Quality of jobs and innovation generated employment outcomes

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IS INNOVATION OBSESSION GOOD NEWS FOR EMPLOYEES?

HOW NEWTECHNOLOGY ADOPTION AND WORK ORGANIZATION PRACTICES TRANSFORM JOB QUALITY AND WORKING CONDITIONS

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Malo Mofakhami, *Centre d'Economie de la Sorbonne,*

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QuInnE - *Quality of jobs and Innovation generated Employment outcomes* -is an interdisciplinary project investigating how job quality and innovation mutually impact each other, and the effects this has on job creation and the quality of these job.

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Abstract: Our paper contributes to better understanding the relations between innovation diffusion by adoption and the evolution of work practices and institutions. Most studies on employment and innovation focus on the impacts of innovation on employment variation and turnover. These studies tend to analyze the differentiated effects of technological change on the labor structure with the well-known skilled-biased technological change (SBTC) and routine-biased technological change (RBTC) hypotheses. However, few empirical studies focus explicitly on the transformative role of new technology adoption in the qualitative dimension of jobs. A new technology adoption in the workplace does not induce a total replacement of the workforce. In that respect, understanding the effect of a new technology adoption on job quality and working conditions, among other job characteristics, is a key element in capturing the reality of technological change with regard to employment. By combining the literature on innovation, workplace practices (especially human resource management (HRM) practices), and job quality, we build an empirical model that highlights various interdependencies. The literature provides us with fragmented hypotheses about these interactions, but the main limit is the very different approaches, which lead to ambiguous effects. Starting from the European Working Conditions Survey (EWCS) (2010), we try to identify the effect of innovation combined with work organization practices on job quality. We observe that new technology adoption is generally associated with better employment quality in some ways but, simultaneously, leads to higher workplace risk and work-time intensity. Furthermore, our study highlights the need to associate innovation with different forms of work practices. Analyzing new technology adoption coupled with new information and communication technology (ICT) use or some work organization practices, we observe dissociated effects, and the same occurs when we separately analyze the new technology adoption effect by type of employee. Our paper is a first step not only in answering the calls for more in-depth research on the links between employment variation and work transformations due to technological change but also in studying that which more clearly distinguishes the effect according to the type of innovation. Finally, our study shows the weakness of the available and adopted database for testing and evaluating these interrelations.

JEL code: J08, J53, J81, L22, M54, O32

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1. Introduction

This paper studies the effect of innovation adoption in the workplace on different dimensions of the work environment. Using a micro analysis at the employee level, this study shows how innovation interacts with different aspects of working conditions, both work organization practices and job quality. We seek to understand the impact of innovation on the qualitative aspects of work and thus contribute to completing existing studies on technological change. Research on the role of innovative dynamics in employment is often concerned with shedding light on it as a central issue, especially in a knowledge-based economy (European strategy 2020[1]). The fast adoption of innovativeness all at once in the strategies of firms and in public policies on industries calls for more detailed academic research on this issue to support firms and policies. More accurately understanding the multiple indirect impacts of new technology adoption is essential to promote adapted recommendations. The European project "Quality of jobs and innovation-generated employment outcomes," supported by the European Commission (EC), illustrates the weight given to the relation between innovation and job quality. This article meets the objective of better understanding this relation and makes a contribution with regard to this new concern.

Currently, the abundant empirical literature is mainly focused on the impact of innovation on variation in the level of employment (the net effect of creation / the destruction mechanism of technological change). These studies are diverse in terms of methodology and approach; indeed, we find both theoretical and empirical contributions at different levels, such as country-, industry- and firm-level analysis (Vivarelli, 2014). However, despite this apparent diversity, the emphasis on the sole net effect of job creation / destruction conceals part of the employment impact induced by technological change. To better understand the complex impact of innovation, it seems essential to clarify the effect of innovation on employees in the workplace beyond the sole effect on employment variation and turnover. This article aims to make a contribution on the interaction of innovation with job quality to better understand the transformation of tasks induced by technological change and innovation. The originality of our empirical strategy is to combine frameworks regarding the economics of innovation with job quality, which is a relatively new way, both empirically and theoretically, to deal with this issue.

The multidimensional framework of job quality is more comprehensive than the sole category of employment variation; simultaneously, it completes the learning or work organization framework (Guergoat-Larivière and Marchand 2011). Taking into account only one aspect of the labor issue does not allow scholars to observe the differentiated effects of technological change. For instance, we could expect supporting effects on innovation from work organization practices (learning practices or more autonomy); simultaneously, we could expect negative effects on other aspects of work, such as work-time intensity or contract stability. From this perspective, our study consists of articulating frameworks on job quality and work organization with innovation, here taken as new technology adoption at the workplace.

Our paper aims to empirically investigate at the employee level how innovation related to work organization practices directly impacts job quality. Innovation is a concept and a phenomenon that is difficult to isolate, and the scope of its analysis differs among studies, though a wide definition is quite

1 https://ec.europa.eu/info/strategy/european-semester/framework/europe-2020-strategy_en.

easy to establish[2]. In macro level analysis, the terms technological change or technological progress are more common; in contrast, micro analysis prefers the term innovation. Additionally, scholars often divide innovation into subcategories to capture more homogeneous realities; the empirical reference is given by the Oslo Manual (2005)[3]. In our article, innovation is taken in the sense of diffusion of new technology (new technology adoption at the workplace).

This study contributes to better understanding the overall link between innovation (as defined above) and some employment issues based on the concepts of job quality, working conditions and work organization practices. To that end, based on the scheme below (Graphic 1), we aim to answer three main questions. First, how does new technology adoption in the workplace directly shape working conditions and job quality (relationship 1 in the graphic)? How does the work organization interact with both innovation (relationship 2) and job quality performance (relationships 3, 1 and 2)? Third, does innovation combined with some workplace practices have differentiated effects (4)?

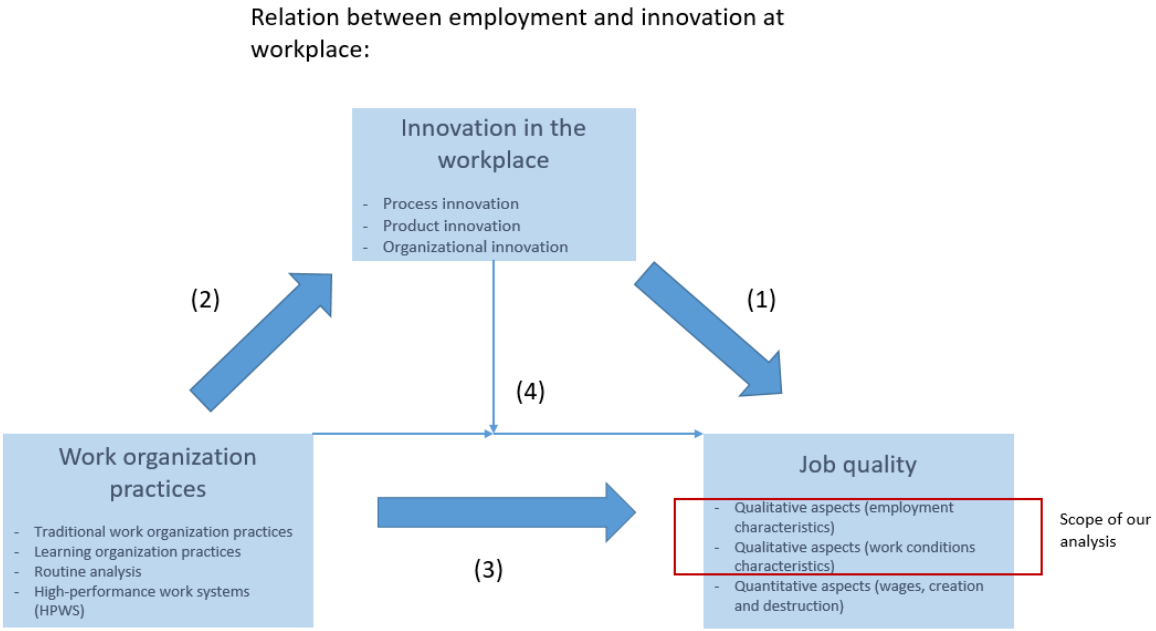
To the best of our knowledge, no large and in-depth set of studies has been conducted from an economic perspective on this specific topic, in part because the interactions are complex and the theory is missing. Along with some very recent other studies (Bustillo et al. (2016) and Erhel and Guergoat-Larivière (2016)), our research constitutes a first empirical step from this perspective. Promoting innovation must be based on a comprehensive view of its impact on employment. Even if there are several well-documented studies on employment variation, knowledge of the effects of new technology adoption by employees on working conditions is lacking. Our study should also introduce some elements regarding the central issue of inequalities by skill and occupation.

In the second section, we discuss in more detail the empirical framework used with regard to job quality, work organization practices and innovation. Then, in the third section, we present the methodology and our empirical strategy. In the fourth section, we show the results. Finally, in the last section, we present some concluding remarks.

2 For instance, the Oxford Living Dictionaries define innovation as “make changes in something, especially in introducing new methods, ideas, or products.”

3 The empirical literature on innovation insists on several levels of distinctions between innovation production and innovation adoption, between incremental and radical innovation, and regarding the level of novelty, the type of innovation (technological – process or product – organizational and even marketing), among others.

Graphic 1: Model of the interaction between job quality, innovation and work organization practices[4].



2. What links job quality, work organization practices, and innovation?

Economic research does not directly tackle the issue of the relationship between innovation and job quality. However, as noted in our introduction, we can identify in different approaches some hypotheses that offer references and guidelines for our empirical approach. Neoclassical studies provide a limited framework on qualitative aspects at the employee level. The multilevel, multidimensional, and special nature of innovation[5] lead us to mainly build our study on neo-institutionalist works. Additionally, qualitative measures of employment and work emerge within the institutionalist approach (Bustillo et al. 2010) and, more recently, within the economics of happiness (Clark, 2005); therefore, we have to introduce our literature review with a brief presentation on the corpus of this topic.

Innovation interacts through complex mechanisms (Winter and Nelson, 1982). For this reason, to facilitate understanding, we have to distinguish approaches that tend to rely on job quality in respect to innovation as an input or as an output and focus on the first case.

a. Job quality concept

Our research strategy aims to better understand the interactions between innovation and employment. From this perspective, we can derive some hypotheses from the literature on these fields. The issue of job quality is somewhat recent and, since the end of the 1990s, has become a major concern in the social

[4] This graphic synthesizes the conceptual model of our article; it is defined in detail in section two.

[5] From economic perspectives, innovation leads to several market failures that are difficult to deal with (great uncertainty, non-rival and, to some extent, non-excludable goods, and externalities).

sciences. At the initiative of the International Labor Organization (ILO) and the EC, this issue was proposed through the notion of "decent work" (Guergoat-Larivière and Marchand, 2012). However, this concept of job quality encompasses a large variety of research fields; its definition is wide and variable among scholars. Some focus on working conditions, while others focus on employment quality or working environment, etc. This concept is multidimensional, and many different methodologies are used. For this reason, in our study, we focus on one main empirical reference, which focuses mainly on the individual characteristics of workers.

The seminal research of Bustillo et al. (2010) restricts the methodology to a narrower definition of experienced job quality, and they deviate from taking into account the institutional setting of the labor market. Their empirical framework is grounded in the European Working Conditions Survey (EWCS), which is an employee-level survey, and they retain five dimensions: pay, the intrinsic quality of work (autonomy and skills), employment quality (contract quality and opportunities), workplace risks, and working time and work-life balance. This perspective is work experience based, and it leaves out institutional aspects of job quality that are included in some European definitions. Unlike an institutionally oriented framework, such as the seminal analysis of Davoine et al. (2008), it contains some additional aspects of job quality, for instance, autonomy and skills or learning practices. The European Foundation for the Improvement of Living and Working Conditions (Eurofound) provides a similar methodology (Eurofound, 2012a.)

To better identify the differences between approaches, we present some seminal studies on job quality in Table 2.1 (appendices). The job quality methodology presented here is based on a multidimensional view that allows scholars to make connections with other fields of research, such as education, employment policy, inequality, and, clearly, technological change. By comparison, it represents a major difference from firm or employment models, where all working conditions are synthesized by wage in a principal-agent case with compensation mechanisms (Jensen and Meckling, 1976). However, some recent studies (Clark, 2005, 2015) have developed the concept of job satisfaction within the field of the economics of happiness. Starting from the tools of job quality, these studies try to measure an employee's level of satisfaction with a job and, thus, to relate an objective measure of job quality to a certain level of satisfaction to make policy recommendations. On paper, this methodology is convincing since it offers a direct measure of the final goal (satisfaction) and is not a proxy, as are job quality or wage measures. However, great difficulties at the empirical level emerge, such as the weak degree of comparability, the weak interpretability of the theoretical mechanism and its difficulty for use in terms of public policy (Guergoat-Larivière and Marchand, 2012). Moreover, regardless of the satisfaction of workers due to new technology adoption, objectively identifying the changes in working conditions for workers induced by new technology is central.

b. Does innovation lead to better job quality?

The standard innovation models based on the firm-employee model does not explicitly focus on the innovation impact on job quality, even in new endogenous growth models (Aghion et al., 1998); this issue is the core of analysis. A major reason, which is somewhat obvious, for this lack of focus is the use of a firm-level model without work quality parameters. However, agency theory coupled with the direct and positive impact of innovation on productivity tends to assume that innovation at the firm level increases wages. This innovation rent redistribution effect is the main argument of neoclassical economics supporting the positive effect of innovation on job quality.

Most empirical research on the links between employment and innovation focuses on employment variation and aims to evaluate the net employment effect of innovation. This strategy is first confronted with a problem stemming from the strong differentiated effect among the analysis levels chosen. The net effect comes from two decomposed effects: the labor-saving effect, resulting from productivity gains (mainly resulting from process innovation), and compensation effects, such as new demand via a decrease in prices, an increase in investments, an increase in incomes or new products from innovation (Vivarelli, 2014).
These empirical studies lead to different conclusions, but the majority of studies point out a positive net effect of product innovation on the level of employment and a neutral net effect of process innovation (Van Reenan et al., 1997; Piva and Vivarelli, 2005; Harrison et al., 2014; Van Roy et al., 2015; Piva and Vivarelli, 2017). However, these effects decrease when the level of analysis grows (industry and country level). At the macro level (or country level), the effect is more ambiguous, and even if the literature seems to show a positive effect (Vivarelli, 2014), one can argue that under a free trade regime, this positive impact could be compensated by negative externalities in other countries, as shown at the industry level.
Ugur et al. (2017) present a meta-analysis of studies on the links between employment and technological change. They conclude that even if product and process innovations seem to lead to increasing employment and, in particular, skilled labor demand, the empirical measure of this effect is smaller than is frequently claimed due to overlooked selection bias. Moreover, they shed light on very heterogeneous results due to the complex measures of innovation (R&D, information and communication technology (ICT) investment, patents, self-reported innovation, etc.). Beyond the limits resulting from the aggregation of employment, these studies focus mainly on employment variation and not on the impact of innovation on change in work characteristics.

However, a different and related question emerges; from a job quality perspective, we should concentrate analysis on the transformation of the features of new and remaining jobs rather than on the net effect of creation or destruction. If we reject the neutral effect of productivity gains, namely, a homogenous reduction of workers over occupations, two questions emerge: what are the characteristics of the new jobs created compared to the jobs destroyed? Do we observe task transformations inside the same professions? The first question finds several answers in the empirical literature as well as theoretical research on endogenous growth. In the long run, development (capital accumulation) tends to re-affect employment from capital-intensive professions to labor-intensive professions.

More recently, several scholars (Askenazy and Galbis, 2007; Autor 2015) have been focusing more specifically on the transformation of tasks from technological change and, in particular, new ICT adoption. They try to show a differentiated effect among workers; for instance, some of them attempt to observe a differentiated impact among skills, occupations and even tasks. They assume that beyond a global effect of innovation, there is a structural impact of innovation, which raises other issues such as inequality, lifelong training, or social protection. This thesis is based on empirical studies that show that the labor-saving effect from innovation is not homogenously distributed among workers. The skilled-biased technological change (SBTC) hypothesis argues that unskilled workers undergo labor saving in favor of more highly skilled workers (Author, 2015). If this mechanism is combined with a weak training capacity, it tends to reduce the compensation effect at the macro level and induces a rise in unemployment.

In a similar vein, another hypothesis emphasizes instead a polarization effect in the degree of routinization in jobs, which is different from skills, because jobs with weak routinization are present in all occupations, especially in elementary and weakly capitalistic tasks as well as in highly skilled tasks

(Askenazy and Galbis, 2007; OECD, 2010; Author, 2015; Fernández-Macías and Hurley, 2016). This literature proposes different issues and focuses on more qualitative aspects, such as the degree of skill or routine. Nonetheless, biased technological changes (SBTC or routine-biased technological change (RBTC)) focus only on employment variation.
Routine tasks are progressively substituted by automation, and less routinized tasks are concentrated inside jobs. Simultaneously, the same holds true for high-skilled job (such as learning activities) and low-skilled job, which are in complementarity with digital platform technology. As pointed out by the ILO report (2016) about the growth of nonstandard jobs in developed economies, the impact of technological change can also be associated with bad job quality involving poor contracts and strong intensity.

A second set of empirical studies, in the neo-institutional framework, focuses less on the direct impacts of innovation than on the suitable firm environment for innovation. Through their contribution to the national system of innovation (NSI) concept, Lundvall and Johnson (1994) show the interaction of innovation and learning practices at the workplace and, thus, beyond the training and academic fields. In an empirical study, Lorenz and Lundvall (2011) support the fact that innovation requires a creative work organization with learning practices and some autonomy. We find similar approaches in the fields of routine theory or neo-Schumpeterian research (Becker et al. 2005), where routine adaptation and the work organization should encourage and foster innovation and technological change. Finally, without claiming to be exhaustive, we can underline within management sciences new forms of human resource management (HRM) that support innovative behavior. To go further and linked this literature with the previous one, some studies present similar analysis about the links of innovation and work, in a broad scope of economics, and go beyond like management sciences. In management science the concept of High Performance Work System (HPWS) stemming from Human resource management, confirms the link between new technology and new HRM. HPWS has several benefit for employees, they are better taken into consideration, because the main goal is to achieve higher performance by a better involvement, motivation and also job satisfaction (Guest, 1997; Laursen and Fauss, 2003; Boxal and Macky, 2009).
More recently, the Eurofound (2017) has synthesized the hypotheses from the work organization literature with those from management sciences, which are more focused on case studies and HRM practices. They show how workplace organizations and practices could influence innovation beyond performance.

This second set of empirical studies is closer to providing some qualitative analysis of the interactions between workplace practices and a ripe environment for innovation. To summarize the central findings, work organization practices lead to different links with innovation. Involvement and autonomy practices tend to improve the firm's capacity to better react to environmental changes and to innovate, and thus, they increase the probability of innovation adoption. In the case of learning practices, it is instead the efficiency of innovation adoption, which is improved, that thus induces a better innovation absorptive capacity of innovation. Some recent empirical studies confirm the positive impact of some work organization practices on innovation, in addition to the known positive effect on performance (Eurofound, 2013; Eurofound 2017).
However, this research neglects the transformative effect of technological change on employment and omits the issue of polarization and the upgraded skill effect on the workforce. Thus, to better understand the complex interactions that come from innovation in the workplace on work practices and employment, we decide to use a triptych, adding the job quality framework to work organization practice and innovation analysis.

Finally, empirical studies that directly relate innovation and job quality, including some recent studies such as Bustillo et al. (2016, 2017) and Erhel and Guergoat-Larivière (2016), show, on the whole, a positive link between job quality and innovation at the country, industry and employee level. Erhel and Guergoat-Larivière demonstrate the complementarities between good labor institutions and an efficient innovation system at the country level, represented by Nordic countries. Bustillo et al., for their part, use the EWCS and show a positive link between their job quality index and innovation. Their methodology is particularly interesting because it is the first analysis at the employee level; however, they do not refer empirically to the work organization framework. One issue of our study is thus to extend these studies at the employee level and to introduce in empirical analysis broad work dimensions, such as work organization practices.

c. A combined view of employment concepts

To summarize this section, we can argue that the link between innovation and employment is not linear and clearly identified. It appears that an important part of scholarly research focuses, on the one hand, on work organization practices, learning activities and innovation capabilities (routine change, the learning organization, high-performance work system (HPWS), workplace innovation, intrapreneurship) from a knowledge economy perspective. On the other hand, employment is related to innovation mainly in terms of employment variation or social regulations on employment. Thus, there are few insights into the work practice transformations in the workplace induced by the innovation diffusion and adoption related to work organization practices.

The originality of our empirical work stems from the fact that it interrelates these different streams of literature in a mediating model that is directly derived from our introductive scheme (Scheme 1). We focus explicitly on the observed links between technology adoption and uses and work organization practices at the employee level (despite the difficulty of controlling the direction of causality). In addition, we thus show how these interrelations could impact individual performance in terms of job quality. A direct analysis at the employee level allows us to observe not only what the dominant effect of innovation at workplace is but also whether there are different mechanisms or differentiated effects. Few empirical studies have focused on innovation at the employee level, unlike studies on the firm level and employment variation, which argue for a positive impact of innovation. Before designing an innovation policy, policy makers have to consider the benefit not only for the firm and for the level of employment but also for employee well-being. Our study offers an opportunity to complete the vision of this picture.

3. Data and methodology

a. Data and variables

For our econometric analysis, we use the dataset of the EWCS, which is conducted by the Eurofound. The data from this survey were collected from European employees in all industries and sectors. We use the fifth wave of the survey conducted in 2010 in all European Union (EU) countries and six neighbor

countries (Norway, Macedonia, Turkey, Albania, Kosovo and Montenegro). This survey covers wide aspects of working conditions such as the physical environment, social relationships, and the work organization, and therefore, it corresponds to our research perspective.

This survey has the advantage of encompassing broad dimensions of working conditions while simultaneously providing some variables on new technology adoption; it is a major reference for job quality empirical analysis in Europe. However, the major limitation of the EWCS comes from the cross-sectional data, which do not allow us to carry out a robust econometric analysis with causality. In contrast, the high number of individuals in the EWCS (36,457 observations) offers a perspective for analyzing the relevant interdependencies. Another argument for the use of this survey comes from its frequent use by scholars. For instance, Lorenz and Lundvall (2010) use it to capture different work organization patterns, as do Bustillo et al. (2010) to measure job quality empirically.

However, this survey, which is very rich in regard to employment questions, provides only two questions related to change and innovation. The first that we can associate with being faced with product or process innovation is *"During the last 3 years, have **new processes or technologies been introduced** at your current workplace that affected your immediate working environment?" (Question 15a).* The second is *"During the last 3 years, has **substantial restructuring or reorganization been carried out** at your current workplace that affected your immediate working environment?" (Question 15b)*, which corresponds to organizational innovation but could be associated instead with organizational change. We should thus note that the first question is a more explicit and narrow measure of innovation than the second, which can encompass very different changes. However, one of the major advantage of these questions comes from the direct relation to the workplace; this relation allows us to measure innovation experienced conversely to measures of firm-level innovation, which can induce very different effects among types of employees in the firm.

In summary, this survey has important qualities that enable us to obtain rich information about working conditions and work organization practices and to have some measure of workplace innovation. Nonetheless, this dataset raises other issues: first, it is built cross-sectionally without the possibility of matching individuals with the previous waves of the survey. It tends to have information from workers at the same time; thus, it is impossible to deduce causality between variables with certainty. This problem is stressed by the nature of the phenomena observed, which are interrelated, as we observed in the literature review (innovation can cause better or worse working conditions; however, some work organization practices can also improve the level or the occurrence of innovation). However, questions 15a and 15b are the only questions in the survey that refer to a past period; thus, we can assume that these changed occurred before the situations reported by other questions.

Second, regarding our research fields, the survey is unbalanced; employment dimensions are predominant, and innovation is measured by just two questions. As we pointed out at the beginning of the article, the limited amount of previous studies explicitly on the link between qualitative aspects of work and innovation dynamics may explain the weakness of survey's mixing the two. An alternative survey, the Company Innovation Survey (CIS), dedicated to firms' innovation behaviors, yields almost nothing about employment practices and working conditions. Additionally, the European Company Survey appears to be a good tradeoff, but the survey is more focused on work organizations and less on job quality aspects. Further, there is no information directly reported by employees. Our empirical strategy is thus constrained by the availability of data that are dedicated to our research questions.

The dataset enables us to implement our empirical strategy, to study the impact of new technology adoption on working conditions at the employee level, and to infer the positive combination of innovation and job quality. From this perspective, we present indicators and variables that measure our different dimensions of the intrinsic quality of jobs, the work organization practices and innovation diffusion. Most of these variables are constructed by combining several raw variables (employees' answers from the survey). The dataset also provides very good control variables based on employee attributes such age, gender, industries, occupations and countries.

For our analysis, we have employees from 28 European countries; we keep only 27 EU countries – the 28 EU countries less Croatia, as was the case in 2010 – and Norway (because this country is very close in its institutional settings). The dataset is large since it contains 36,457 observations that offer a real robustness to our analysis, but we have to stress that observations by country do not represent their population weight in the whole. Indeed, France, Belgium, Germany and Italy have larger sample sizes than the other countries[6].

Based on these observations, we build synthetic indices at the employee level to capture different dimensions of job quality and work organization practices; all our indicators are based on the research of Bustillo et al. (2010) and Eurofound (2012a) methodologies and are inspired by Holm et al. (2010). Additionally, we can use different variables that deal with innovation diffusion, but clearly, the survey is relatively limited from that perspective. The Oslo Manual (2005), which is the reference for innovation measures and indices, identifies not only different forms of innovation (process, product, organization and marketing) and different degrees of novelty (new to the firm, new to the market, or new to the world) but also different degrees of intensity (by combining different variables, such as the impact of innovation inside the firm).

The EWCS does not enable us to have precise measures of innovation; in addition, the measure of innovation is not at the firm level but at the employee level and focuses either on new technology (product or process) introduced into workplace or on organizational change (without direct mention of innovation). These measures directly come from questions in the survey (q15a and q15b) as dummy variables, as presented above. Thus, the first measure is the better innovation variable; thus, we retain it as our reference variable for innovation. It is a measure of diffusion of new technology by adoption in the workplace, and it simultaneously encompasses different degrees of novelty and different levels of innovation intensity. To distinguish different forms of innovation, we also use an ICT measure (as frequently used, Ugur et al., 2017). Another way of confronting the imprecision of our innovation variable is to use a combination of variables; in that respect, we also use two innovative control variables to refine the scope of our innovation measure (ICT use and new technology adoption; new technology adoption and organizational change).

Table 3.1: Summary of the variables constructed using the EWCS

[6] Therefore, all our descriptive statistics are not weighted (especially because our software does not support the sampling weight for descriptive statistics). Nonetheless, we have to bear in mind that all samples are as representative as possible in each country, with at least 1,000 individuals; thus the misinterpretation is not too great. Furthermore, to minimize this issue, our regressions are weighted by the weighting variable.

	Index	Questions used in EWCS 2010	Source	Construction
Innovation indicator	New technology or process in the workplace (dummy)	q15a	Directly provided by the survey	Dummy variable
Innovation control indicators	Index of ICT use	q24h / q24i	Created	Dummy variable as a Combination of the q24h AND q24i
	Substantial reorganization in the workplace (dummy)	q15b	Directly provided by the survey	Dummy variable
Work organization practices variables	Involvement practices	q49b / q51c / q51d / q51e / q51i / q51o / q55b / q56	Derived from Bustillo et al., 2014, Eurofound, 2012a, and Holm et al., 2010	Mean of dummy variable (0 to 1)
	Learning practices	q61a / q61c / q49c / q49d / q49e / q49f	Derived from Bustillo et al., 2014, Eurofound, 2012a, and Holm et al., 2010	Mean of dummy variable (0 to 1)
	Autonomy and internal flexibility	q37d / q39 / q43 / q50a / q50b / q50c / q51f	Derived from Bustillo et al., 2014, Eurofound, 2012a, and Holm et al., 2010	Mean of dummy variable (0 to 1)
	Degree of task division	q49a / q46a / q46c / q46d / q46e / q55a / q62a	Derived from Bustillo et al., 2014, Eurofound, 2012a, and Holm et al., 2010	Mean of dummy variable (0 to 1)
Job quality dimensions	Earnings index (from hourly income)	ef10 / ef11 /q18	Derived from Eurofound, 2012a	Normalized index from 0 to 1
	Contract quality and career progression	q6 / q7 / q12 / q61a / q77c / q77a / q14a / q14b	Derived from Bustillo et al., 2014 and Eurofound, 2012a	Mean of dummy variable (0 to 1)
	Working time quality and work intensity	q18 / q32 / q33 / q34 / q35 / q41	Derived from Bustillo et al., 2014	Mean of dummy variable (0 to 1)[7]
	Workplace risks	mean q23a-g / mean q24a-e	Derived from Bustillo et al., 2014 and Eurofound, 2012a	Mean of dummy variable (0 to 1)
	Work pressure	q24g / q51p / q51l /q51g / Q45a / q45b	Derived from Bustillo et al., 2014 and Eurofound, 2012a	Mean of dummy variable (0 to 1)

[7] Based on an index of continuous variables conversely to the others, which are multinomial.

	Social environment	q51a / q51b / q58b / q58d / q77e / q71a / q71b / q71c /	Derived from Eurofound, 2012a	Mean of dummy variable (0 to 1)
Job satisfaction index	Job satisfaction	q76 / q77b / q77d / q77f / q77g	Used subjective perception of job quality	Mean of dummy variable (0 to 1)

As Table 3.1, we also created an index of digital technology use as a proxy for a specific form of technology adoption.

The second set of variables focuses on work organization practices, with four indices; three encompass the learning organization methodology (based on the routine and learning organization concepts), and one encompasses instead the degree of work organization constraint (a measure of more classical HRM and work organization presence in the workplace). In some studies, work organization practices are part of the job quality dimension; here, to test our hypothesis on the interactions among three sets of dimensions, we explicitly separate the work organization practices indices from the job quality indices. It is important to note that the variables for work organization practices are not exhaustive; they explicitly focus on the concepts that we have presented above in the literature review. Clearly, the boundaries between other job quality dimensions and these work organization measures are porous; thus, we intentionally accentuate the distinction to easily test our hypothesis.

The first dimension, involvement practices, is based on the literature on new forms of HRM. As we have seen above, some aspects of the learning organization and the HPWS should facilitate innovation by making it possible to take the initiative and to react easily to external shocks. However, as we will see below, the relation between innovation and involvement is difficult to restrain to only one direction; thus, we can assume that the link is more like an interrelation. This index contains variables about the capacity of employees to take the initiative or to react to external shocks.
The second dimension contains variables on learning practices; the expected effects of these organizational forms are less reactive to the environment but have better efficiency to absorb new technology. Learning practices are also a way to use internal more than external flexibility when a new technology is adopted in the workplace. We can assume that in the case of frequent innovations, a firm will foster these practices to improve innovation performance. Our dimension contains variables based on both on the tasks that are experienced in a job (such as problem solving or task complexity) and more formal practices such as training.
The third dimension seems close to the first but refers more to the autonomy of workers and the flexibility in working time. It is an interesting dimension that we decide to separate because the literature relates these aspects to better work performance but not explicitly to innovation capacity. Indeed, autonomy without involvement probably brings less pressure but does not necessarily lead to a better innovation process.
For this reason, we also decide to have a dimension that measures the degree of interrelations in tasks in a large sense. Simultaneously, this fourth dimension is based on not only hierarchical constraints but also horizontal constraints; thus, it is a measure of the degree of the deepening division of tasks.

The third set of variables provides six indices on job quality that are directly based on the methodology of Bustillo et al. (2010 and 2014) and the Eurofound methodology (report *Trends in job quality in*

Europe, 2012). Table 3.1 presents the questions from the 5th EWCS, which was used to build our aggregate index. In each case, the questions are transformed into dummy variables, except for those concerning working time and intensity, for which we transformed the questions into a continuous index from 0 to 1. The aggregate indices are an arithmetic mean of all dummies (or indices) and vary between 0 and 1. The dimensions selected for job quality overlap with dimensions existing in the literature and the main dimensions revealed in Guergoat and Marchand (2012). The job quality indices are very close to the methodologies used by scholars in the field of job quality that we presented above. Unlike typical methodologies, here, we extracted all variables of the learning and autonomy dimension from our job quality dimension to clearly isolate the two concepts. The first two indices (pay and employment stability) are focused on contract quality; they are also the two closest to traditional measures of job quality. The third index on working time quality also involves a common measure since it contains nonstandard working time and offers a measure of the issue of increasing nonstandard labor. Thus, workplace risks, work pressure and the social environment are dimensions that are based more on the working environment and working conditions in the workplace, and we can assume that the variability of these variables will be more related to idiosyncratic aspects of the workplace.
Finally, we built an index on subjective aspects to check the frequent hypothesis from the literature supporting a positive impact on motivation from the HPWS. Some recent studies show the links and the complementarities between objective and subjective measures of job quality (Clark, 2015). Thus, by comparison, we want to stress a potential psychological effect that could induce innovation in the workplace.

b. Descriptive statistics and robustness

Although it has been used by previous analyses, the weakness of our data strategy could hinge on an ex post definition of indices that could be conceptually but not empirically relevant to our dataset. To deal with this issue, we assess the consistency of these variables with some descriptive statistics. For example (see Tables 3.2 and 3.3 in the appendices), the workplace risks dimension is two times higher for low-skilled occupation (groups 6 to 9, ISCO 0-8) than it is for high-skilled occupations. The same applies for involvement, autonomy, learning practices, pay and contract quality, for which we observe lower scores, on average, when we move closer to the low-skilled occupations. Moreover, some expected exceptions improve the relevance of the indices. For instance, autonomy is particularly high for group 6 (agricultural workers), and simultaneously, these workers have a lower level of pay and contract quality. The other dimensions are less occupation oriented, as the intergroup standard deviation shows. For instance, the social environment, working time quality and work pressure dimensions have the three weakest intergroups standard deviations of all the dimensions.

Focusing on correlations (Table 3.4), we also find expected links between our dimensions. Each set of variables presents the expected correlations. Work organization practices show that the first three indices are strongly correlated, suggesting that these practices are often implemented as an overall policy. Regarding job quality, we observe that good contractual quality leads to better working conditions except in terms of work pressure, which, on average, slightly increases with employment quality. It is also in line with the literature on job quality; the job quality dimensions reinforce each other, in opposition to wage compensation theory. Finally, our three measures of innovation are positively and significantly related. If the literature clearly stresses the empirical and theoretical links between organizational change and new technology adoption (Lam, 2004), then the positive link between new

technology adoption and ICT use shows that our innovation variable encompasses ICT innovation to some extent.

Some descriptive statistics about our innovation indices can allow us to better understand the relevance of our innovation variables. The Oslo Manual provides an empirical distinction to measure the different realities of the phenomenon, such as horizontal differences with products (which could be divided into goods and services in some cases) and process, organizational, and marketing innovations. However, as we see below, we cannot have the same level of distinction with the EWCS; however, we can estimate the relevance with a traditional innovation measure at the macro level. The traditional measures of innovation come not only from the CIS conducted by the EC based on the Oslo Manual methodology but also from R&D or innovation expenses as an input or the rate of patents as an output. Finally, the Innovation Union Scoreboard (IUS) methodology (2015), established by the EC, aims to measure a complete institutional set of innovation in a multidimensional manner and to provide a synthetic index titled the Summary Innovation Index (SII). The IUS, with the OECD equivalent report (the Science, Technology, and Industry Outlook), is considered a major reference in empirical measures of innovation at the country level.

Thus, with the aim of testing the measure of our EWCS innovation indices, we use a macro-level comparative correlation between these recognized innovation measures and our variables. At a second point in time, we use categorical (occupation and industry) analysis within EWCS to characterize our variables.

Table 3.5 shows a positive and relatively strong correlation between the EWCS variables of innovation and the SII, but this correlation is lower for our organizational change variables than for our technological change variables. For the latter, we find a lower level of correlation, though positive, with R&D expenses or declarative innovation (from the CIS) and the same relation. For the former, we find a lower correlation with the technological innovation variables and no correlation with the organizational innovation variable from the CIS. However, this variable is strongly correlated with new technological change, and the formulation of the question is vague and does not refer explicitly to innovation. We thus decide to focus mainly on new processes or technologies introduced and use organizational change instead as a control variable. With the poor information on innovation in the EWCS, we manage to obtain different types of innovation in combination with not only ICT use and organizational change but also work organization practices. Such variables do not measure radical versus incremental innovation or the production versus the diffusion (or adoption) of innovation; however, we can observe the impact of new technologies on the workplace environment in different cases.

To narrow the analysis, we focus now on the distribution of our change variables among occupations and industries (Tables 3.6 and 3.7). First, the new technology occurred mainly for high-skilled workers (managers, professionals, and technicians) but also for clerical support, trade and manufacturing workers. Organizational changes such as ICT use are more frequent for high- and middle-skilled occupations, unlike new technology adoption, which is also quite high for blue-collar workers. On the industry side, most innovation adoptions occur in the manufacturing industry; however, some also occur in some service industries such as information and communication as well as financial and insurance industries, in addition to public administration, education or human health and social work. This finding confirms the large scope of this variable, which is not limited to innovation production but, rather, extends to innovation diffusion.

Finally, observing the scores of our dimensions (not only job quality but work organization practices) by innovation variables, we obtain some insights into the relation, despite not controlling for causality. We can distinguish two different types of variables: those that vary according to the innovation variables and those that do not. The social environment, workplace risks (except in the case of ICT use), and working time do not depend on our innovation variables. These work dimensions do not seem to be associated with new technology adoption or new organization practices in the workplace. In contrast, employment stability, pay, work pressure and all our work organization dimensions (learning, autonomy, involvement, and task division) seem to be positively associated with innovation adoption. These relations are also confirmed by our correlation table (see Table 3.4 in the appendices).
However, this first descriptive analysis does not take into account the structural differences between employees, nor does it take into account the other variables that could simultaneously be impacted by innovation and impact the job quality dimensions (for instance, occupation). Our model could support the idea that work organization practices adapted to innovation could be the explanation of the better job quality performance rather than a direct effect of innovation diffusion on job quality.

Table 3.7: Scores of the job quality dimensions by the innovations variables

		Pay	**Employment stability and advancement**	**Workplace risks**	**Working time quality**	**Work pressure**	**Social environment**	**Learning practices**	**Autonomy and flexibility**	**Involvement**	**Degree of task division**
New technology adoption in the workplace	Yes	0.60	0.52	0.23	0.84	0.32	0.86	0.66	0.58	0.57	0.49
	No	0.54	0.43	0.24	0.84	0.25	0.86	0.48	0.55	0.49	0.38
ICT use	Yes	0.62	0.53	0.14	0.87	0.32	0.87	0.67	0.66	0.60	0.45
	No	0.54	0.43	0.27	0.83	0.26	0.86	0.49	0.52	0.48	0.41
New organization practices in the workplace	Yes	0.60	0.52	0.23	0.84	0.33	0.86	0.64	0.57	0.56	0.50
	No	0.55	0.44	0.23	0.84	0.25	0.87	0.51	0.56	0.50	0.38

c. Empirical strategy

Our empirical strategy should play a clarifying role in providing a better overview of the relationship among new technology adoption in the work environment, work organization practices and working conditions. In this respect, we test the relation between our different dimensions of job quality and work organization practices and our variables of innovation through a multivariate linear model. Beyond the effect on workforce variation due to innovation that has been very well documented by scholars, we aim to investigate the working conditions and the environment of workers who are confronted with new technology and some work organization practices compared to other workers.

Our hypotheses are based on the following findings (for more details, see the first and second sections):

- Some work organization practices (learning practices, HPWS, employee involvement, etc.) tend increase performance including both the innovative absorption capacity and job quality (except for intensity and pressure, which could decrease).
- Thus, innovation could be associated with better jobs without being the direct cause, which should instead be work organization practices.
- However, the neoclassical view supports the idea of a positive effect on wages when firms increase their profit rate, for instance, by innovating (the bargaining model).
- Finally, from the SBTC or the RBTC perspective, innovation could also tend to concentrate less-skilled tasks or more routinized tasks in some jobs, and then influence job quality. These effects of inequality are observed in employment variation analysis, but they could also be observed at the employee level after new technology adoption.

In the first step of our econometric analysis, we combine our innovation measure with the work organization practice variables to identify the relationships with job quality. To analyze inequalities in the effects of innovation, we perform econometric regressions on subsamples by occupation and by the degree of task routinization[8]; to do so, we use the routine task intensity (RTI) index developed by Author and Dorn (2013)[9]. We report only the second set of regressions because the routine subsample brings more insights than the occupation subsample[10].

We use our main innovation variable, presented in Table 3.1, as the explanatory variable of job quality. For each dimension of job quality, we conduct three regressions. The first contains only our innovation variables and structural control variables. In the second set of regressions, we add the two complementary innovation variables and all our work organization practice variables. In the last set of regressions, we add the interactions terms between the work organization practice variables and innovation. Compared to the first set, the second set aims to differentiate the own effects of new technology adoption from the effects of work organization practices, which are often related, on job quality outcomes. The third set of regressions tries to identify the specific effect from the way in which innovation is implemented. By combining the innovation variables with other practices, we can more clearly identify the differentiated innovation impact according to the work organization practices associated.

Even if the variable of innovation adoption refers to the three previous years, we are not really able to provide a causality analysis because the database is built cross-sectionally. Instead, we perform a controlled correlation analysis between new technology adoption and our variables of work organization practices with job quality. Multivariate regressions are run with the ordinary least squares (OLS) method (performed by maximum likelihood). In all our regressions, we control not only by countries and industries but also by occupations, firm size, gender and age.

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8 We decide to report analysis on the routine concept because scholars have pointed out the relevance of this concept to identify different effects of technological change in the workplace. This work experience appears richer for our research question than the skill level of occupations, but we also conducted the same analysis based on this latter category. These results are reported in the appendices and are available upon request (we use three different groups, high-skilled employees (ISCO 1-4), middle-skilled employees (ISCO 5 and 6) and low-skilled employees (ISCO 7-10)).

9 This RTI index is built by Author and Dorn (2013) based on the average observed tasks experienced in each occupation. In the appendices, we report the occupations contained in the three categories that we used.

10 The results are available upon request.

Model (OLS)

First model: $$Y_i = \beta_0 + \beta_1 X_i + \beta_2 C_i + \varepsilon_i$$

Second model: $$Y_i = \alpha_0 + \alpha_1 X_i + \alpha_2 Z_i + \alpha_3 C_i + \varepsilon_i$$

Third model: $$Y_i = \mu_0 + \mu_1 X_i + \mu_2 Z_i + \mu_3 X_i Z_i + \mu_4 C_i + \varepsilon_i$$

where
Yi: Job quality indices
Xi: Innovation variable (new technology adoption)
Z_i: Work organization practices and innovation variable (only in the second regression)
C_i: Control variables (industry, occupation, firm size, and level of education, country, gender and age of the employee)

4. Results

Our regression focuses on the job quality dimensions and job satisfaction as dependent variables (Table 4.1 below[11]). The main explanatory variable is new technology adoption in the workplace[12], but in the second and the third set of regressions, we add work organization practices and innovation complementary variables as complementary explanatory variables. The main interest of this empirical strategy is to better estimate the direct effect of innovation on job quality. Since previous empirical research stressed the strong positive effects of some work organization practices (HPWS) on job performance and job quality, it is important to distinguish the effect of innovation and the effect of work organization practices related to the innovation strategy. In a similar vein, we conducted three sets of regressions: one without controlling for work organization practices, a second with these variables, and a third with interactions terms.

First, without controlling for work organization practices, we find results that are in line with those of previous studies. Innovation in the workplace is associated with better employment conditions (better pay and more contractual stability); simultaneously, however, the work requires more investment on the employee side. On average, new technology adoption leads to more pressure, more risks and weaker working time quality at work. This ambivalent first effect supports the well-known concept of wage compensation: jobs are more demanding, and consequently, the employer has to offer better contractual conditions. However, innovation also seems related to better job satisfaction and a better social environment. This observation could be linked with the motivating dimension of the innovative workplace. Indeed, as frequently pointed out[13], an innovative environment can be viewed by some employees as a source of motivation. For instance, this effect is particularly relevant in the case of startups.

However, these effects from our broad innovation variable probably encompass very different realities of innovation. As seen at the beginning of the article, innovation may be accompanied by different

11 Table 4.1 present the regression without the controls for the characteristics. The full table is in the appendices (Table 4.5).

12 Note that the question refers to new technology adoption in the workplace that impacts employee work.

13 A rich literature on workplace innovation stresses the link between an innovation environment and employees' motivation and well-being (Fu et al. 2015 and Eurofound 2013).

organizational practices. To refine these preliminary results, we add innovation variables and work organization variables as controls in our model.

In our second set of regression, the first interesting result comes from the possible indirect effect from new technology adoption. When our explanatory variable is controlled by work organization practices, it has a weaker effect on job quality, but this effect remains significant expect for the social environment dimension of job quality. Regarding work organization practices, we find the traditional and well-known positive relationship with job quality. Involvement, autonomy and flexibility as well as learning practices improve all job quality dimensions and job satisfaction. As the literature on work organization practices (OECD, 2013; Eurofound, 2013; Fu et al. 2015) points out, these practices could be presented as a means to counterbalance the negative effect of the in-depth degree of task division. In our regression, a stronger division of tasks is instead associated with lower job quality dimensions.

Moreover, we observe negative impacts or no effects from our variable of reorganization[14] on all dimensions of job quality (no effect on the contractual dimension, pay and employment). The social environment, quality of working time, pressure at work and job satisfaction seem to deteriorate when reorganization occurs. These observations are quite difficult to interpret, but the literature on organizational change (Lam, 2004) underlines different strategies according to the status of the innovator; in cases where new technology adoption seeks to increase cost-efficiency, organizational restructuration is more binding for the employee (efficiency's goals) than in cases of new technology production, where new organizational practices aim to increase the innovativeness of employees (creativity's goals). We could assume that, here, we capture the first effect.

Otherwise, ICT use has a somewhat positive effect on employees in terms of not only pay and employment stability but also the working condition dimensions except work pressure. Indeed, the use of new ICT seems to be associated with more pressure at work, which could be explained by the fact that it creates a constant link with colleagues and the capacity to work at a distance, which could lead to more pressure in terms of deadlines. In a similar vein, we could think about the effects of digital platforms leading to more control for workers.

Finally, in the last set of regressions, we try to refine our measure of innovation by combining it with work organization practices; we aim to obtain measures of different types of implemented innovation. This third model confirms that our innovation variable covers different realities: indeed, it remains significant only for pay, workplace risks and work pressure. The general effect of innovation seems to confirm the existence of a compensation effect. However, for the other dimensions (except the social environment), we find specific effects from our combined variables. Thus, in a context of innovation, employment stability is reinforced in the case of learning practices. Autonomy is also a key element for reducing risks in the workplace when innovation occurs. Beyond the own positive effects from work organization learning practices, these results confirm that they are a precondition to improve job quality when innovation is introduced.

The use of ICT practices combined with innovation is negatively related to employment stability and pay as well as job satisfaction. This last effect was not an explicit hypothesis of our study but, rather, is

[14] Note that this variable of organizational change is strongly correlated with our main variable of innovation (technology adoption).

in line with the view of the new digital transformation. New ICT aims to reduces complex tasks and standardized work. Being confronted with new technology when we mainly use ICT tends to reduce the relative value of skilled labor compared to “software skills” (Acemoglu and Restrepo, 2016; Frey and Osborne, 2017). In this regard, it has been pointed out that new digital technologies are the main driver of employment variation by a deep reorganization of the value chain.

Overall, these results confirm the ambiguous effects, both positive and negative, that innovation may have on employees and their jobs, but two effects certainly do not appear for each employee. For instance, we can assume the following interpretation. In cases where innovation is the main driver of a firm’s activity, its implementation will probably be accompanied by learning practices and autonomy and flexibility to allow employees to be able to efficiently adapt to this innovation. In this case, employees will thus benefit from better stability, better pay and fewer risks at work. In contrast, in cases process or standardized innovation, driven by the competitiveness goal (cost reduction by a new software or information system), employees may obtain better pay but have higher risks and more pressure. However, this interpretation, coming from our preliminary results, must be approached with caution. First, our empirical analysis does not provide causality but correlation, and second, innovation, as defined in this paper, is a broad concept that includes very different realities, such as radical innovation close to the technology frontier and more incremental (or adoption) innovation processes with a goal of cost reduction.

In terms of control variables, the usual relationships are observed. Job quality is, on average, higher in larger firms and for high-skilled workers with a high level of education. The agricultural sector is characterized by lower job quality, and the manufacturing sector is riskier and offers the lowest employment stability. Finally, as expected, the service sector is characterized by the strongest work pressure. Furthermore, our age control variables present concave effects, as frequently outlined in employment studies.

To synthesize the insights from our three sets of regressions, we could assume that the significant positive link between innovation and job quality is, in reality, strongly mediated by work organization practices such as learning, involvement and autonomy. Depending on these work organization practices, innovation could be viewed as a virtuous circle or a vicious circle. These two extreme cases are also probably related to the characteristics of jobs, such as the degree of task routinization of jobs. To extend the analysis, we conduct a regression (third model) on the subsamples by the degree of routinization.

Table 4.1: Econometric results with the job quality dimensions as dependent variables (linear regression, OLS)[15]

	Full sample			Full sample			Full sample			Full sample			Full sample			Full sample			Full sample		
	Pay			**Employment stability and advancement**			**Social environment**			**Workplace risks**			**Working time quality**			**Work pressure**			**Job satisfaction**		
Explicative variables	***Model 1***	***Model 2***	***Model 3***	***Model 1***	***Model 2***	***Model 3***	***Model 1***	***Model 2***	***Model 3***	***Model 1***	***Model 2***	***Model 3***	***Model 1***	***Model 2***	***Model 3***	***Model 1***	***Model 2***	***Model 3***	***Model 1***	***Model 2***	***Model 3***
New technology adoption in the workplace	0.00874***	0.00637***	0.0136*	0.0642***	0.0326***	0.00480	0.00611*	0.000731	0.00142	0.0306***	0.0195***	0.0634***	-0.0122***	-0.00777*	-0.0141	0.0533***	0.0106*	0.0296*	0.0213***	0.0167***	0.0209
	(4.80)	(3.47)	(2.28)	(21.89)	(10.70)	(0.52)	(2.03)	(0.22)	(0.14)	(8.85)	(5.22)	(5.55)	(-4.46)	(-2.51)	(-1.53)	(12.03)	(2.22)	(2.08)	(4.61)	(3.37)	(1.32)
Learning practices		0.0138***	0.00997*		0.216***	0.203***		0.0302***	0.0382***		-0.0163*	-0.00748		-0.00954	-0.00692		0.0288**	0.0246*		0.0837***	0.0876***
		(3.85)	(2.16)		(36.16)	(27.50)		(4.54)	(4.87)		(-2.20)	(-0.85)		(-1.63)	(-0.94)		(3.11)	(2.14)		(8.23)	(7.18)
Autonomy and flexibility		0.0135***	0.0120**		0.00324	-0.00253		0.0136*	0.0130		-0.0750***	-0.0592***		0.0206***	0.0185**		-0.0852***	-0.0816***		0.0895***	0.0948***
		(3.86)	(2.74)		(0.59)	(-0.37)		(2.25)	(1.78)		(-11.41)	(-7.32)		(3.80)	(2.71)		(-10.11)	(-7.76)		(9.89)	(8.31)
Involvement		0.0144***	0.0191***		0.0432***	0.0375***		0.161***	0.153***		0.0469***	0.0426***		-0.0278***	-0.0291***		0.0287**	0.0351**		0.224***	0.213***
		(3.84)	(4.18)		(7.67)	(5.13)		(26.90)	(21.10)		(6.96)	(5.26)		(-4.93)	(-4.10)		(3.21)	(3.09)		(24.17)	(18.44)
Degree of task division		-0.0132***	-0.00917*		0.00892	0.0133		-0.0210***	-0.0221**		0.160***	0.169***		-0.0284***	-0.0330***		0.260***	0.270***		-0.0753***	-0.0787***
		(-3.46)	(-2.07)		(1.56)	(1.88)		(-3.30)	(-2.89)		(21.95)	(19.15)		(-4.89)	(-4.64)		(29.82)	(25.06)		(-8.00)	(-6.62)
Substantial reorganization in the workplace		-0.000370	-0.0000319		0.00460	0.00489		-0.0167***	-0.0168***		0.0106**	0.0108**		-0.00838***	-0.00856***		0.0288***	0.0292***		-0.0423***	-0.0424***
		(-0.20)	(-0.02)		(1.46)	(1.55)		(-4.88)	(-4.90)		(2.75)	(2.80)		(-2.64)	(-2.69)		(5.89)	(5.96)		(-8.29)	(-8.29)

[15] the effects of the control variables are reported in the appendices.

ICT use	0.00653***	0.0119***	0.0114***	0.0192***	-0.0112**	-0.0102*	-0.0589***	-0.0575***	0.0300***	0.0302***	0.0647***	0.0637***	0.00323	0.0159*
	(3.04)	(4.18)	(3.40)	(4.30)	(-3.07)	(-2.12)	(-15.50)	(-12.20)	(9.17)	(7.34)	(12.20)	(9.09)	(0.63)	(2.41)
Learning practices * New technology adoption in the workplace		0.00837		0.0336**		-0.0200		-0.0256		-0.00601		0.00901		-0.0111
		(1.22)		(2.92)		(-1.57)		(-1.81)		(-0.53)		(0.50)		(-0.57)
Autonomy and flexibility * New technology adoption in the workplace		0.00436		0.0162		0.00222		-0.0393**		0.00539		-0.00946		-0.0109
		(0.63)		(1.53)		(0.19)		(-2.97)		(0.51)		(-0.57)		(-0.61)
Involvement * New technology adoption in the workplace		-0.0124		0.0155		0.0183		0.00757		0.00360		-0.0165		0.0249
		(-1.65)		(1.39)		(1.50)		(0.55)		(0.32)		(-0.92)		(1.36)
Degree of task division * New technology adoption in the workplace		-0.0103		-0.00888		0.00244		-0.0227		0.0114		-0.0248		0.00835
		(-1.36)		(-0.80)		(0.20)		(-1.61)		(1.04)		(-1.49)		(0.46)

New technology adoption in the workplace * ICT use	-0.0108**	-0.0170**	-0.00246	-0.00108	-0.000577	0.00267	-0.0254**
	(-2.75)	(-2.85)	(-0.37)	(-0.16)	(-0.10)	(0.28)	(-2.71)

Regression by the RTI index

In the second part of the empirical analysis, we conduct regressions on subsamples (model 3) to identify some heterogeneity among the structures of the workforce. In this section, we want to test the main RBTC hypothesis. We divide our sample into three subsamples by the degree of task routinization[16]. Table 4.3 (below) presents only the effects of the explanatory variables and work organization practices and not the controls because their effects are very similar to the previous regression.

As we could expect, we find different profiles of new technology adoption according to the degree of task routinization. In itself, new technology adoption is positively associated with pay for workers with task routinization. The negative effect on workplace risks is confirmed for all task routinization groups[17]. Interestingly, in itself, innovation seems to be positively associated with job satisfaction only for workers with weak task routinization.

In addition, we find an average positive effect of our three first variables of work organization practices on the job quality dimension. More specifically, learning practices seem to have a stronger effect on highly routinized jobs, involvement seems to have stronger effects for workers with low and moderate task routinization, and autonomy and flexibility seem to be more homogeneous. In contrast, the degree of task division has a negative effect on employment stability, but we find a positive effect on the middle task routinization group in the case of pay and job stability. We can also stress the very strong links between job satisfaction and the work organization variables. An interpretation of the differences of these effects by occupations could be the relative intra-occupation variability, which differs by level of routinization. Indeed, learning practices are less frequent for highly routinized jobs; thus, the effect of these practices is more likely to be associated with specific working conditions.

Organizational change impacts all kinds of workers. It is associated with a weaker social environment and higher work pressure for jobs with low routinization. For those with moderate routinization, only the effect on the social environment remains significant, and for highly routinized jobs, organizational change also seems to induce a negative effect on workplace risks. Moreover, we can underline the strong negative effect that organizational change entails in terms of job satisfaction, as shown in the first set of regressions. Here, the negative effect is quite strong and significant for all groups of workers.
We can also underline the positive effects of ICT use in terms of quality of employment (stability and pay) for highly and moderately routinized jobs and in terms of working time quality for jobs with low and moderate routinization. We also find a homogenous positive relation of ICT use and work pressure.

From this perspective, the analysis of combined effects by subgroups brings new insights. For instance, new technology adoption mainly seems to bring benefits in terms of wages for highly routinized jobs, but if this innovation process is combined with a high level of task division, then the positive effect is compensated by a negative effect. This first observation supports the phenomenon of automation. The labor-saving effects of innovation require a deep division of tasks with reorganization, which could be viewed as a way to increase the substitutability of work by technology and could thus explain the weaker wages.

[16] The sample is divided into three categories based on the RTI index developed by Author and Dorn (2013); in the appendices (Table 4.2), the occupations that compose each group are reported. We also test the same strategy by skill level; we do not report these results here, but they are available upon demand.
[17] In contrast to the regressions by skill level, as expected, the findings for middle- and low-skilled workers, unlike high-skilled workers, support the workplace risks induced by innovation.

In the same vein, new technology adoption coupled with learning practices is associated with better employment stability for moderately and highly routinized jobs. This observation also supports the idea of different ways to implement innovation. We also find that autonomy coupled with new technology adoption induces instead a positive effect for highly routinized jobs (employment stability) or moderately routinized jobs (workplace risks).
Finally, quite surprisingly, involvement coupled with innovation seems to reduce pay and, simultaneously, improve the social environment for workers with routinization. A "startup effect" could explain this finding; highly involved employees agree to work in an innovative firm rather than in large firms and arbitrate between a high wage with fewer challenges and a low wage with better motivation.
In general, from a learning perspective, work organization practices seem instead to be a way to improve the quality of jobs for moderately and highly routinized jobs facing innovation.

The combined effects are weakly significant since the sample size is lower. However, innovation coupled with ICT remains significant in three dimensions for workers with a medium level of task routinization. The adoption of new ICT is correlated with weaker pay, weaker stability and weaker job satisfaction. Examining the features of the jobs that are in this middle category, we find precisely jobs that are confronted with digitalization. At first glance, this result could be quite surprising because routine theory predicts that the strongest negative effects of technological change will be jobs with a higher level of routinization. However, these jobs are mainly manual and face automation; in other words, they are weakly complementary to new ICT. Our results seem to point to a digitalization process where moderately routinized jobs face bad task reorganization when new technology is introduced.

Table 4.3: Econometric results with the job quality dimensions as the dependent variables by the RTI index (linear regression, OLS)

	Low RTI index	Middle RTI index	High RTI index	Low RTI index	Middle RTI index	High RTI index	Low RTI index	Middle RTI index	High RTI index	Low RTI index	Middle RTI index	High RTI index	Low RTI index	Middle RTI index	High RTI index	Low RTI index	Middle RTI index	High RTI index	Low RTI index	Middle RTI index	High RTI index
	Pay	**Pay**	**Pay**	**Employment stability**	**Employment stability**	**Employment stability**	**Social environment**	**Social environment**	**Social environment**	**Workplace risks**	**Workplace risks**	**Workplace risks**	**Working time quality**	**Working time quality**	**Working time quality**	**Work pressure**	**Work pressure**	**Work pressure**	**Job satisfaction**	**Job satisfaction**	**Job satisfaction**
Explicative variables	*Model 3*	*Model 3*	*Model 3*	*Model 3*	*Model 3*	*Model 3*	*Model 3*	*Model 3*	*Model 3*	*Model 3*	*Model 3*	*Model 3*	*Model 3*	*Model 3*	*Model 3*	*Model 3*	*Model 3*	*Model 3*	*Model 3*	*Model 3*	*Model 3*
New technology adoption at workplace	0.0143	0.00763	0.0329**	0.0252	0.00591	-0.0120	-0.00722	-0.0147	-0.00382	0.0448**	0.0499**	0.0704**	-0.0321	-0.0243	0.0144	0.0381	0.0393	0.0352	0.0670*	-0.0113	-0.0164
	(1.25)	(0.78)	(2.74)	(1.55)	(0.35)	(-0.77)	(-0.38)	(-0.86)	(-0.20)	(2.73)	(2.73)	(2.82)	(-1.88)	(-1.58)	(0.90)	(1.52)	(1.60)	(1.36)	(2.39)	(-0.43)	(-0.55)
Learning practices	0.00978	0.0134	0.00619	0.259***	0.180***	0.161***	0.0240	0.0212	0.0458**	0.0132	-0.0119	-0.0363*	-0.00560	-0.0212	-0.00662	0.0265	0.0593**	0.0224	0.0680**	0.0941***	0.0695**
	(1.12)	(1.58)	(0.82)	(20.44)	(13.11)	(12.88)	(1.79)	(1.55)	(3.18)	(1.06)	(-0.83)	(-2.00)	(-0.43)	(-1.60)	(-0.51)	(1.31)	(2.99)	(1.11)	(3.33)	(4.37)	(3.13)
Autonomy and flexibility	0.0251**	0.00421	0.0118	-0.00234	0.00442	-0.00190	0.0133	0.0188	0.0224	-0.0834***	-0.0227	-0.0407*	-0.00330	0.0276*	0.0432**	-0.0824***	-0.122***	-0.0666***	0.0963**	0.0839***	0.130***
	(2.99)	(0.54)	(1.81)	(-0.19)	(0.36)	(-0.17)	(1.01)	(1.55)	(1.68)	(-6.63)	(-1.76)	(-2.49)	(-0.29)	(2.22)	(3.57)	(-4.51)	(-6.67)	(-3.56)	(5.11)	(4.22)	(6.20)
Involvement	0.0291**	0.0179*	0.00485	0.0334*	0.0514***	0.0229	0.155***	0.136***	0.163***	0.0551**	0.0246	0.0374*	-0.0335***	-0.0381**	-0.0222	0.0146	0.0661***	0.0398*	0.190***	0.204***	0.229***
	(3.56)	(2.32)	(0.60)	(2.57)	(4.08)	(1.87)	(12.66)	(10.72)	(12.55)	(4.75)	(1.91)	(2.26)	(-2.82)	(-3.15)	(-1.76)	(0.73)	(3.50)	(2.01)	(9.85)	(9.98)	(11.17)
Degree of tasks division	-0.0309***	0.0109	-0.00913	0.0207	0.0254*	-0.00232	-0.00714	-0.0212	-0.0323*	0.102***	0.137***	0.236***	-0.0456***	-0.0124	-0.0339***	0.263***	0.271***	0.269***	-0.0363	-0.0719***	-0.110***
	(-3.52)	(1.25)	(-1.46)	(1.50)	(2.00)	(-0.21)	(-0.50)	(-1.67)	(-2.42)	(7.41)	(9.20)	(14.47)	(-3.58)	(-0.90)	(-2.98)	(12.91)	(14.71)	(14.64)	(-1.76)	(-3.40)	(-5.32)
Substantial re-organization at workplace	0.00126	0.000765	-0.00200	0.00292	0.00327	0.00703	-0.0184***	-0.0225***	-0.0115	0.00932	0.00830	0.0190*	-0.00853	-0.00686	-0.0104	0.0476**	0.0255**	0.00938	-0.0416***	-0.0462***	-0.0422***
	(0.42)	(0.21)	(-0.65)	(0.60)	(0.56)	(1.23)	(-3.49)	(-3.69)	(-1.81)	(1.87)	(1.21)	(2.22)	(-1.67)	(-1.14)	(-1.89)	(6.00)	(2.81)	(1.11)	(-5.44)	(-4.81)	(-4.32)
ICT use	0.00286	0.0252***	0.0221***	0.0140*	0.0235**	0.0315**	-0.00921	-0.00873	-0.00733	-0.0424***	-0.0718***	-0.0374*	0.0266**	0.0435***	0.0147	0.0884**	0.0357**	0.0606*	0.0165	0.0152	0.0111
	(0.68)	(5.50)	(3.63)	(2.22)	(3.02)	(2.60)	(-1.31)	(-1.11)	(-0.59)	(-7.26)	(-8.86)	(-2.06)	(4.36)	(6.85)	(1.35)	(9.05)	(3.13)	(2.50)	(1.80)	(1.28)	(0.66)
Learning practices * New technology adoption at workplace	0.0229	-0.00603	-0.00669	-0.0119	0.0824***	0.0453*	-0.0136	-0.00614	-0.00290	-0.0285	-0.0144	-0.0212	0.00134	-0.00107	-0.0145	0.0210	-0.0276	-0.0301	-0.0446	-0.0103	0.0585
	(1.89)	(-0.48)	(-0.54)	(-0.65)	(3.80)	(2.07)	(-0.64)	(-0.30)	(-0.12)	(-1.46)	(-0.57)	(-0.70)	(0.07)	(-0.05)	(-0.75)	(0.69)	(-0.88)	(-0.93)	(-1.37)	(-0.31)	(1.64)
Autonomy and flexibility * New technology adoption at workplace	-0.0101	0.0160	0.000853	0.0216	-0.0214	0.0482*	-0.0151	0.0192	0.0208	-0.0304	-0.0539*	-0.0273	0.0291	0.00272	-0.0299	-0.0266	0.00561	0.0253	-0.0265	0.00711	-0.0146
	(-0.89)	(1.24)	(0.07)	(1.28)	(-1.10)	(2.46)	(-0.77)	(1.00)	(0.88)	(-1.69)	(-2.29)	(-0.94)	(1.70)	(0.14)	(-1.60)	(-0.98)	(0.19)	(0.84)	(-0.93)	(0.24)	(-0.41)
Involvement * New technology adoption at workplace	-0.0307*	-0.00968	0.00397	0.0127	0.0181	0.0145	0.0471*	0.0144	-0.0132	-0.00102	0.0275	0.00631	-0.00531	0.00213	0.0268	-0.00621	-0.0439	-0.0196	0.0460	0.0340	0.00506
	(-2.47)	(-0.70)	(0.31)	(0.71)	(0.90)	(0.70)	(2.40)	(0.69)	(-0.58)	(-0.06)	(1.16)	(0.20)	(-0.29)	(0.11)	(1.36)	(-0.21)	(-1.39)	(-0.62)	(1.56)	(1.09)	(0.15)
Degree of tasks division * New technology adoption at workplace	0.00940	0.00113	-0.0386**	-0.00633	-0.0167	-0.00553	-0.0216	0.0130	0.0149	0.0117	-0.00807	-0.0497	0.0177	0.0162	-0.00766	-0.0104	-0.0279	-0.0163	-0.0555	0.0673*	0.0216
	(0.71)	(0.08)	(-2.93)	(-0.32)	(-0.83)	(-0.28)	(-1.01)	(0.61)	(0.67)	(0.57)	(-0.33)	(-1.65)	(0.89)	(0.82)	(-0.43)	(-0.36)	(-0.93)	(-0.56)	(-1.82)	(2.11)	(0.62)
New technology adoption at workplace * ICT use	-0.00561	-0.0223***	-0.00716	-0.00938	-0.0270*	-0.0180	0.00636	-0.00488	-0.0182	0.000175	-0.00229	0.00952	0.00134	0.00351	-0.0152	-0.0172	0.0186	-0.0151	-0.0201	-0.0428**	-0.00839
	(-1.01)	(-3.31)	(-0.72)	(-1.07)	(-2.51)	(-1.13)	(0.65)	(-0.45)	(-1.00)	(0.02)	(-0.19)	(0.39)	(0.15)	(0.36)	(-1.03)	(-1.21)	(1.13)	(-0.53)	(-1.49)	(-2.60)	(-0.35)
Controls																					
Industry Control	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Level of education	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Size of the firm	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Country	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Age	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Gender	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
N observations	12736	9705	9833	12736	9705	9833	12736	9705	9833	12736	9705	9833	12736	9705	9833	12736	9705	9833	12736	9705	9833

5. Conclusions

From the perspective of improving our understanding of the global effect of innovation on employment practices, our paper focuses on the qualitative impact of innovation (new technology adoption) in the the workplace. In this respect, we discuss the different contributions of the literature regarding the link between innovation and job characteristics to formulate our hypotheses. Based on an empirical methodology, which comes from the job quality literature, and work organization practices, we try to build a new model that underlines the controlled relationships among innovation, work organization practices and job quality dimensions. As revealed above, the main limits of our work concern, on the one hand, the difficulty of conducting analyses for causality and, on the other hand, the weakness of our innovation variable. These powerful limits call for new research that is able to overcome these issues. It is also essential to call for the development of an improved database that should deeply relate employment (working conditions and work organization practices) to the innovation environment (input, output, strategy, types of innovation, etc.).

However, our study offers an empirical analysis that encompasses broad aspects of jobs and employment. It turns out that our empirical analysis emphasizes some interesting and original empirical facts. First, it confirms that innovation must be studied as a multidimensional phenomenon that is interrelated to employment institutions, working conditions and work organization practices. From this perspective, innovation diffusion seems to have heterogeneous effects according to not only the types of innovation but also the dimensions of job quality observed and the firm environment where it occurs. This finding supports the research program of complexity in studying the effect of innovation on employment (Robert and Yoguel, 2015).

Second, as some scholars describe it, innovation is associated with organizational practices, especially those that stimulate involvement, autonomy and learning practices (learning organization / HPWS) as well as more traditional forms of work task division.

Third, from this perspective, it seems that innovation has in its own limited effects on the job quality dimensions and even somewhat mixed effects in terms of contractual aspects. The frequent positive link stressed by previous studies could thus come from the effect of the good work organization practices associated with innovation.

Fourth, we confirm the results of previous studies regarding the positive impact of the learning organization and the HPWS on the job quality dimension; simultaneously, however, but our study underlines some mixed effects. First, involvement leads to more pressure and more intensity at work, and second, task division, which leads to negative effects on job quality, is positively associated with learning practices and involvement.

Fifth, innovation has differentiated effects, depending on its characteristics; despite the limited measure of innovation in our dataset, our results support the fact that some cost reduction innovations (digitalization or automation) could have a negative effect on job quality. Our empirical model requires further studies that entail the possibility to better identify the type of innovation, based on the Oslo Manual methodology.

Sixth, our study does not provide clear conclusion on the issue of technological bias among workers. We could argue that innovation is organizationally biased because we observe that a HPWS coupled with innovation leads to better jobs. The subsample regressions by the degree of task routinization also seem to support the idea of somewhat more positive effects for tasks with a low level of routinization, as opposed to highly routinized tasks, from new technology adoption. Thus, in terms of the qualitative aspects of jobs (and not creation-destruction analysis), we instead support the idea of routine-biased effects but cannot reject the existence of skilled-biased effects since high-skilled workers (creative workers) benefit more from the learning organization.

To conclude, our study brings some interesting evidence and fits well with the different views of the phenomenon of innovation in regard to employment; however, further research is necessary. Our methodology contains several limits that we presented; simultaneously, however, it allows a more complex and detailed analysis. Further work in this field must distinguish innovation diffusion and innovation production or radical innovation since it seems that these two types of innovation include different realities; similarly, innovation, measured based on ICT diffusion, especially digital platforms, could be particularly relevant. Such a distinction should make it possible to more precisely investigate the causality of the effect. Finally, the impact of innovation on work organization practices and job quality in the workplace should be articulated with the quantitative impact of innovation on employment (destruction and creation of employment) to better understand the overall effect and better respond to political and societal expectations.

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APPENDICES:

Table 2.1: Summary of key studies on job quality

Author	Objective	Dimensions	Level of analysis
Guergoat-Larivière, Marchand (2012)	Literature review	- Health and working conditions - Earnings - Working times and work-life balance - Security employment and Social protection - Social dialogue and collective representation - Life-long learning	Literature review
Erhel, Davoine (2008)	Improve Laeken methodology, a new reference of quality of Jobs analysis	- Socio-economic security (i.e. decent wages and secure transitions) - Skills and training - Working conditions - Ability to combine work and family life, and promotion of gender equality	National level with macro variables
OECD (2015)	Proposal of a tridimensional measure of Job quality.	- Earnings quality - Labor market security - Quality of the working environment	National level with macro variables
de Bustillo et al. (2008)	Provide an individual measure of job quality focused of personal features	- Pay - Intrinsic quality of work - Employment quality - Workplace risks - Working time and work-life balance	Individual level with micro variables (from survey EWCS)
Eurofound (2012a)	Establish a measure of job quality backed on the European Working Conditions Survey	- Earnings - Prospects - Intrinsic job quality - Working time quality	Individual level with micro variables (from survey EWCS)

Table 3.2: Average score of work dimensions by occupation

Occupations	Pay	Employment stability and advancement	Workplace risks	Working time quality	Work pressure	Social environment	Learning practices	Autonomy and flexibility	Involvement	Degree of tasks division
Armed Forces Occupations	0.60	0.56	0.20	0.83	0.27	0.89	0.71	0.54	0.55	0.52
Managers	0.63	0.51	0.15	0.80	0.31	0.89	0.66	0.78	0.75	0.44
Professionals	0.63	0.54	0.14	0.87	0.27	0.88	0.70	0.63	0.62	0.40

Technicians and Associate Professionals	0.60	0.52	0.15	0.87	0.30	0.86	0.67	0.61	0.54	0.44
Clerical Support Workers	0.58	0.48	0.14	0.90	0.29	0.85	0.55	0.53	0.44	0.43
Services and Sales Workers	0.53	0.43	0.23	0.78	0.27	0.86	0.47	0.49	0.47	0.35
Skilled Agricultural. Forestry and Fishery Workers	0.43	0.36	0.34	0.70	0.19	0.90	0.43	0.81	0.62	0.34
Craft and Related Trades Workers	0.53	0.43	0.40	0.86	0.29	0.87	0.52	0.51	0.50	0.53
Plant and Machine Operators and Assemblers	0.50	0.43	0.31	0.80	0.29	0.84	0.44	0.39	0.37	0.52
Elementary Occupations	0.51	0.37	0.33	0.87	0.24	0.83	0.32	0.51	0.37	0.37
Total	0.56	0.46	0.23	0.84	0.28	0.86	0.55	0.56	0.51	0.42

Source: EWCS 2010

Table 3.3: Average score of work dimensions by industry

Industries	**Pay**	**Employment stability and advancement**	**Workplace risks**	**Working time quality**	**Work pressure**	**Social environment**	**Learning practices**	**Autonomy and flexibility**	**Involvement**	**Degree of tasks division**
AGRICULTURE	0.43	0.37	0.32	0.74	0.19	0.89	0.43	0.73	0.56	0.35
MANUFACTURING	0.53	0.46	0.29	0.86	0.27	0.85	0.54	0.49	0.48	0.55
CONSTRUCTION	0.56	0.42	0.38	0.87	0.31	0.88	0.53	0.57	0.54	0.50
SERVICES	0.58	0.47	0.20	0.84	0.28	0.86	0.56	0.56	0.52	0.39
Total	*0.56*	*0.46*	*0.23*	*0.84*	*0.28*	*0.86*	*0.55*	*0.56*	*0.51*	*0.42*

Source: EWCS 2010

Table 3.4: Correlation table of our indexes

	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**	**(13)**	**(14)**
(1) Pay	1.0000													

(2) Employment stability and advancement	0.3087*	1.0000												
(3) Workplace risks	-0.1422*	-0.1386*	1.0000											
(4) Working time quality	0.1338*	0.0393*	-0.1628*	1.0000										
(5) Work pressure	0.0683*	0.0828*	0.2723*	-0.1768*	1.0000									
(6) Social environment	0.0044	0.0852*	-0.1018*	0.0566*	-0.1684*	1.0000								
(7) Job satisfaction	0.3262*	0.3906*	-0.2086*	0.1107*	-0.1322*	0.3708*	1.0000							
(8) Learning practices	0.2524*	0.4920*	-0.1615*	0.0382*	0.1260*	0.0974*	0.2432*	1.0000						
(9) Autonomy and flexibility	0.1906*	0.1086*	-0.1925*	0.0085	-0.1243*	0.1505*	0.2786*	0.2441*	1.0000					
(10) Involvement	0.1706*	0.2321*	-0.0825*	-0.0312*	0.0295*	0.2924*	0.3498*	0.3833*	0.4810*	1.0000				
(11) Degree of tasks division	0.0167*	0.1468*	0.2466*	-0.0228*	0.3301*	-0.0287*	-0.0631*	0.1971*	-0.1933*	0.0508*	1.0000			
(12) New technology adoption	0.1678*	0.2836*	-0.0230*	0.0126	0.1386*	0.0084	0.0898*	0.3227*	0.0577*	0.1489*	0.2291*	1.0000		
(13) New organization	0.1278*	0.2093*	-0.0052	0.0125	0.1503*	-0.0286*	0.0116	0.2444*	0.0235*	0.1091*	0.2234*	0.4672*	1.0000	
(14) ICT use	0.2248*	0.2593*	-0.2981*	0.1209*	0.1182*	0.0229*	0.1528*	0.3153*	0.2312*	0.2020*	0.0653*	0.2110*	0.1729*	1.0000

Source: EWCS 2010

Table 3.5: Correlation table innovation variable at country level

New technology adoption	**New organization and restructuring**	**Number of patent per million**	**Total amount of R&D (% of GDP)**	**SII**	**Product or process innovation (CIS)**	**Marketing or organizational innovation**	**Product innovation**	**Process innovation**

New technology adoption	1.0000								
New organization and restructuring	0.9056*	1.0000							
Number of patent per million	0.5438*	0.4905*	1.0000						
Total amount of R&D (% of GDP)	0.5885*	0.5420*	0.7997*	1.0000					
SII	0.7142*	0.6000*	0.8003*	0.8598*	1.0000				
Product or process innovation (CIS)	0.5492*	0.4015	0.6537*	0.6916*	0.8356*	1.0000			
Marketing or organizational innovation	0.4534	0.2889	0.3998	0.4199	0.5887*	0.7504*	1.0000		
Product innovation	0.5749*	0.4305	0.6880*	0.7047*	0.8479*	0.9769*	0.7363*	1.0000	
Process innovation	0.3970	0.2486	0.3638	0.4490	0.5912*	0.8651*	0.7712*	0.8481*	1.0000

Source: CIS 2012. EWCS 2010 and OECD 2012

Table 3.6: New technology adoption by occupations

	New technology adoption	ICT use	New organization
Armed Forces Occupations	52.47%	43.31%	37.58%
Managers	51.20%	43.26%	57.82%
Professionals	51.08%	38.83%	50.78%
Technicians and Associate Professionals	51.03%	41.77%	55.87%
Clerical Support Workers	47.20%	41.11%	60.94%
Services and Sales Workers	27.35%	24.67%	12.75%
Skilled Agricultural. Forestry and Fishery Workers	25.45%	13.89%	3.96%
Craft and Related Trades Workers	37.51%	28.76%	7.00%
Plant and Machine Operators and Assemblers	38.55%	35.78%	5.27%
Elementary Occupations	19.29%	18.95%	3.06%
Total	*39.68%*	*32.96%*	*30.56%*

Source: EWCS 2010

Table 3.7: New technology adoption by industries

Industries	**New technology adoption**	**ICT use**	**New organization**
AGRICULTURE	27%	8%	16%
MANUFACTURING	48%	25%	42%
CONSTRUCTION	33%	17%	25%

SERVICES	39%	34%	33%
Total	*40%*	*30%*	*33%*

Source: EWCS 2010

Table 4.2 Degree of routine tasks, occupation by groups and comparison with skill level categories

Low Routinized Jobs

ISCO_08 2-digit	**Freq.**	**Percent**	**Skill level**
Chief executives, senior officials and legislators	272	1.97	High-skilled level
Administrative and commercial managers	755	5.46	High-skilled level
Hospitality, retail and other services managers	846	6.11	High-skilled level
Science and engineering professionals	695	5.02	High-skilled level
Health professionals	908	6.56	High-skilled level
Teaching professionals	2,401	17.35	High-skilled level
Business and administration professionals	720	5.20	High-skilled level
Legal, social and cultural professionals	873	6.31	High-skilled level
Business and administration associate professionals	2,585	18.68	High-skilled level
Legal, social, cultural and related associate professionals	483	3.49	High-skilled level
Information and communications technicians	314	2.27	High-skilled level
Customer services clerks	770	5.56	Middle-skilled level
Personal care workers	1,6	11.56	Middle-skilled level
Protective services workers	616	4.45	Middle-skilled level

Moderate Routinized Jobs

ISCO_08 2-digit	Freq.	Percent	**Skill level**
Production and specialized services managers	833	7.85	High-skilled level
Information and communications technology professionals	334	3.15	High-skilled level
Science and engineering associate professionals	819	7.72	High-skilled level
Health associate professionals	971	9.15	High-skilled level
General and keyboard clerks	1,134	10.69	Middle-skilled level
Other clerical support workers	441	4.16	Middle-skilled level
Personal service workers	1,953	18.41	Middle-skilled level
Sales workers	3,127	29.48	Middle-skilled level
Market-oriented skilled agricultural workers	864	8.14	Low-skilled level
Market-oriented skilled forestry, fishing and hunting workers	92	0.87	Low-skilled level

Street and related sales and service workers	40	0.38	Low-skilled level

High Routinized Jobs

ISCO_08 2-digit	Freq.	Percent	**Skill level**
Numerical and material recording clerks	977	8.76	Middle-skilled level
Building and related trades workers, excluding electricians	1,508	13.51	Low-skilled level
Metal, machinery and related trades workers	1,175	10.53	Low-skilled level
Handicraft and printing workers	253	2.27	Low-skilled level
Electrical and electronic trades worker	538	4.82	Low-skilled level
Food processing, wood working, garment and other craft and related trades workers	948	8.50	Low-skilled level
Stationary plant and machine operators	814	7.29	Low-skilled level
Assemblers	309	2.77	Low-skilled level
Drivers and mobile plant operators	1,481	13.27	Low-skilled level
Cleaners and helpers	1,8	16.13	Low-skilled level
Agricultural, forestry and fishery labourers	341	3.06	Low-skilled level
Labourers in mining, construction, manufacturing and transport	808	7.24	Low-skilled level
Food preparation assistants	207	1.86	Low-skilled level

Source: Autor and Dorn, 2013

Table 4.1: Econometric results with job quality dimensions as dependent variables (linear regression, OLS)

	Full sample			Full sample			Full sample			Full sample			Full sample			Full sample			Full sample		
	Pay			**Employment stability and advancement**			**Social environment**			**Workplace risks**			**Working time quality**			**Work pressure**			**Job satisfaction**		
Explicative variables (see Table 4.1.1)	***Model 1***	***Model 2***	***Model 3***	***Model 1***	***Model 2***	***Model 3***	***Model 1***	***Model 2***	***Model 3***	***Model 1***	***Model 2***	***Model 3***	***Model 1***	***Model 2***	***Model 3***	***Model 1***	***Model 2***	***Model 3***	***Model 1***	***Model 2***	***Model 3***
Control variables																					
Male	0.0267***	0.0244***	0.0244***	0.0240***	0.00905**	0.00901**	0.000371	-0.00929**	-0.00936**	0.00253	0.00490	0.00493	-0.0373***	-0.0378***	-0.0378***	0.00324	-0.00462	-0.00460	0.0226***	0.00271	0.00275
	(15.20)	(13.67)	(13.70)	(8.21)	(3.25)	(3.24)	(0.12)	(-3.15)	(-3.17)	(0.81)	(1.62)	(1.64)	(-13.57)	(-13.62)	(-13.62)	(0.74)	(-1.10)	(-1.09)	(4.98)	(0.62)	(0.63)
Female (reference)	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*
Age squared	-0.00000130***	-0.00000119***	-0.00000119***	0.00000350**	0.00000392**	0.00000377**	-1.88e-08 (-0.15)	0.00000471***	0.00000464***	0.00000103***	0.00000574***	0.00000587***	-0.000000431***	-0.00000377**	-0.00000378**	0.000000956***	0.00000231	0.00000238	-0.00000122	0.00000822***	0.00000821***
	(-15.30)	(-14.21)	(-14.15)	(2.70)	(3.18)	(3.04)		(3.72)	(3.67)	(7.10)	(4.06)	(4.15)	(-3.70)	(-3.17)	(-3.18)	(5.13)	(1.28)	(1.31)	(-0.62)	(4.27)	(4.26)
Age	0.00135***	0.00124***	0.00124***	-0.000391**	-0.000435***	-0.000418**	0.0000260	-0.000487***	-0.000480***	-0.00108***	-0.000626***	-0.000639***	0.000424***	0.000374**	0.000375**	-0.000954***	-0.000200	-0.000207	0.0000863	-0.000896***	-0.000894***
	(15.51)	(14.42)	(14.36)	(-2.92)	(-3.41)	(-3.27)	(0.20)	(-3.75)	(-3.70)	(-7.29)	(-4.30)	(-4.38)	(3.54)	(3.06)	(3.08)	(-4.97)	(-1.07)	(-1.11)	(0.42)	(-4.52)	(-4.51)
Industries																					
Agriculture	-0.0531***	-0.0542***	-0.0545***	-0.0576***	-0.0532***	-0.0527***	0.0206***	0.0109	0.0113	0.0976***	0.0970***	0.0959***	-0.0592***	-0.0580***	-0.0577***	-0.0575***	-0.0430***	-0.0437***	-0.0355***	-0.0566***	-0.0565***
	(-9.80)	(-9.94)	(-10.00)	(-8.89)	(-8.47)	(-8.41)	(3.50)	(1.85)	(1.92)	(11.11)	(11.41)	(11.27)	(-7.43)	(-7.15)	(-7.11)	(-6.44)	(-5.01)	(-5.09)	(-3.37)	(-5.45)	(-5.42)
Construction	0.0116***	0.0101**	0.00966**	-0.0221***	-0.0370***	-0.0373***	0.0264***	0.0130*	0.0130*	0.0903***	0.0801***	0.0796***	0.0553***	0.0580***	0.0582***	0.0317***	0.0131	0.0127	0.0243**	0.00308	0.00286
	(3.34)	(2.88)	(2.77)	(-4.37)	(-7.79)	(-7.84)	(5.05)	(2.54)	(2.53)	(11.31)	(10.39)	(10.31)	(12.45)	(13.15)	(13.20)	(3.99)	(1.70)	(1.64)	(2.79)	(0.36)	(0.34)
Manufacturing	0.00142	0.00191	0.00151	-0.0138***	-0.0180***	-0.0181***	0.00486	0.00319	0.00313	0.0354***	0.0201***	0.0198***	0.0333***	0.0363***	0.0364***	-0.0261***	-0.0540***	-0.0540***	0.000650	0.00165	0.00102
	(0.65)	(0.86)	(0.68)	(-3.41)	(-4.77)	(-4.80)	(1.10)	(0.75)	(0.73)	(6.97)	(4.11)	(4.04)	(9.42)	(10.25)	(10.24)	(-4.33)	(-9.19)	(-9.20)	(0.10)	(0.26)	(0.16)

Services (reference)	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*
Size of the firm																					
Single	-0.0176***	-0.0256***	-0.0249***	-0.0621***	-0.0612***	-0.0598***	0.0234***	-0.00560	-0.00500	-0.0124***	0.0359***	0.0357***	-0.0458***	-0.0557***	-0.0558***	-0.0678***	0.00961	0.00982	0.0562***	-0.0154	-0.0150
	(-4.52)	(-6.10)	(-5.94)	(-12.50)	(-12.12)	(-11.87)	(4.30)	(-0.98)	(-0.88)	(-2.38)	(6.40)	(6.33)	(-9.40)	(-10.68)	(-10.62)	(-9.93)	(1.37)	(1.39)	(7.24)	(-1.91)	(-1.86)
Very small entreprise	-0.00626***	-0.00905***	-0.00896***	-0.0249***	-0.0233***	-0.0233***	0.0227***	0.00929***	0.00943***	0.00490	0.0191***	0.0193***	-0.0204***	-0.0232***	-0.0233***	-0.0246***	0.000803	0.000894	0.0449***	0.0168**	0.0169**
	(-3.01)	(-4.39)	(-4.34)	(-7.00)	(-6.98)	(-6.94)	(6.33)	(2.65)	(2.69)	(1.20)	(4.78)	(4.84)	(-6.14)	(-6.98)	(-6.99)	(-4.47)	(0.15)	(0.17)	(7.88)	(3.06)	(3.08)
Small and medium entreprise (reference)	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*
Intermediate entreprise	0.00405	0.00503*	0.00500*	0.0109**	0.0101**	0.0103**	-0.00902*	-0.00358	-0.00355	0.00956*	0.00670	0.00677	-0.0122***	-0.0116**	-0.0117***	0.00310	-0.000395	-0.000180	-0.0155*	-0.00592	-0.00616
	(1.89)	(2.34)	(2.33)	(2.73)	(2.65)	(2.73)	(-2.03)	(-0.84)	(-0.83)	(2.00)	(1.46)	(1.48)	(-3.38)	(-3.26)	(-3.30)	(0.50)	(-0.07)	(-0.03)	(-2.33)	(-0.94)	(-0.98)
Big firms	0.0125***	0.0124***	0.0126***	0.0366***	0.0253***	0.0253***	-0.00509	-0.000726	-0.000262	0.00484	-0.00147	-0.000427	-0.0214***	-0.0197***	-0.0199***	0.00993	-0.0102	-0.00988	-0.0166*	-0.00905	-0.00847
	(4.26)	(4.22)	(4.27)	(7.80)	(5.75)	(5.73)	(-1.01)	(-0.15)	(-0.05)	(0.84)	(-0.26)	(-0.08)	(-4.85)	(-4.49)	(-4.50)	(1.33)	(-1.41)	(-1.37)	(-2.16)	(-1.25)	(-1.17)
Occupations																					
High-skilled workers	0.0222***	0.0200***	0.0194***	0.0207***	0.00296	0.00320	-0.00399	0.00148	0.00145	-0.0551***	-0.0376***	-0.0387***	0.0818***	0.0742***	0.0743***	-0.0187***	-0.0323***	-0.0327***	0.0162**	0.0156**	0.0149**
	(9.69)	(8.53)	(8.31)	(5.75)	(0.85)	(0.92)	(-1.12)	(0.42)	(0.41)	(-14.81)	(-9.99)	(-10.31)	(24.72)	(21.61)	(21.61)	(-3.55)	(-6.21)	(-6.26)	(2.94)	(2.90)	(2.75)
Middle-skilled workers (Reference)	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*
										0.111***	0.0899***	0.0893***									

Low-skilled workers	-0.00630**	-0.000255	-0.000164	-0.0257***	-0.00302	-0.00298	-0.0193***	0.00257	0.00256	(22.66)	(18.70)	(18.58)	0.0537***	0.0587***	0.0588***	-0.000575	-0.00386	-0.00407	-0.0470***	-0.000449	-0.000497
	(-2.63)	(-0.10)	(-0.07)	(-6.42)	(-0.79)	(-0.77)	(-4.80)	(0.64)	(0.64)				(13.66)	(14.55)	(14.55)	(-0.10)	(-0.66)	(-0.70)	(-7.31)	(-0.07)	(-0.08)
Level of education																					
Primary education	-0.00229	-0.000430	-0.000274	-0.0196***	-0.00422	-0.00403	-0.00963*	-0.00173	-0.00172	0.0293***	0.0283***	0.0282***	0.0134***	0.0126***	0.0126***	-0.00265	0.00550	0.00550	-0.00956	0.00559	0.00581
	(-0.95)	(-0.17)	(-0.11)	(-5.17)	(-1.17)	(-1.12)	(-2.35)	(-0.44)	(-0.43)	(6.36)	(6.31)	(6.30)	(3.68)	(3.41)	(3.42)	(-0.46)	(0.98)	(0.98)	(-1.52)	(0.92)	(0.96)
Secondary education (Reference)	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*	*Ref*
Terciary education	0.0435***	0.0389***	0.0390***	0.0384***	0.0180***	0.0173***	-0.00112	-0.0175***	-0.0176***	-0.0400***	-0.0281***	-0.0275***	0.00744*	0.00495	0.00493	0.00598	0.00431	0.00447	0.0401***	0.00622	0.00629
	(19.36)	(16.70)	(16.71)	(10.66)	(5.28)	(5.07)	(-0.30)	(-4.77)	(-4.78)	(-10.24)	(-7.40)	(-7.23)	(2.24)	(1.47)	(1.46)	(1.11)	(0.83)	(0.86)	(7.19)	(1.15)	(1.16)
Constant	0.539***	0.529***	0.526***	0.477***	0.341***	0.348***	0.822***	0.764***	0.764***	0.205***	0.154***	0.141***	0.797***	0.817***	0.820***	0.357***	0.228***	0.221***	0.596***	0.492***	0.491***
	(104.53)	(92.70)	(89.26)	(61.05)	(41.78)	(40.92)	(103.72)	(87.45)	(84.34)	(23.73)	(16.38)	(14.31)	(111.24)	(100.68)	(97.04)	(31.86)	(19.10)	(17.93)	(49.10)	(36.52)	(34.52)
Country control	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N observations	33069	32 691	32 691	33069	32 691	32 691	33069	32 691	32 691	33069	32 691	32 691	33069	32 691	32 691	33069	32 691	32 691	33069	32 691	32 691
t statistics in parentheses																					
* p<0.05	** p<0.01	*** p<0.001																			

Table 4.4: Econometric results with job quality dimensions as dependent variables by skill level (linear regression, OLS)

	High-skilled workers	Middle-skilled workers	Low-skilled workers	High-skilled workers	Middle-skilled workers	Low-skilled workers	High-skilled workers	Middle-skilled workers	Low-skilled workers	High-skilled workers	Middle-skilled workers	Low-skilled workers	High-skilled workers	Middle-skilled workers	Low-skilled workers	High-skilled workers	Middle-skilled workers	Low-skilled workers	High-skilled workers	Middle-skilled workers	Low-skilled workers
	Pay	**Pay**	**Pay**	**Employment stability**	**Employment stability**	**Employment stability**	**Social environment**	**Social environment**	**Social environment**	**Workplace risks**	**Workplace risks**	**Workplace risks**	**Working time quality**	**Working time quality**	**Working time quality**	**Work pressure**	**Work pressure**	**Work pressure**	**Job satisfaction**	**Job satisfaction**	**Job satisfaction**
Explicative variables																					
New technology adoption at workplace	0.00419	0.0183	0.0311*	0.0304*	0.0175	-0.00490	-0.0194	-0.00827	0.00705	0.0206	0.0714***	0.0672*	-0.0167	-0.0351	0.0202	0.0176	0.0348	0.0463	0.0278	-0.00405	-0.00817
	(0.45)	(1.49)	(2.33)	(1.99)	(0.83)	(-0.30)	(-1.07)	(-0.39)	(0.36)	(1.19)	(3.36)	(2.54)	(-1.19)	(-1.62)	(1.19)	(0.75)	(1.11)	(1.71)	(1.06)	(-0.12)	(-0.26)
New organization at workplace	-0.00458	0.00625	0.000545	0.00661	0.00594	0.00555	-0.0201**	-0.0405***	-0.0101	0.0101	0.0219*	0.0220	-0.0174**	-0.00827	-0.00735	0.0300*	0.0257	0.00514	-0.0567***	-0.0466**	-0.0525***
	(-1.29)	(0.98)	(0.13)	(0.93)	(0.57)	(0.68)	(-2.65)	(-3.33)	(-1.13)	(1.47)	(2.07)	(1.78)	(-2.70)	(-0.74)	(-0.86)	(2.56)	(1.79)	(0.43)	(-4.91)	(-2.82)	(-3.71)
New organization at workplace * New technology adoption at workplace	0.00740	-0.00894	-0.00324	-0.0102	-0.00847	0.00638	0.00293	0.0178	-0.00151	-0.000995	-0.00706	-0.00142	0.0105	0.0148	-0.00582	0.0180	0.0289	0.00766	0.0182	-0.00513	0.0212
	(1.46)	(-0.98)	(-0.50)	(-1.11)	(-0.59)	(0.54)	(0.29)	(1.14)	(-0.12)	(-0.11)	(-0.44)	(-0.08)	(1.20)	(0.92)	(-0.51)	(1.21)	(1.37)	(0.45)	(1.22)	(-0.21)	(1.05)
ICT use	-0.000966	0.0230**	0.0109	0.0138*	0.0369**	0.0242	-0.0128*	0.00260	-0.0308	-0.0483***	-0.0363**	-0.0229	0.0275***	0.00906	0.0162	0.0713***	0.0527**	0.0644	0.0145	0.0260	-0.00267
	(-0.27)	(3.28)	(1.19)	(2.34)	(2.98)	(1.46)	(-1.97)	(0.20)	(-1.66)	(-8.89)	(-2.87)	(-0.84)	(5.35)	(0.82)	(0.99)	(7.87)	(3.05)	(1.75)	(1.64)	(1.50)	(-0.13)
New technology adoption at workplace * ICT use	-0.00410	-0.00760	0.00770	-0.0139	-0.0167	0.000568	0.00900	-0.0222	-0.00235	-0.00522	-0.00746	0.0162	0.00229	0.0120	-0.0286	-0.00659	0.00207	-0.0135	-0.0228	-0.0391	-0.00429
	(-0.84)	(-0.72)	(0.54)	(-1.67)	(-0.98)	(0.03)	(0.98)	(-1.16)	(-0.09)	(-0.62)	(-0.36)	(0.43)	(0.29)	(0.66)	(-1.24)	(-0.49)	(0.08)	(-0.31)	(-1.75)	(-1.45)	(-0.13)
Learning practices	0.00904	0.00134	0.00378	0.252***	0.167***	0.159***	0.0227	0.0301*	0.0489***	-0.0156	0.0225	-0.0360	-0.0195	-0.0128	-0.00730	0.0307	0.0173	0.0223	0.0853***	0.0870***	0.0817***
	(1.14)	(0.14)	(0.49)	(19.20)	(11.93)	(12.37)	(1.68)	(2.14)	(3.33)	(-1.26)	(1.48)	(-1.91)	(-1.88)	(-0.82)	(-0.55)	(1.50)	(0.87)	(1.08)	(4.18)	(3.69)	(3.60)
Learning practices * New technology adoption at workplace	0.0207	0.00511	-0.00821	-0.00667	0.105***	0.0379	0.00196	-0.0441	-0.00337	-0.00837	-0.0391	-0.0251	-0.00615	-0.0398	-0.0123	0.0182	0.0225	-0.0359	-0.00407	-0.0229	0.0336
	(1.89)	(0.32)	(-0.64)	(-0.37)	(4.16)	(1.64)	(0.09)	(-1.78)	(-0.13)	(-0.42)	(-1.29)	(-0.78)	(-0.37)	(-1.38)	(-0.60)	(0.62)	(0.61)	(-1.05)	(-0.13)	(-0.53)	(0.92)
Autonomy and flexibility	0.0222**	-0.00244	0.00980	-0.00512	0.0200	-0.00330	0.0166	0.00870	0.0219	-0.0747***	-0.0103	-0.0379*	0.0156	0.00742	0.0382**	-0.0895***	-0.110***	-0.0681***	0.0918***	0.0707**	0.116***
	(2.94)	(-0.27)	(1.45)	(-0.43)	(1.54)	(-0.28)	(1.27)	(0.70)	(1.60)	(-6.28)	(-0.69)	(-2.27)	(1.50)	(0.53)	(3.09)	(-4.84)	(-5.85)	(-3.63)	(4.85)	(3.19)	(5.46)
Autonomy and flexibility * New technology adoption at workplace	-0.0118	0.0212	0.00207	0.0119	-0.00851	0.0440*	-0.00904	0.0344	0.0136	-0.0307	-0.0618*	-0.0144	0.0188	0.0164	-0.0347	-0.0193	-0.0338	0.0273	-0.0278	0.0437	-0.00373
	(-1.16)	(1.24)	(0.16)	(0.72)	(-0.36)	(2.16)	(-0.48)	(1.47)	(0.57)	(-1.76)	(-2.05)	(-0.47)	(1.26)	(0.60)	(-1.77)	(-0.75)	(-0.91)	(0.87)	(-1.05)	(1.10)	(-0.10)
Involvement	0.0216**	0.0200*	0.00703	0.0484***	0.0380**	0.0251*	0.154***	0.149***	0.161***	0.0455***	0.0263	0.0323	-0.0298**	-0.0224	-0.0257*	0.0146	0.0352	0.0539**	0.193***	0.225***	0.233***
	(3.11)	(2.22)	(0.85)	(3.84)	(2.80)	(1.97)	(12.75)	(11.29)	(12.01)	(4.01)	(1.86)	(1.89)	(-2.98)	(-1.49)	(-1.97)	(0.74)	(1.86)	(2.64)	(10.10)	(9.88)	(11.10)
Involvement * New technology adoption at workplace	-0.0229*	-0.0278	0.00588	0.00475	-0.00115	0.0125	0.0368*	0.00487	-0.0174	0.0223	0.0313	0.00889	-0.0108	0.0157	0.0265	0.0116	-0.0470	-0.0423	0.0277	0.0199	-0.00916
	(-2.06)	(-1.58)	(0.44)	(0.28)	(-0.04)	(0.57)	(1.99)	(0.20)	(-0.74)	(1.30)	(1.01)	(0.27)	(-0.71)	(0.55)	(1.28)	(0.42)	(-1.19)	(-1.27)	(1.01)	(0.46)	(-0.25)
Degree of tasks division	-0.0301***	0.0205*	-0.0113	0.00987	0.0503***	-0.00836	-0.0116	-0.0236	-0.0321*	0.112***	0.135***	0.247***	-0.0349**	-0.0321	-0.0336**	0.268***	0.297***	0.272***	-0.0660***	-0.0639**	-0.111***
	(-3.97)	(1.99)	(-1.78)	(0.75)	(3.56)	(-0.72)	(-0.85)	(-1.64)	(-2.35)	(8.29)	(8.25)	(14.74)	(-3.12)	(-1.90)	(-2.85)	(13.50)	(14.70)	(14.56)	(-3.31)	(-2.74)	(-5.21)
Degree of tasks division * New technology adoption at workplace	0.0112	-0.00932	-0.0358**	0.00458	-0.0572*	-0.0117	-0.0103	0.0278	0.00996	0.0217	-0.0124	-0.0516	0.0139	0.0130	-0.0101	-0.0409	-0.00773	-0.0194	-0.00708	0.0305	0.0195
	(1.02)	(-0.49)	(-2.64)	(0.26)	(-2.22)	(-0.56)	(-0.51)	(1.13)	(0.43)	(1.09)	(-0.41)	(-1.62)	(0.83)	(0.48)	(-0.53)	(-1.47)	(-0.20)	(-0.64)	(-0.25)	(0.72)	(0.53)
Controls																					
Industry Control	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Level of education	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Size of the firm	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Country	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Age	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
Gender	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*	*Yes*
N observations	13293	7410	9385	13293	7410	9385	13293	7410	9385	13293	7410	9385	13293	7410	9385	13293	7410	9385	13293	7410	9385