on the software itself, how to use it and how its implementation will change the nature of work in terms of new tasks and new collaborative relationships. Training users is important because ERP is not easy to use even for highly educated managers with good IT skills (Vosburg and Kumar 2001; Woo 2007). The full benefits of ERP cannot be realized until end users are using the new system properly: a critical mass of knowledge to solve problems within the framework of the system is required to avoid the risk that employees will invent their own processes using those parts of the system they are able to manipulate (Hutchins 1998).

End user training should start preferably well before the implementation begins and continue also during the post-implementation phases: periodic meetings can help identify problems with the system and encourage the exchange of information gained through experience (Krupp 1998).

2.3 Organizational change

ERP systems are software packages composed of several modules equivalent to the business functions and modeled on a structured chain of command that links one user to another, inside and among the functions; one cannot proceed if the previous link has not done everything he must do. Therefore, in most companies where the organizational structure is not particularly rigid (or for example in the small firms) the existing organizational structure and processes before the adoption of ERP systems are not compatible with its structure, tools, and types of information (Umble et al. 2003). Even the most flexible ERP system imposes its own logic on a company's strategy, organization, and culture: redesigned processes require corresponding realignment in organizational control that typically impacts most functional areas and many social systems within the organization (Minahan 1998; Holland et al. 1999). Some firms also started to engage in process redesign to implement new structures, becoming more “matrixed”, so that new process teams or process executives were added to the firm's formal structures (Ross et al. 1998).

2.4 Critical issues about union's involvement in ERP implementation

A research gap about unions' involvement as a critical success factor of ERP implementation emerges from the literature.

Therefore, in light of the above mentioned review (§2.1-2.3) and of the knowledge about trade unions in industrial relations context, it is possible to outline three critical issues that needed to be explored in order to analyze the apparent lack of involvement of unions and employees' representatives in decisions related to ERP technology.

The key-discriminatory factor is the different degree of opening of the space of negotiation related to the ERP: it is fundamental to frame the extent to which the apparent disinterest to IS matter is up to unions' strategic orientation or due to the absence of rights or skills for negotiation.

In fact, it could be the case that (i) decisions on ERP do not fall within information and consultation rights, which means that the negotiation space is zero; or it is possible that (ii) unions and ER would like to be involved but they suffer a lack of competences on digital technologies and IS, thus indicating negotiation to be compressed in a narrower space compared to the actual possibilities; eventually, (iii) with a degree of opening maximum, unions have rights and skills to exert a role in the digital organization of labor but decide for a conflict strategy focused on salary negotiation.

3. The inquiry

In this section the methodology followed for the qualitative analysis together with an appraisal of the limits and values of the study design are presented. Before confronting the unions' representatives, I decided to firstly interview IT managers because they oversee everything concerning ERP systems and could have helped me to better frame in which moments of ERP life-cycle unions could have space of negotiation; in this way, I had the chance to refine the unions' interview track. Hence, results from the interviews to IT managers are exposed (§3.2); on that basis, the value of the critical issues about unions' involvement (§2.4) has been confirmed; therefore, those issues have been discussed with representatives of two metalworkers' unions (§3.3).¹²

3.1 Methodology

We use a qualitative, explorative case study design (Yin 2009) to investigate the space of negotiation between firms' Board and the unions following an ERP implementation. Nine in-depth interviews - of an average duration of one and a half hours - have been conducted with IT managers, among whom at least two of them also perform management control functions (Table 1).

The questionnaire prepared for the survey consisted of three main sections: company and workers' profile; ERP implementation; and, organization, job content and training. Two different questionnaires were administered on the basis of ERP life-cycle phase (upgrading vs post-implementation) with the aim of drawing as much as possible a detailed picture about five dimensions of ERP use: adoption decision; purpose of the adoption; communication towards employees; employees' participation into the implementation process; and, finally, training activities.

The sample is composed of nine companies whose names have been suggested by Sygest Srl, an IT consulting firm operating mostly in Parma province, as well as by Faculty members of the Economic Department of University of Parma on the basis of the likelihood that IT managers would have accepted to be interviewed.

¹² Since the drafting moment of the research design, the intention was to collect interviews from all the three parts involved in the digital organization of labor: management, unions and workers.

Unfortunately, due to a generalised resistance from HR departments, I succeeded in collecting just a few replies to the questionnaire - only closed-ended questions - I shared with the firms which provided me with a sample numerically insufficient to be representative for the whole population of the firms' employees. Therefore, I decided to not include those pieces of evidence in this paper.

Table 1 - Companies Surveyed and details of their role, sector of the company and ERP status

	LOCATION	MULTI-NATIONAL	BUSINESS SECTOR	PRODUCTION	ERP status
ENG-1	PARMA	YES	ENGINEERING	Machines and equipment for bottling	UPGRADE
ENG-2	PARMA	YES	ENGINEERING	Valves for food, chemical and pharmaceutical industries	POST-IMPL
ENG-3	PARMA	YES	ENGINEERING	Machines and equipment for bottling	POST-IMPL
ENG-4	MODENA	YES	ENGINEERING	Machines for processing aluminium and PVC	POST-IMPL
ENG-5	BELLUNO	YES	ENGINEERING	Heat pump systems for air conditioning	POST-IMPL
ENG-6	BOLOGNA	NO	ENGINEERING	Industrial brushes	POST-IMPL
ENG-7	BRESCIA	YES	ENGINEERING	Engineered components for windows and doors	POST-IMPL
CHEM-1	MODENA	YES	CHEMICAL	Polyurethane foam in blocks, slabs, special pieces, liquid systems	PRE-UPGRADE
FOOD-1	PARMA	NO	FOOD	Tomato processing	POST-IMPL

The companies' sample is quite heterogeneous in the firms' number of employees (between 100 and 627) as well as in the composition of the workforce by gender and age; frequencies of employees by education degree are more homogenous towards the upper classes (with a common prevalence of high school diploma). Above all, among the nine companies of the survey, seven operate in the manufacturing sector, one in the chemical sector and one in the food industry. Also, seven of them are using ERP software in a major post-implementation upgrade life-cycle phase, while two others are in the earlier stage of upgrading very old versions. Notably, the number of firm functions that are using ERP software are increasing, also including Production (even if not used by all the workers but often just by the heads of department) and towards the direction of a fully integrated company (Table 2).

Interviews with IT managers revealed the importance of the critical issues (§2.4) formulated in light of the literature review, which served as a compass in formulating the questionnaires for the unions' representatives, in particular the secretaries in Bologna of the metalworkers' category of two of the three main Italian unions: FIOM-CGIL (Italian General Confederation of Labor) and FIM-CISL (Italian Confederation of Workers' Trade Unions). Some literature reports that after the 1970s unions have lost bargaining power on new technologies adoption and implementation and all the labor organization matters that have become, and still are, under the control of management (Bamber and Lansbury 1989; Davis 1986); Bologna represents an exception to this general framework, because mostly the metalworkers' union categories have been able to get and maintain space for their claims (Cetrulo et al. 2022). Therefore, although the surveyed companies are not located in the province of Bologna, the opinion of Bologna unions on employees' representatives' involvement in digital organization of labor can be even more relevant for the purpose of this study, to assess if there are positive experiences of negotiation also about ERP technology.

3.2 Management point of view

Most of the cases, adoption/major upgrade decision is taken unilaterally by the Board, balancing the expensive nature of the investment and the need to equip the company with ERP software, a need that happens to be exogenous, driven by requirement of regulatory nature (Administration and finance function activities): "The law often changes and we must adapt; about every six months a new release of the system is launched by the software companies and a system update is required. The last innovation that has invested all the firms was the electronic invoicing"¹³ says an IT manager. Moreover, for a multinational company it is fundamental to integrate the information flows generated by all the productive plants in one single monitoring tool. Typically, the adoption decision doesn't involve workers, who happen to be "formally" informed after a long period in which the Board has made IT function get going on the ERP dossier and, maybe, has already signed the contract with the software providers: "As IT team we worked a year and a half on the ERP project reviewing the launch version numerous times with the consultancy firm, and no one knew in the firm except from us"¹⁴. Employee participation is planned only at an advanced stage of the implementation process: the "process owner" (often the Head of IT) of the entire project identifies key-figures (key-user) for each involved function who are in charge of mapping business processes; then, key-users are demanded to interface only with employees of their own function. During the test-period (before the official go-live of the software) training activities offered to employees are short, focused and targeted to system changes. Structured training activities are often offered to key-user figures who are required to then train their function colleagues. IT function offers

¹³ translation by the researcher, this is the original version: "Cambia la legge e noi ci dobbiamo adeguare: circa ogni sei mesi viene rilasciato una nuova release dalla casa madre ed è necesssario un aggiornamento del sistema. L'ultima innovazione che ha investito tutte le imprese è stata la fatturazione elettronica".

¹⁴ translation by the researcher, this is the original version: "Ci abbiamo lavorato per un anno e mezzo come team IT facendo diverse prove del progetto con i consulenti e nessuno sapeva niente in azienda".

user-friendly manuals and is always approachable by an online ticketing system: “We organised a five day training program together with the consultancy firm. Afterwards, as IT team we opened the ticketing system: our colleagues from the business functions where ERP was restructured are aware that when they need assistance, they have just to send us an email and we will take care of them”¹⁵.

Interviews about the post-implementation phase reveal that adoption decisions about the software updates are suggested to the Board by the IT function, on the basis of exogenous needs related to normative requirements but also to new releases issued by the manufacturer. Communication of the updates is not structured. Impact of a new release could involve just a few business functions, always with a top-down approach through function managers: nonetheless, a certain importance is recognized to one-to-one dialogue as well as to horizontal discussion, but they are not structured in the process mostly because they are considered to be time-consuming: “You have to listen to them, talk with every single employee who must work with the ERP system, understand his/her needs, what he/she does in the daily work-life if you want to set up a good program. But listen to the employees all together .., I mean, democracy is not always the best tool if you have deadlines”¹⁶. None structured training activities are provided but assistance is offered through a daily-accessible system of ticketing. IT managers, indeed, do believe that it would be useful to formalize on a rolling-basis training and discussion sessions about the relationship that users have with ERP systems, but they don’t think they will organize such activities because of the general workload of IT function: “Yes, it would be really useful... but we are just three people in the team, we can’t afford to be in charge of other activities. If they need us, they have the manual we have worked on and the ticketing system”¹⁷.

There is a general agreement among the IT managers that the adoption or main upgrades of an ERP software can potentially have a strong impact on enterprise hierarchical structure, but it is generally not run with this goal; it depends on the willingness of the Board to approach digitalization investment in a more conservative or innovative way. Among the interviews do not emerge any case of profound innovation: “ERP adoption might have a significant impact on the firm internal organization, but only if the investment is faced with this intention since the very beginning. On the contrary, the Board takes its decisions on the basis of legal obligations and of the cost of the work of the consulting firm”¹⁸.

¹⁵ translation by the researcher, this is the original version: “Abbiamo organizzato un training di cinque giorni con i consulenti in sede al termine del quale abbiamo aperto il sistema di ticketing. I colleghi delle funzioni investite dalla ristrutturazione del gestionale sanno che se hanno bisogno di assistenza basta che ci mandino una mail e interveniamo”.

¹⁶ translation by the researcher, this is the original version: “Li devi ascoltare tutti, parlare con ognuno di loro singolarmente di quelli che lavorano col gestionale, devi capire di cosa hanno bisogno, cosa fanno ogni giorno per svolgere le loro mansioni se vuoi che il gestionale aderisca al loro modo di lavorare e che funzioni. Ma parlare tutti insieme... dirò una cosa forte, ma la democrazia non è sempre il migliore strumento da usare se devi stare dentro tempi stretti”.

¹⁷ translation by the researcher, this is the original version: “Sì, sarebbe davvero utile ... ma noi del team IT siamo solo tre, non riusciamo a prenderci in carico anche l’organizzazione di questi momenti. Ma poi, insomma, se hanno bisogno di qualcosa (i colleghi, ndr) hanno il manual che abbiamo preparato e il sistema di ticketing.”

¹⁸ translation by the researcher, this is the original version: “Il sistema potrebbe davvero avere un impatto rilevante sulla riorganizzazione interna, ma dovrebbe essere gestito a monte con questa intenzione, e invece la proprietà decide in base agli obblighi e a quanto costa il lavoro dei consulenti”.

If the decision of the Board is to implement a standard version of the ERP software, then it generally requires a standardization of business processes, in some cases this implies a more hierarchical organizational structure. Similarly, ERP softwares might potentially generate an increasing automation of production planning, but the trend is in the opposite direction: a more wide-spread management control and less autonomy of workers. If the Board wants to pursue a strategy of high production flexibility oriented to clients' requests, the digitization of the production process will be minimal and ERP information flows will assume mostly the meaning of an excellent information control tool for the management: "It is not the ERP software that makes you discover autonomy".¹⁹

Eventually, IT managers are homogeneously convinced of the importance of making employee involved during the process of adopting/upgrading ERP systems; they think it could be useful to schedule post-implementation training as well as moments of confrontation among employees about their broad relationship with the software; but they report that these are highly time-consuming activities that hardly will be carried out. All in all, IT managers think it is fundamental to make employees involved, but they do not believe employees' representatives involvement to be useful. For what they know, they are not formally involved by the Board (Table 3) and the subject is not of interest of their bargaining activity: "Among the key-users identified for each business function, one of them was also an employees' representative but he never said anything about how to make employees more involved in the process"²⁰.

3.3 Unions point of view

Interviews with IT managers have confirmed the relevance of the three critical issues presented above (§2.4) about the lack of involvement of unions and employee representatives in decisions related to ERP technology. The inquiry about different degrees of opening of the space of negotiation has been carried out through interviews to unions' representatives.

Information and consultation rights. According to Michele Bulgarelli, Secretary of FIOM-CGIL Bologna, the information rights about firms' digital investments and their impact on labor organization are enshrined in Article 9 of the metalworkers' National Collective Bargaining Agreement (CCNL) titled "Information and consultation at company level". In firms with at least 50 employees, the Board must call a meeting to provide information to employees' representatives (Rappresentanza Sindacale Unitaria - RSU) or to the local unions about each decision that can result in relevant changes of labor organization.

¹⁹ translation by the researcher, this is the original version: "Non è il gestionale che ti fa scoprire l'autonomia".

²⁰ translation by the researcher, this is the original version: "Uno dei key-user di funzione era anche rappresentante sindacale e non gli ho mai sentito dire niente sul coinvolgimento dei lavoratori".

Table 2 - Business Functions adopting ERP softwares

	ENG-1	ENG-2	ENG-3	ENG-4	ENG-5	ENG-6	ENG-7	FOOD-1	CHEM-1
Supply Chain (Purchases, Logistics, Warehouse etc)	X	X	X	X	X		X	X	X
Administration and finance	X	X	X	X	X	X	X	X	X
Sales and retail	X	X	X	X	X	X	X	X	
Management control	X			X		X		X	
Customare Care									X
Product Management	X						X		
HR	X		Dedicated ERP	Dedicated ERP	X		X	X	
Health, Safety, and Environment	X								
IT	X				X	X	X		
Production planning / Quality control	X	X		X	X		X	X	X
Production²¹	X	X	X	X	X	X	X	X	X
After-sales (Service) / External Training activity	X		X		X				
Technical office / R&D	X	X	X		X		X		X

²¹ Only few workers of the company function, typically the managers of the production lines

This refers also to the adoption of technology and to substantial modifications of the productive system, of the overall organization of work or of the production in progress that may affect the overall employment or impact significantly the job conditions. The article does not apply to the case of recurring modifications of labor organization or means of production conforming to the ordinary improvement of business results. RSU or local unions can formalize their own opinion and forward it to the employer, to whom a substantiated reply is requested.

Therefore, article 9 seems to be applicable to the ERP scenario in the case of first adoption (as discussed in section 2.3, the organizational structure is always impacted) or deep upgrading of the system due to general restructuring.

According to Massimo Mazzeo, Secretary of FIM-CISL Bologna, unions' information rights also benefit from notices released by the firm twice a year which reports all the investments and, therefore, also the case of investment on adoption/upgrading of digital tools.

Looking at the consultation rights in second level bargaining practices, FIOM-CGIL Bologna always proposes the counterpart to insert a statement in the agreement which establishes prior discussions between the firm and RSU/unions about the adoption of technology impacting on employment, tasks, job title and description. Theoretically, according to Secretary Bulgarelli this clause should apply also to relevant ERP investments.

All in all, the interpretation about whether decisions on ERP fall within information and consultation rights is ambiguous, marking again how different can be the impact of its adoption/implementation depending on the Board strategic orientation.

Lack of competence. Given the framework of information and consultation rights, according to both FIM and FIOM-CGIL generally speaking RSU delegates - who are volunteers - do not assert these rights: they are often not trained enough to engage in bargaining with the firm about the organization of labor and the implementation of technology.

According to FIM-CISL there is also an ideological prejudice: in most cases, RSU delegates fear digitalization because of the threat of an increased workload due to the increase in production and feel the pressure of reporting on their work to their colleagues.

In this case, the interpretation of the willingness of the RSU delegates to be trained on the subject of digitalization of the work and ERP software suffers the ideological element related to employee representative strategy of conflict.

Table 3 - Union and employees representatives' presence in companies and their involvement in ERP

	RSU	RSA (n°; acronyms)	% RSA members	unions involvement
ENG-1	YES	3	14,7	NO
ENG-2	YES	1: CISL	6,7	NO
ENG-3	YES	2	N/A	NO
ENG-4	YES	2: FIOM-CGIL; CISL	Doesn't know	NO
ENG-5	YES	2	7,8	NO
ENG-6	YES	1: UIL	60	NO
ENG-7	N/A	N/A	N/A	NO
CHEM-1	YES	1: CGIL	30	NO
FOOD-1	YES	3: CGIL; CISL; UIL	N/A	NO

Labor organization. According to FIM-CISL, firms deal with labor organization as a subject of their exclusive interest, as a key-dimension of their business risk. Nonetheless, the union affirms to aspire to bargain the subject, and to be directly involved also in the impact of ERP management.

On the other side, FIOM-CGIL believes the union has provided itself in Bologna with sufficient regulatory protections about the impact of digitalization which gives enough space to intervene if the firm adopts behaviour harmful to the workers; but where the second level bargaining is weaker this protection is not guaranteed. Anyway, according to FIOM-CGIL the digitalization of labor, and ERP systems in particular, do not represent the core of its trade union activity.

All in all, according to both FIM-CISL and FIOM-CGIL, if the firm is willing to radically innovate the organization of labor through digitalization tools (e.g. ERP systems) it would be a change deep enough to fall into consultation rights: in their experience, these cases seldom occur. In that innovative scenario, it would be of firm interest to inform RSU and the unions to overcome user resistance.

Therefore, conclusions on the hypothesis of lack of interest from unions about the topic are strongly mediated by what unions expect from employers in matters such as digitalization and labor organization. We can conclude that the space of negotiation about ERP has a great potential to be widely opened.

The current spreading interconnection of the Production function to ERP systems - at the beginning of its diffusion ERP was adopted only by the clerical functions - challenges the two unions differently. According to FIM-CISL, given the technological progress the metal worker has become a hybrid figure between a clerk and a workman, whose job nowadays is “highly cognitive”; metal workers have excellent technical skills, can remotely assist the machines, therefore loses manual skills in part. To protect the workers, unions must interpret this historical change, for example bargaining the “right to disconnect”. The progressive erosion of the assembly line, which was much under the supervision of the unions, risks to shift the relationship between employer and employee to a more individualistic dimension, weakening the role of the employee representatives.

On the other hand, according to FIOM-CGIL - even if inside the union there is already an ongoing debate about the role and the ownership of the data produced by workers (see the latest Lamborghini agreement) - the availability of a rich set of digital tools, which provide employers with a large amount of information about job performance, has not yet provoked a vexatious control against the workers.

4. Conclusions

This case study on ERP systems provided insights into the digital tool most frequently adopted worldwide by firms. Even if these systems are subject to continuous development - forcing firms to a never-ending upgrade - the logic, the purpose and the potential of the ERP seems to be the same as the origins (in terms of

interconnection of business functions and data production for management control), and so are the challenges that its adoption and implementation push firms to face.

There is a noticeable increase in the stream of contributions focusing on the sociological aspects of end users' relationship with ERP, however it remains a minor niche with respect to the main research field dealing with ERP.

By identifying some critical issues useful to define the degree of opening of the space of negotiation, it has been possible to reveal how nowadays the bargaining power about ERP between users and employer is highly unbalanced, mostly relying on the firm strategic orientation that go with the decision of investing in ERP technology. While the literature highlights the crucial role of users' involvement in each step of the ERP life cycle, it will be hard for employees and their representatives to negotiate about labor organization and the impact of digitalization if the employer interprets the ERP adoption just as a duty exogenously imposed mostly by tax requirements (as it seems to be confirmed by the interviews). What can be concluded downstream of this investigation is that ERP impact on digitalization of production processes seems to generally stop at the digitalization of data, which could and should be only the first step into a path of digitalization of the firm.

In this scenario, the lack of unions and employees' representatives' involvement that emerges from the literature is understandable, as it is the apparent poor attention that unions pay to the theme.

Since this trend related to ERP technology itself seems to be widespread, results from this study can be of common interest, regardless of the geography and the traditional industrial context, questioning in the first place the decisions of the employers. In fact, even a strong collaborative experience of second level bargaining as the one placed in Bologna has shown all the limits for unions and employees' representatives in interpreting the widest potential of a technology's impact to the organization of labor when the expectations of the employers about their own investments are rather narrow.

By shedding light on the research gap about unions' involvement as a critical success factor of ERP implementation, this study calls for further investigation on the strategic orientation of digital investments, as well as on the limits of calling for more end users' participation and involvement using an analytical framework in which employees are perceived only as individuals instead of a group of interest.

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