Article

The Human Sustainability of ICT and Management Changes: Evidence for the French Public and Private Sectors

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Abstract: We investigate the human sustainability of ICT and management changes using a French linked employer-employee survey on organizational changes and computerization (COI). We approach the human sustainability of changes through the evolutions of work intensity, skill utilization and the subjective relationship to work. We compare in the private sector and the State civil service the impacts of ICT and management changes on the evolution of these three dimensions of work experience. We find that when ICT and management changes are intense, they are positively associated in the public sector with work intensification and new knowledge. In the private sector ICT and management changes increase the use of skills, but at a rate decreasing with their intensity and without favoring the accumulation of new knowledge. However, their impacts on the subjective relationship to work are much stronger, with public sector employees expressing discouragement as well as the feeling of an increased effort-reward imbalance when private sector employees become more committed. We tested that the self-selection of employees, the specific sources and paths of changes and the implementation of performance pay did not explain this divergence. We identify two partial explanations: one is related with employee turnover in the private sector, the other one with the role of trade unions. These results suggest that the human sustainability of ICT and management changes depends on their intensity and on how their implementation takes into account the institutional context of the organization.

Keywords: organizational changes; ICT; management tools; work experience; employee outcomes; comparison of public and private sectors; linked employer-employee survey

1. Introduction

The large definition of a sustainable development adopted the Brundtland report where both the needs of the present and of the future have to be met allows applications in all fields of human activity [1], including work. The concept of sustainable work system crafted from 2002 in an international research program takes into account both workers' well-being and the quality of goods and services produced [2]. Since then, many studies and researches in social sciences explored sustainable work from different angles and developed tools to measure its various dimensions. Volkoff and Gaudard [3] argue that sustainable work depends on physical constraints, which can become harmful for physical health in the long run, but also on work organization, that may favor or alter well-being, mental health and skills' development according to how work intensity, autonomy and workers' cooperation are combined in the workplace.

Questions surrounding the work experience of French employees have entered the public debate following what the media has described as a spate of work-related suicides in large French companies between 2006 and 2009. A set of converging empirical results further established the

difficulty of performing work in France. International surveys of the values of individuals revealed that the French gave work a particularly high importance while simultaneously demonstrating reluctance about the place that it took in their lives, revealing a contradiction that generates unease between the growing demands of work on one side and the need to protect their personal lives on the other. Between 1995 and 2015, French workers have faced a slow but persistent degradation of their working conditions, creating a vulnerability to work-related risks above the European median [4]. As possible sources of this apparent deterioration of the quality of working life, several authors have emphasized the effects of recorded changes in productive organizations since the 1980s. However, the debate on the consequences of organizational changes is not fully resolved there is a clear division between authors who stress the intensive rather than sustainable nature of new work systems when others who highlight the mutual gains and the enrichment of work brought about by these changes [5].

Furthermore, it is interesting to consider this issue in both private and public organizations. Indeed, some authors argue that the management style of the French State civil service has moved towards the practices and values of the private sector [6]. Changes in government would thus be partly implemented using management tools that by private companies have also adopted. It is therefore relevant to consider how these tools, which are becoming common, impact working conditions in both institutional sectors. Some empirical studies have shown that organizational changes did not have the same effects in the two sectors. For instance [7] found that the methods developed in the private sector did not have the same impact in the public sector in terms of workers' autonomy.

In this paper, we question the human sustainability of organizational changes driven by the implementation of new ICT and management tools. We study the relationship between indicators of change in private sector organizations and in the State civil service and indicators of evolution in the work experience of employees. To our knowledge, it is only in Norway [8] and Britain [9, 10] attempts to analyze the dynamic dimension of the relationship between workplace practices and employee outcomes have been made using representative datasets. In addition, we consider multiple dimensions of both organizational changes and work experience. We summarize organizational changes with two continuous indicators that describe the evolution in the use of Information and Communication Technologies (ICTs) and of management tools [11]. We do not focus on a unique dimension of work experience as reported by the surveyed employees, but consider work intensification, job enrichment and the subjective relationship to work.

We use the linked employer-employee survey on organizational change and computerization (COI), which includes a survey of private sector organizations as well as a survey of the State civil service. It allows us to measure the organizational changes that occurred between 2003 and 2006/2007 from retrospective questions asked to employers in the public and private sectors. The analysis of their implications for the workforce comes from an identical questionnaire for employees of both sectors. Thus, the matching of employer level data with data from their employees allows drawing relationships between the introduction of organizational changes and their subsequent effects on the workplace.

Our main finding is the identification of a divergence between the public and the private sector in how organizational changes driven by the adoption of new ICT and management tools interact with the subjective relationship to work. We further explore this result by considering and testing possible explanation related to institutional differences between the two sectors.

The organization of this paper is as follows: Section 2 presents our modelling and the data we use. Section 3 gives our results on the relationships between organizational changes and the evolution of work experience. Section 4 tests various hypotheses about the reasons of the observed divergence between the private and the public sectors. Section 5 concludes.

Modelling and data

2.1. Basic econometric model

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We assume that tools used by organizations reflect models of organized action and employers reveal their intention of changes through the adoption or dropping of tools. As a result, the diffusion dynamics of new equipment and tools reflect the intensity of organizational changes [12]. We distinguish two types of tools as they apply to different functions in the organization: those that relate to the management of information systems and those that concern the management of productive activity. ICTs are part of the first family. The rapid decline in the relative prices of computer equipment and the growing scope applications due to technological progress as well as network effects has fueled their diffusion. Management tools like *just in time production* or *quality certifications* are part of the second family. They relate with the diffusion of management concepts like *high performance work organizations* in the private sector and *new public management* in the public sector. The distinction between these two broad types of tools allows to cover a large set of organizational changes and to consider the consequences of their joint adoption for employees' work experience. Indeed, the literature on productive complementarity argues that it is their joint use that yields the highest performance impact in private as well as public sector organizations [13; 14; 15; 16; 17].

Furthermore, previous studies have shown that employees' work experience is more sensitive to the cumulative adoption of tools or practices than to the implementation of any specific one [18]. This is in line with the results in Godard [19] showing that as the number of high performance practices increases, their positive effect on workers' well-being decreases and eventually becomes negative, especially for self-esteem and satisfaction. Thus, if the joint adoption of tools is beneficial for economic performance, it could be to the detriment of employees' quality of working life. This questions the human sustainability of economic performance. As discussed earlier, we consider three dimensions of work experience likely to be influence by organizational changes and contributing to the quality of working life: work intensity, skills utilization and the subjective relationship to work. The generic model we estimate is the following:

$$Z_{ij} = \alpha X_i + \beta Y_j + \theta \Delta ICT_j + \mu \Delta ICT_j^2 + \gamma \Delta MAN_j + \delta \Delta MAN_j^2 + + \tau \Delta ICT_j * \Delta MAN_j * + \varepsilon_i \quad (1)$$

Z_{ij} identifies the change in work experience indicators for the worker i in the productive organization j. This change is captured by binary or ordinal variables. ΔICT_j and ΔMAN_j are respectively the indicators of changes in ICTs and in use of management tools for the employer j. The X and Y vectors represent control variables defining respectively the characteristics of the worker i and of his employer j. Finally, ε_i is a random error term specific to the worker i. The quadratic form of the specification we choose allows for nonlinear effects of organizational changes. Beyond some intensity thresholds, a mitigation or aggravation of the influence of changes on work experience indicators could occur. The last variable is an interaction term between the two types of changes capturing the impact on work experience indicators of simultaneous changes in ICTs and management tools.

Specification (1) is a first differences model chosen to eliminate all constant fixed effects in the 2003-2006 period of observation, like those created by the subjective perception of employee work experience. Thus, the unobservable heterogeneity that we cannot control here would play through omitted variables influencing simultaneously organizational changes and the evolution of the perception of working life.

Considering that we are only looking for an evaluation of the partial effects of explanatory variables, we estimate the generic specification (1) at the sample mean using a linear model. In fact, as stated by Wooldridge [20], using linear estimation of a binary or ordinal variable is correct as far as the estimated coefficients are not used for the purpose of predictions. This choice has consequences on the interpretation of marginal effects as can be seen from the influence of changes in ICT tools:

$$\frac{\partial Z}{\partial \Delta ICT} = \theta + 2\mu \Delta ICT + \tau \Delta MAN \quad (2)$$

This effect varies with the intensity of changes both in management and in ICT tools. The estimated coefficient $\hat{\theta}$ measures the marginal effect of changes in ICT tools when both types of changes are at the sample mean. As the quadratic form in specification (1) allows for both non-constant returns and complementarity effects in the influence of changes, a complete picture of the relationship requires estimation at various points of the distributions of changes. We have run these estimations and we will consider them in interpreting the results at the sample mean, but we will not present them.

Furthermore, we have considered the possibility of a voluntary ex ante selection of workers in the sectors. We perform the Heckman two stages method. The first stage consists in estimating the choice of sector by the worker with a probit model. The second stage takes into account this possible voluntary selection augmenting specifications (1) with the inverse Mills ratio (or λ) . This ratio, which corrects the omitted variable bias, is calculated from the estimated results of the first stage regression. We use two sets of instrumental variables to identify our model. The first contains indicators describing the occupation held by the father of the worker when he was eighteen, and the second identifies whether his mother was of French nationality. Indeed, the assumption of social reproduction predicts an influence of parental choice on the career paths for the children. In addition, the preference for employment in the public sector can be part of a public sector motivation, which foundations may rely on parental education. Finally, foreign origin is usually an obstacle for entry into the French civil service. We will present further specifications in section 4, with their associated theoretical hypothesis.

2.2. Data, measurement frame and descriptive statistics

2.2.1. A linked employer-employee survey

We rely on the linked employer-employee survey on organizational change and computerization (COI 2006), which includes a survey of private sector organizations (COI-TIC) as well as a survey of the State civil service (COI-FP). Random samples of organizations with 10 employees and more have been selected in both sectors. Each surveys has a specific questionnaire with a common architecture, a large part of which covers a similar set of information on changes in the organization of productive units. Most of the questions relate to the year of the survey, 2006 in the private sector and 2007 in the public sector, and the retrospective situation in 2003, which allows us to measure the organizational changes that occurred between 2003 and 2006/2007.

The questions capturing work experience come from a unique questionnaire addressed to employees whatever the institutional characteristic of their organization. Employees have been randomly selected in responding organizations (in a random sub-sample of them for the private sector) and their number is related, not strictly proportional, to their workforce. Once sampled, employees have been interviewed about 12 months later, with the consequence that they have at least one year of seniority. The population studied here is thus that of stable employees in companies and administrations.

In order to study a comparable population from the two sectors, we took out from the sample of private sector employees occupations not represented in the public sector like salespersons, drivers or laborers. Reciprocally, we excluded from the scope of the investigation in the State civil teachers, magistrates and agents of the Ministry of Defense service because their work activity had no equivalent in the private sector. We merge the employer and employee sections of the survey in the final sample. This leads to restricting the private sector to units of 20 or more employees as employees have not been sampled below this size threshold. The resulting working sample, which is representative of the covered population, contains 11731 employees working in 5643 enterprises and 946 public agents working in 298 organizations.

2.2.2. The intensity of organizational change

The analysis of organizational changes in the private and public sectors requires addressing three methodological issues. First, because no tool or equipment can alone summarize the

heterogeneity of observed management strategies, we have to find a way to capture the diversity in the uses of modernizing tools by productive organizations. We thus choose to synthesize the use of ICTs and management tools with composite indexes that take into account this diversity. We use Multiple Correspondence Analysis (MCA), which aims at producing a simplified low-dimensional representation of information in the large frequency table where each item response, identifying whether the company uses each of the listed tools, is coded as a dummy variable. The MCA generates quantitative scores, called dimensions, which are linear combinations of the dummy-coded variables that maximize the average correlation among them. We use the survey sampling weights in the analysis. We interpret the vector of coefficients in the linear combination as a metric determined by the set of situations taken into account in the analysis and corresponding to a given type of tools in an institutional sector at a given date. We limit ourselves to the first dimension of the MCA, which reflects the intensity in use of the selected tools. On this first dimension, organizations using several tools jointly are opposed with organizations that are non-users or that are only using a small number of them. More advanced tools that are at the beginning of their diffusion curve in the population of organizations score higher in the composite index. Thus, a composite index with a higher value indicates that the organization uses a larger set of more advanced ICT or management tools.

Second, we have to measure the change over time of our composite indicator. The COI survey collects information at the date of the survey (2006 for the private sector and 2007 for the State Civil Service) and for 2003 through a retrospective question. We could perform the MCA for both dates; with the disadvantage of obtaining a representation of the data determined in different situations in time. The indicator of the intensity in use of a given set of tools would then be specific to a particular date. We therefore create an additional hypothesis for a temporal comparison. As the date of the survey is an implicit reference in the retrospective questions throughout the questionnaire, we apply to the tools used by the productive organizations in 2003, the metric conditioned by the situations at this date. In computational terms, this calculation amounts to applying the vector of coefficients defining the position of the productive organizations on the first dimension of the MCA conducted in 2006 to the vector of the tools used in 2003. We obtain a synthetic indicator of the tools observed in 2003, expressed in the metric or the base of 2006. We then simply compute the change indicator as the first difference between the intensity in use of modernization tools observed in 2006/2007 and in 2003 (expressed in base 2006).

Third changes measured in the private and the public sectors have to be comparable. This requires the identification of a set of tools used in both institutional sectors and the determination of a common metric underlying the composite index. We conducted a thorough comparison of questions concerning ICTs and management tools in the two employer questionnaires and selected questions about similar or comparable tools. Fifteen ICT tools and thirteen management tools came out from this analysis as common to both sectors. As with temporal comparisons, we choose to express changes in the public sector using the private sector 2006 baseline metric. Indeed, the questionnaire designed to apply specifically to State administrations was built to align with the measurement of changes developed in the private sector. Furthermore, like in many European nations, the reform of the French civil service relies on the import of management tools used in the private sector [21]. Table A1 in the Appendix gives the list of ICTs and management tools, the percentage of organizations using them in 2003 and 2006/2007 in the private and the public sector and the private sector 2006 baseline metric.

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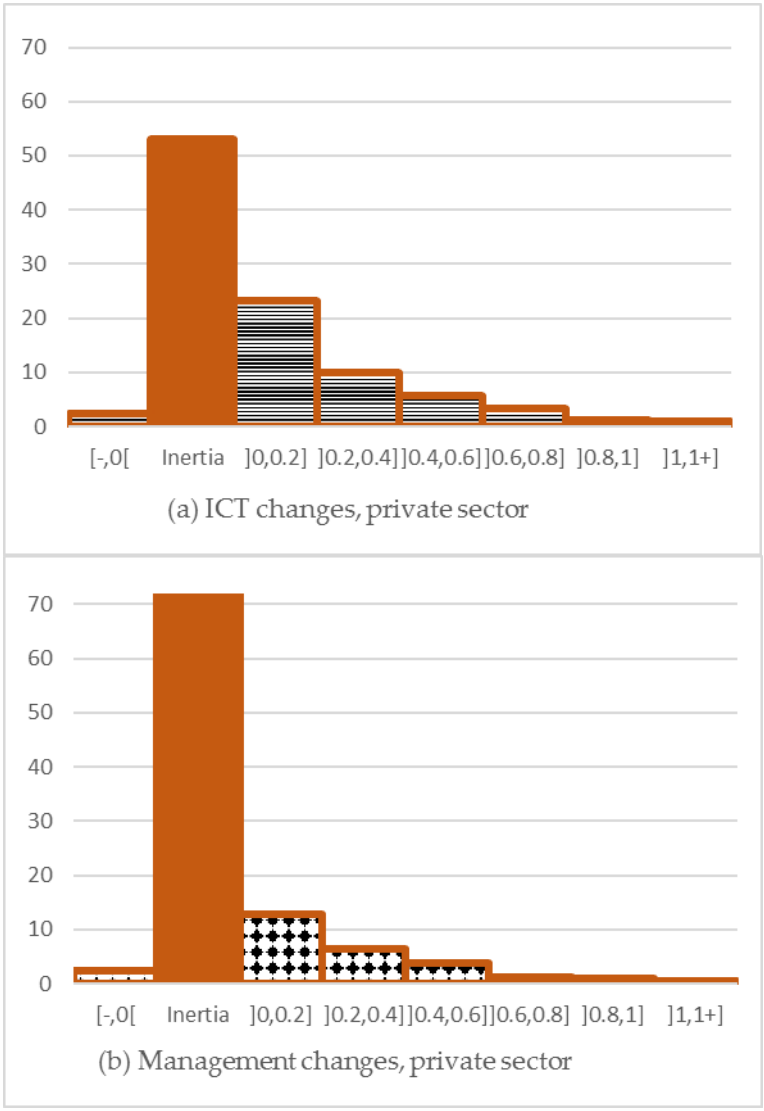

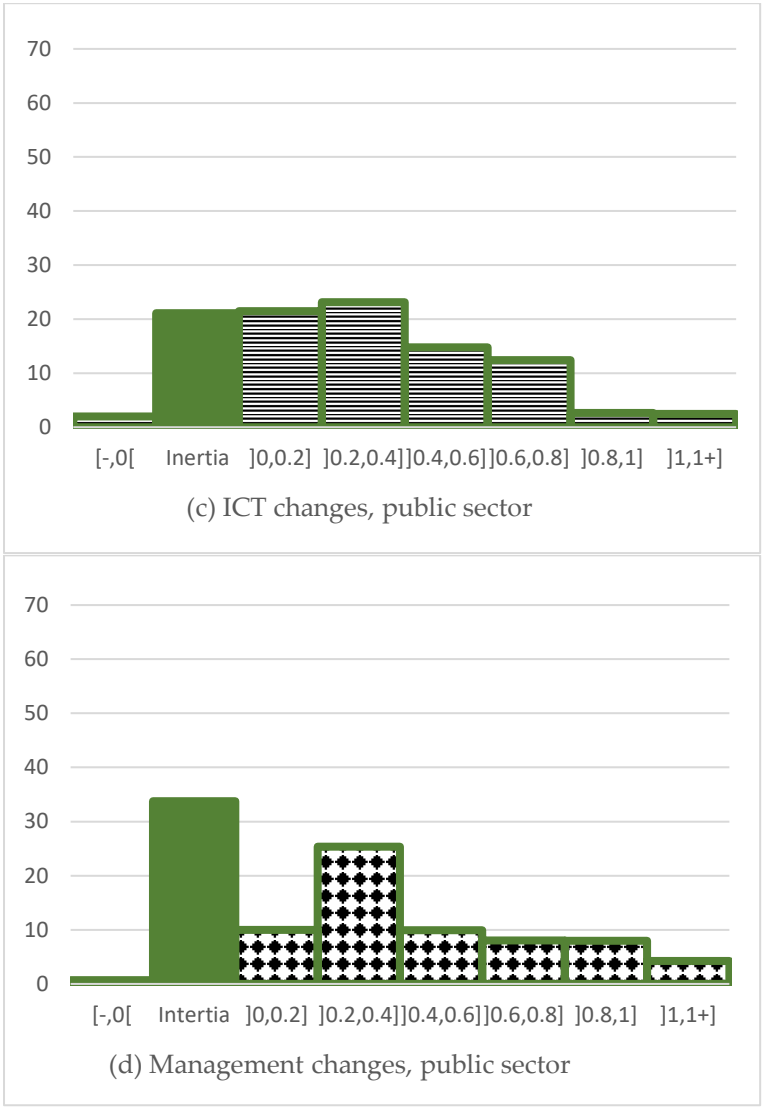

Graph 1. Distribution of ICT and management changes in the populations of private and public organizations
Data source: COI 2006/INSEE-DARES-CEE, COIFP 2006/DGAFP-DARES-CEE
Coverage: Productive units of 20 or more employees in the private sector and of 10 or more employees in the public sector. Weighted data.

One striking feature in graph 1, which is contrary to common belief, is the higher inertia of private sector companies compared with public administrations. In the private sector, respectively 53% of enterprises have not implemented any ICT changes (a) and 72% no management changes (b) when these figures amount to respectively 21% (c) and 34% (d) in the State civil service. As a result, there is substantial average difference between public and private employers. The average change was twice as large in the State civil service for ICT changes and more than four times greater for management changes. Furthermore, in the private sector, the share of companies having implemented changes decrease with their intensity when situations are more contrasted in the public sector. The mode of the distribution of the two indexes in the private sector is inertia. In the public sector, intermediate intensities of change (0.2+, 0.4) constitute the modal group for ICT changes and the second modal group for management changes which distribution is bimodal. It is also interesting to note that private and public sector organizations seldom indicate that they drop tools. The change dynamic is that of an accumulation of new tools rather than a process of substitution between them. Finally, the ICTs dynamics is stronger than the management tools dynamics, especially in the private sector where only a small share of companies has implemented management changes.

To seize how ICT relates with management change, we have crossed two dummy variables indicating whether the organization had implemented a change other than marginal (changes strictly lower to 0.2). We are thus able to identify four groups of organizations: stable ones, with substantial ICT changes only, with substantial management changes only, with both substantial ICT and management changes. The top part of table 1 shows the exposure of employees to these four types of organizational contexts in the private and public sectors. It confirms the findings of Graph 1 and gives further information. About 60% of employees in the private sector work in companies that have remained stable as they have not implemented any substantial ICT or management changes. The most frequent type of change in this sector is ICT changes only, which affects 21% of employees. In contrast, only 23% of public sector employees belong to stable organization and 37% of them are exposed to substantial ICT and management changes. Overall, the working environment of employees in the State civil service seems more unsettled than that of private sector employees.

2.2.3. The dependent and control variables

We consider three dimensions of work experience: work intensity, skill utilization and the subjective relationship to work. We distinguish two indicators of work intensification. The first measures whether the constraints weighing on work pace decreased, increased, or remained stable over the last three years. The questionnaire identifies five types of constraints according to their source: internal demand, external demand, deadlines or production standards to meet, automatic movement of a product or part or machine pace, and the work of one or more colleagues. The second indicator measures whether activity peaks became more frequent or less frequent over the past three years or whether their frequency remained unchanged. The measurement of work intensity through constraints weighing on the work pace is a classical approach in working conditions survey, which implicitly assumes that the technical and organizational environment regulates workers' activity. The inclusion of the reference to an external demand requiring an immediate response augmented this classic measure to adapt it to service activities. The second indicator, on the frequency of activity peaks, complements the first one by further assessing work intensity in the service sector where it is more difficult to control the pace of work, as most of the time the work activity cannot be separated from the delivery of the service.

We approach skill development with complementary indicators. The first one measures the evolution of skill use over the past three years. This indicator tells us whether the employee needs to activate his knowledge while working more or less intensively than before. To some extent, this indicator measures the enrichment of the employee's work. The second indicator defines whether the employee feels that he has the opportunity of learning new things at work. The fact of increasing skill utilization or knowledge is likely to make work richer but also more complex.

Finally, we measure the evolution the subjective relationship to work by a direct answer to the question: Do you get involved more, less, or as much as you did three years ago or when you arrived

at the company (if recently hired)? The COI survey supplements this measure by an assessment of the recognition of employees' work by the employer. This question, asked at the very end of the questionnaire, determines whether employees believes that their work is recognized at fair value upon consideration of what they brings to their company and the corresponding benefits they get. It measures the employees' perception of the fairness of the treatment that they receive at the workplace.

Table 1. Employees' exposure to organizational change and evolution of quality of working life across sectors

% Employees	**Private sector**	**Public sector**
Exposure to organizational change		
ICT and management changes	8.2	36.8
ICT changes only	20.9	18.1
Management changes only	11.2	21.9
Inertia or marginal changes (<0.20)	59.7	23.2
Evolution of quality of working life		
Work intensification		
Increased constraints on work pace	39.8	41.3
Decreased constraints on work pace	5.2	3.7
Stable constraints on work pace	40.9	34.5
No constraints on work pace	14.1	20.5
More activity peaks	38.5	42.2
Similar activity peaks	41.4	41.2
Fewer activity peaks	12.2	8.9
No activity peaks	7.9	7.7
Skill development		
Increased use of skills	41.8	40.1
Similar use of skills	46.6	46.4
Reduced use of skills	11.6	13.6
Learning new things at work	73.8	81.6
Evolution of the subjective relationship to work		
More involved	33.0	30.6
Similarly involved	52.5	56.8
Less involved	14.6	12.6
Work recognised at fair value	44.9	38.8
Number of observations	11,731	946

Data source: COI 2006/INSEE-DARES-CEE, COIFP 2006/DGAFP-DARES-CEE
Coverage: Stable employees (one year of service) from productive units of 20 or more employees in the private sector and 10 or more employees in the public sector. Weighted data.

We report descriptive statistics across sectors for these indicators in Table 1. Public sector employees report slightly more frequent work intensification (41.3% vs 39.8% for increased constraints on work pace and 42.2% vs 38.5% for more activity peaks) as well as more frequent opportunities of learning new things at work (81.6% vs 73.8%), but without higher increase in skill use (40.1% vs 41.8%). In addition, employees of the State civil service more often report that they are less involved (30.6% vs 33%) and that they do not feel recognized at their fair value (61,2% vs 55,1%).

Control variables in our regressions benefit from the linkage between the employer and employee survey, which makes high quality and detailed information on both levels available. From the employer's side a first set of dummies indicate the main sector where the company operates and in the State civil service the relevant ministry; a second set of dummies indicate the size of the interviewed employer unit. From the employees' side, the control variables taken into account are as follows: sex, seniority, age, education, marital status, spouse's employment status (employed or non-

employed), weekly working hours, part-time work, employment status, and pay, net of all social security contributions. Regressions also include the inverse Mills ratio to control for the ex-ante self-selection of employees in the private and public sector.

3. Organizational changes and the evolution of working life quality

3.1 Work intensification in the public sector for intense ICT related organizational changes

Tables 2 displays the estimated results for the indicators of work intensification: the evolution of constraints weighing on the work pace and the evolution of activity peaks. The table shows the coefficients associated with the quadratic form for ICT and management changes. It does not show the control variables coefficients except for the inverse Mills ratio (Lambda). As an illustration, the coefficient reported in the first row and the first column identifies the marginal effect of the indicator of ICT changes (Ch. ICT) on the evolution of constraints on the work pace in the private sector, measured at the sample mean. It is positive and very weakly significant (10.6% significance level).

Table 2. Effects of organizational changes on work intensification

Evolution of…	**…constraints on work pace**		**…activity peaks**	
	Private sector	**Public sector**	**Private sector**	**Public sector**
Ch. ICT	0.086	-0.056	0.072	-0.101
	(0.106)	(0.521)	(0.216)	(0.270)
Ch. ICT²	-0.122	**0.262***	**-0.196***	**0.250***
	(0.290)	**(0.063)**	**(0.075)**	**(0.054)**
Ch. Management	0.015	-0.001	-0.002	0.122
	(0.830)	(0.994)	(0.978)	(0.157)
Ch. Management²	-0.062	0.157	-0.023	0.113
	(0.644)	(0.248)	(0.849)	(0.367)
Interaction ch.	-0.192	0.074	0.131	0.041
	(0.274)	(0.764)	(0.397)	(0.858)
Lambda	-0.172	-0.431	-0.017	-0.090
	(0.115)	(0.123)	(0.918)	(0.451)
Observations	10,079	756	10,806	873

Data sources: COI 2006/INSEE-DARES-CEE, COIFP 2006/DGAFP-DARES-CEE
Coverage: Stable employees (one year of service) from productive units of 20 or more employees in the private sector and 10 or more employees in the public sector.
Note: Controls included for employer and employee level characteristics and for employee self-selection, weighted regressions, significance level in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

The evolution of constraints weighing on the work pace seems to be relatively unaffected by organizational changes in the private sector as none of the coefficients reported in the first column of table 2 is significant at conventional statistical thresholds. The estimations at various points of the distribution of changes (which we do not report here) confirm this result: it only shows a weakly positive marginal effect of ICT changes on the evolution of work pace constraints for median values of the two indicators of change. The second indicator of work intensification, the evolution of activity peaks, shows similar results at sample mean (third column of table 2) although at the second-order, ICT changes have a weakly significant negative impact. However, the estimations at various points of the distribution of changes do not suggest a decrease in the incidence of activity peaks in response to organizational changes in the private sector.

Results are more conclusive in the public sector for intense ICT related organizational changes. The second column of table 2 shows that at the second-order the coefficient associated with ICT changes is positive and weakly significant, suggesting a U-shaped relationship. The estimations at various points of the distribution of changes confirm this relationship. In administrations with high intensities of both types of changes, State officials feel reinforced obligations to adjust to an imposed work pace. In the fourth column of table 2, the results for activity peaks show a similar profile as those for work pace constraints, with a positive but weakly significant coefficient associated with ICT changes at the second order. However, the estimations at various points of the distribution of changes show at best a positive marginal effect of management changes on increased activity peaks, which increases in value and significance with the intensity of organizational changes.

Finally, the coefficient associated with lambda is negative but non-significant. Therefore, the inclusion of the inverse Mills ratio in the regressions has not altered the result.

3.2 Contrasted change related skill development in the private and public sectors

In contrast to the results discussed so far, the evolution of skill development reported in table 3 shows a clear difference between the private and the public sectors. Public officials in the State civil service do not seem to perceive organizational changes as inducing changes in the use of their skills (column 2) and the estimations at various points of the distribution of ICT and management changes confirm this result. In contrast, private sector employees perceive an increased use of their skills with ICT and management changes, but at a rate that decreases with the intensity of changes (column 1). Indeed, first order terms are positive and significant, second order terms are negative and the interaction effect is negative. However, the positive impact on skill use is stronger for management changes than for ICT changes: the first order effect is of higher magnitude and the second order effect is non-significant. The estimations at various points of the distribution of changes shows that the increased use of skills vanishes when ICT changes reach their higher decile, but remains positive and significant, albeit with a lower magnitude, for management changes.

Table 3. Effects of organizational changes on skill development

	Evolution of skill use		**Learning new things at works**	
	Private sector	**Public sector**	**Private sector**	**Public sector**
Ch. ICT	**0.098****	0.066	0.0323	**0.076***
	(0.047)	(0.505)	(0.303)	**(0.072)**
Ch. ICT²	**-0.241****	-0.169	**-0.111****	-0.076
	(0.020)	(0.398)	**(0.037)**	(0.239)
Ch. Management	**0.194****	-0.104	0.037	-0.064
	(0.026)	(0.235)	(0.345)	(0.151)
Ch. Management²	-0.201	0.183	-0.037	0.089
	(0.171)	(0.175)	(0.561)	(0.204)
Interaction ch.	**0.300***	0.198	0.034	0.159
	(0.058)	(0.437)	(0.674)	(0.158)
Lambda	0.225	0.075	-0.011	**-0.122****
	(0.290)	(0.531)	(0.885)	**(0.020)**
Observations	11,731	946	11,731	946

Data sources: COI 2006/INSEE-DARES-CEE, COIFP 2006/DGAFP-DARES-CEE
Coverage: Stable employees (one year of service) from productive units of 20 or more employees in the private sector and 10 or more employees in the public sector.
Note: Controls included for employer and employee level characteristics and for employee self-selection, weighted regressions, significance level in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

It is striking to see that employees in the private sector do not seem to accumulate new knowledge with ICT and management changes (column 3). The negative impact of ICT changes at the second order on learning new things at work does not lead to any significant result in the estimations at different points in the distribution of changes. Thus in the private sector, changes contribute to skills development, but with some limitations. They increase the use of skills, but at a decreasing rate and without favoring the accumulation of new knowledge and this limitation seems to be stronger for ICT changes than for management changes.

If skill use appears unaffected by ICT and management changes in the public sector, employees seem to accumulate new knowledge with some combinations of changes. The last column of table 3 shows a positive but weakly significant coefficient associated with ICT changes and the estimations at various points of the distribution of changes show positive impacts on learning new things at work for high magnitudes of changes in the two families of tools.

The coefficient associated with lambda is negative and significant in the public sector. Hence, there is a negative correlation between unobserved heterogeneity favoring self-selection in the public sector and learning new things at work. However, the results on skills development are robust to the inclusion of inverse Mills ratio in the regressions.

3.3 Diverging impacts of changes on the evolution the subjective relationship to work in the two sectors

The largest difference between the private and public sectors appears in the field of work commitment. Actually, ICT and organizational changes seem to be more strongly affecting the subjective relationship to work than they are affecting the more objective dimensions of work intensity and skill utilization.

Table 4. Effects of organizational changes on the evolution the subjective relationship to work

	Evolution of involvement		**Work recognised at fair value**	
	Private sector	**Public sector**	**Private sector**	**Public sector**
Ch. ICT	-0.060	-0.001	**-0.107***	-0.064
	(0.204)	(0.989)	**(0.062)**	(0.306)
Ch. ICT²	-0.030	**-0.308****	-0.0072	0.024
	(0.723)	**(0.012)**	(0.921)	(0.819)
Ch. Management	**0.176*****	**-0.151****	**0.122*****	**-0.139****
	(0.004)	**(0.021)**	**(0.007)**	**(0.032)**
Ch. Management²	**-0.237***	0.034	**-0.248*****	**0.355*****
	(0.093)	(0.798)	**(0.002)**	**(0.003)**
Interaction ch.	**0.444*****	**-0.485*****	**0.201***	**-0.300***
	(0.003)	**(0.006)**	**(0.078)**	**(0.076)**
Lambda	**-0.296****	**0.353*****	0.183	0.022
	(0.027)	**(0.001)**	(0.156)	(0.777)
Observations	11,731	946	11,731	946

Data sources: COI 2006/INSEE-DARES-CEE, COIFP 2006/DGAFP-DARES-CEE
Coverage: Stable employees (one year of service) from productive units of 20 or more employees in the private sector and 10 or more employees in the public sector.
Note: Controls included for employer and employee level characteristics and for employee self-selection, weighted regressions, significance level in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

The results reported in the first column of table 4 show that organizational changes in the private sector go most of the time with a higher involvement of employees. However, it is nonetheless necessary to distinguish between ICT and management changes. The effects of the

former on the evolution of involvement at the workplace are generally limited: the first and second order coefficients associated with ICT changes are negative but non-significant and the interaction term with management changes is strong and positive. As a result, the marginal effects of ICT changes are most of the time non-significant except at the top of their distribution and for low levels of management changes, where they become significantly negative. The effects of management changes are very positive as long as their magnitude is not too large: the first order coefficient is positive, the second order one is negative and the interaction term is positive. Therefore, the marginal effects of management changes are positive through the distribution of both indicators of changes, but they are weaker and less significant for higher deciles. Management changes in the private sector help maintain employee involvement.

In the public sector, by contrast, ICT and management changes are associated with declining employee involvement. The first and second order coefficients for ICT changes are negative but the latter only is significant; the first order coefficient of management changes is negative and significant and the second order one is weakly positive and non-significant; the interaction term is strongly negative. The resulting marginal effects of ICT and management tools are negative along the distribution of both indicators of change, stronger and more significant for higher deciles. In the public sector, the accumulation of changes in the work environment seems to be at odds with the usual exercise of duties.

The analysis of how employees feel about the fair recognition of their work (columns 3 and 4) confirms this diversity of effects across sectors: coefficients have the same signs as those reported for the evolution of involvement, but they have different magnitude and significance level. In the private sector, the negative effect of ICT changes at the first order is stronger and the positive interaction term is smaller. Consequently, we find a negative marginal effect of ICT changes on the feeling of fair work recognition, in particular when they are in the higher deciles. These negative effects become lower with the intensity of management changes. Coefficient associated with management changes remain close to those observed for the evolution of involvement. Hence, the marginal effects of management changes are much the same; they are positive and significant through the distribution of both indicators of change, except in the highest decile of their distribution where they become non-significant.

In the public sector, effects at the second order differ from those observed for the evolution of involvement. The second order coefficient of ICT changes is non-significant when the second order coefficient of management change is positive and significant. Compared with the evolution of involvement, the negative impact of the higher deciles of ICT and management changes are lower. The marginal effects of ICT changes remain negative, but they are lower for higher deciles of ICT changes. The marginal effects of management changes are negative only for the higher deciles of ICT changes and significant for the lower decile of management changes. It weakens when their magnitude is high and even becomes positive and significant when significant management changes are associated with marginal ICT change.

The coefficient associated with lambda is significant in the regressions concerning the evolution of involvement. It is negative in the private sector and positive in the public sector. Hence, the unobserved heterogeneity that explains self-selection into each sector has opposite effects on the evolution of involvement in the two sectors. It favors involvement in the public sector and hinders it in the private sector. However, regression results are robust to the control for employee self-selection. The diverging impact of changes on the subjective relationship to work in the private and the public sector is not explained by the fact that employees are differing in the unobserved characteristics that have motivated the choice to work in one sector or in the other.

4. How can we explain the divergence between the two sectors?

Although organizational changes have some common orientation in the private and public sectors, allowing for a common measure, we find a divergence between the two sectors in their impact on the subjective relationship to work. Public sector employees facing ICT and management changes express discouragement as well as the feeling of an increased effort-reward imbalance. In

the private sector, changes interact positively with involvement and fair work recognition, within certain limits in terms of change intensity. In this section, we discuss these results and test four hypotheses to explain this divergence.

4.1. Does the divergence come from the turnover of unhappy employees in private sector firms?

Our first hypothesis relies on the fact that dissatisfaction with ICT and management changes could drive employees to react differently in the two sectors. When employees are unhappy with organizational changes they may opt for a withdrawal behavior. First, they may choose to resign. Indeed, high levels of job dissatisfaction are good predictors of quits [22]. Second, as quits are costly, employees may prefer some form of internal disengagement, a behavior that Baudelot *and al*. [23] have observed in France when work pressure becomes too hard. However, private firms can still induce disengaged employees to quit or even chose to dismiss them. In the French public sector, on the contrary, voluntary and involuntary job exits are rarer due to strict employment protection.

In the COI survey, employees were randomly sampled in the population of responding firms or administrations. However, at the time of the interview, some 12 months later, around 10% of selected private employees had left their company while only 4% of the public agents were missing. Therefore, we hypothesize that we could explain the increased involvement of employees in changing private companies by the exits of unhappy workers.

To test this ex post selection hypothesis, we take advantage of the sample of the employees who left the company for which they had been sampled at the time of their interview. As these employees have left, we cannot observe the counterfactual subjective relationship to work, which is their work commitment if they had continued to work with that company. Therefore, we chose an extreme hypothesis: we assume that they would have declared a decrease in their work involvement and a feeling that their work was not recognized at fair value. Besides, we observe leavers during the year 2006 only. As we measure changes that have taken place during a three years span, we assume that the rate of voluntary exit has been the same in 2004 and 2005. Therefore, in our robustness check, we give each leaver a weight of three, bringing our sample of 1140 leavers to a size 3420 individuals.

We report in the first two columns of Table 5 below the results of the regression sample of private sector employees extended with exits. They should be compared with those reported in columns 1 and 3 of the above table 4. Making the hypothesis employees who left were dissatisfied does not change the influence of ICT changes on the evolution of involvement, nor on the feeling of fair recognition. However, management changes do not contribute the same to the evolution the subjective relationship to work in this extended sample. The coefficient measuring the first order effect of management changes is close to nil and non-significant when was positive and highly significant in table 4. The second order coefficient is still negative, but its magnitude is reduced and it is no more significant for the evolution of involvement. The interaction effect is still positive, but it is smaller for the evolution of involvement.

Overall, the fact that management changes interact positively with involvement and fair work recognition, when their intensity is not too high could be due to the resignation of unhappy employees. Hence the ex post selection hypothesis could contribute to explaining the favorable impact of management changes in the private sector. Nevertheless, even with this extreme assumption, the effects of management changes on the subjective relationship to work in the private sector are not as negative as observed in the State civil service. In addition, the complementarity of ICT and management changes remains positive on involvement and feelings of fairness in opposition with the evidence in public administrations.

4.2. Can the specific sources and paths of changes in public and private sector explain the divergence?

Organizations in private and public sectors being structurally different according to property rights (public state vs private shareholders) and control (political forces vs market competition), it is reasonable to hypothesize that the cycle of changes will be sector specific. Hence, Meier and O'Toole [24] propose a theoretical model of the influence of institutional differences on the process of organizational changes. As market forces evolve at a faster rhythm than political mandates, the

private sector would be ahead in the cycle of changes with more organizational learning. However, the work processes and management tools of the private sector inspire the methods of the New Public Management applied in many public sector's reforms in western economies [25].

The sources of changes also differ between the two sectors. The private sector firms would change in response to market pressure towards efficiency. Therefore, competition would induce them to select the most effective management and technical tools. On the contrary, the public sector would change under a political agenda. Then, when decided under political pressure, the management and ICT changes in the public sector may be more rapid and based on different selection principles.

Table 5. Analysis of public/private divergence on the evolution the subjective relationship to work

	Private sector with exits		**Exposed private sector**		**Sheltered private sector**	
	Evolution of involvement	**Fair work recognition**	**Evolution of involvement**	**Fair work recognition**	**Evolution of involvement**	**Fair work recognition**
Ch. ICT	-0.018	**-0.090***	-0.044	-0.040	0.089	-0.144
	(0.736)	**(0.069)**	(0.401)	(0.360)	(0.392)	(0.177)
Ch. ICT²	-0.006	-0.005	0.007	-0.068	-0.354	0.208
	(0.952)	(0.935)	(0.942)	(0.331)	(0.104)	(0.343)
Ch. Mangt.	-0.051	0.036	**0.096****	**0.075****	**0.410*****	**0.165***
	(0.410)	(0.423)	**(0.046)**	**(0.039)**	**(0.004)**	**(0.082)**
Ch. Mangt.²	-0.127	**-0.198*****	-0.125	**-0.143****	**-0.584***	**-0.512****
	(0.348)	**(0.005)**	(0.255)	**(0.035)**	**(0.099)**	**(0.015)**
Interaction ch.	**0.321****	**0.196***	**0.357*****	0.070	0.232	0.309
	(0.037)	**(0.063)**	**(0.008)**	(0.485)	(0.556)	(0.298)
Lambda	**-1.418*****	**-0.899*****	0.276	-0.144	0.334	-0.268
	(0.000)	**(0.000)**	(0.238)	(0.239)	(0.215)	(0.205)
Observations	15,151	15,151	9,752	9,752	1,979	1,979

Data sources: COI 2006/INSEE-DARES-CEE, COIFP 2006/DGAFP-DARES-CEE?
Coverage: Stable employees (one year of service) from productive units of 20 or more employees in the private sector and 10 or more employees in the public sector.
Note: Controls included for employer and employee level characteristics and for employee self-selection, weighted regressions, significance level in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

The descriptive statistics of the diffusion of ICT and management tools in private and public productive units reported in table A1 in the appendix gives us some first evidence to confront these hypotheses on the specific paths of changes in the two sectors. First, we observe that the increase in the use of all ICT tools is higher in the public sector than in the private sector, with the exception of electronic data exchange systems. Nevertheless, we cannot here speak of a ICT catch-up as the public sector was already better equipped than the private sector in 2003 with respect to the majority of the fifteen selected tools, particularly the networking tools (website, intranet, Local Architecture Network, extranet). The diffusion of management tools follows a different logic and timing. In the private sector, tools for managing external relationships, already well established in 2003, continued their growth. In the public sector, their rapid diffusion demonstrates the willingness to work differently with suppliers and with the citizens. Other management tools seem more suited to the logic of the private (methods of problem solving, customer relationship management) or the public sector (environmental or ethical certification) and their implementation in the other sector does not occur easily. Overall, in 2003, public sector productive units were ahead in terms of adoption for 12 ICT tools out of 15. For management tools, the private firms displayed a higher rate of adoption for 9

548 out of the 13 tools. Hence, there is no clear evidence in these descriptive statistics that the private
549 firms were clearly ahead in the cycle of changes.
550 To assess whether the observed divergence between the public and private sectors come from
551 the distance to market competition, we separate the private firms into two categories, the exposed
552 and the sheltered ones. The sheltered firms are those acting in national markets where they have not
553 been affected by the emergence of new competitors. The other group of firms is the exposed group.
554 We run our regressions on the evolution the subjective relationship to work for these two sub-
555 samples of private firms and report the results in columns 3 to 6 of table 5 above. In both the exposed
556 and sheltered private sectors, the impacts of management changes on the evolution of involvement
557 and fair work recognition remain significantly positive, at a decreasing rate with the intensity of
558 changes. The major difference is the fact that the complementarity of ICT and management changes
559 has no supplementary positive effect on the subjective relationship to work. However, these new
560 estimates clearly show that the effects of changes in the group of companies sheltered from intense
561 competition are not similar to those observed in the public sector.

562 *4.3. Does the divergence come from different impacts of the implementation of performance pay?*

563 The private sector may complement management and ICT changes with human resource
564 management practices that favor the involvement of employees in the change process, in particular
565 performance pay. In fact, performance pay is one of the most cited practices among the ones forming
566 the management concept of *high performance work organisation*. This incentive system is likely to
567 induce insider employees to increase their level of productive effort and to attract the most
568 motivated outsiders to engage themselves in the productive organization.
569 Why do public organizations seldom use performance pay, when it has proved its efficiency in
570 the private sector? The limited scope of the implementation of performance pay in the public sector
571 has three main reasons [26]. First, many public agencies have multiple and complex objectives and
572 public employees perform multi task jobs. In such jobs, performance pay may induce high effort in
573 compensated task and crowd it out from uncompensated ones. Second, the performance of the civil
574 servant frequently depends on the effort and quality of the public service users who somehow
575 coproduce with him. A well-known example of this situation is the relationship between teachers
576 and pupils. If teachers are paid according to the performance of their pupils, they may over invest
577 helping those who have the best results. Finally, civil servants may have selected themselves in the
578 public sector because of their public service motivation to participate to the goals of public
579 institutions [27]. Hence, this intrinsic motivation may substitute for performance pay [28]. Moreover,
580 this intrinsic motivation may be crowded out by the implementation of performance pay as this
581 incentive system can create doubt about the fact that the public employer is completely confident
582 about their commitment [29]. The use of a similar performance pay system in both sectors may then
583 lead to opposite effects on the subjective relationship to work.
584 The "employee" section of the COI survey has a set of questions on performance pay. It shows
585 that 11% of the private workforce has benefitted from the introduction of performance pay between
586 2003 and 2006 while only 5.5% of public agents were concerned by such an implementation. To test
587 our hypothesis about the role of performance pay on the subjective relationship to work, we
588 augment equation (1) with a dummy variable measuring the introduction of performance between
589 2003 and 2006 and two interaction terms between this dummy and the measure of each type of
590 changes. The positive or negative effects of these interaction terms signals whether performance pay
591 eased or amplified the relationship between organizational changes and the evolution of work
592 commitment.
593 We display the full results in table A2 of the appendix. As expected, the introduction of
594 performance pay has a positive effect on the evolution of involvement in the private sector but not in
595 the public sector. However, it has almost no moderating influence on the impact of changes on the
596 subjective relationship to work. No interaction terms with performance pay are significant in the
597 regressions on the evolution of involvement. Two interaction terms with ICT changes are significant

as far as fair work recognition is concerned: the interaction with the second order term is negative in the private sector and the interaction the first order term is positive in the public sector.

In table 6 below, we summarize the marginal effects of ICT and management changes on the evolution of involvement and the feeling of fair recognition for the average employee according to her eligibility to performance pay in the last three years. We also report the result on the total sample of employees for sake of comparison. When there is no performance pay, the impact of management changes on both the evolution of involvement and the feeling of fair work recognition remains opposite in the two sectors, positive in the private sector and negative in the State civil service.

Table 6. Effects of ICT and management changes according to the introduction of performance pay

		Private Sector		Public Sector	
		Evolution of involvement	**Fair work recognition**	**Evolution of involvement**	**Fair work recognition**
No performance pay	Ch. ICT	-0.079	**-0.113***	0.031	-0.105
		(0.136)	**(0.064)**	(0.705)	(0.152)
	Ch. Mangt	**0.153****	**0.147*****	**-0.143****	**-0.127***
		(0.050)	**(0.007)**	**(0.035)**	**(0.091)**
Total sample	Ch. ICT	-0.061	**-0.107***	-0.004	-0.069
		(0.201)	**(0.064)**	(0.954)	(0.274)
	Ch. Mangt	**0.174*****	**0.122*****	**-0.153****	**-0.139****
		(0.005)	**(0.006)**	**(0.020)**	**(0.032)**
Performance pay	Ch. ICT	0.001	-0.036	-0.292	**0.453****
		(0.991)	(0.738)	(0.261)	**(0.025)**
	Ch. Mangt	**0.379****	-0.069	-0.055	**-0.395****
		(0.011)	(0.600)	(0.828)	**(0.027)**

Data sources: COI 2006/INSEE-DARES-CEE, COIFP 2006/DGAFP-DARES-CEE
Coverage: Stable employees (one year of service) from productive units of 20 or more employees in the private sector and 10 or more employees in the public sector.
Note: Average effects from regressions in table A2, significance level: *** p<0.01, ** p<0.05, * p<0.1.

In the group of workers who benefit from performance pay, results on the subjective relationship to work do not seem to converge either. Interestingly, in the private firms, the implementation of performance pay seems to deteriorate somehow the positive effect of management changes on the feeling of fair work recognition observed in the whole sample. In the State civil service, when workers are eligible to a compensation premium, ICT changes impacts positively the feeling of fair recognition of the average public agent, as if this premium was compensating for an effort to assimilate the new knowledge associated with this technological innovations.

4.4. Does the moderating role of the presence of union representatives explain the divergence?

The way organizational changes are discussed and assessed when implemented at the workplace could also influence their impact on the subjective relationship to work. We will consider here the potential role played by union delegates. First, unions can have a regulating influence both on the nature of changes and on the way they are implemented. Without institutional representation of the workforce, it is more difficult to carry out a common claim from the workforce requests. In case of a significant power of consultation, employees can expect to suggest some adjustments in changes to make them more advantageous. Activation of formal exchanges between employers and

employees representatives may limit the negative consequences for employees through their influence on the content of changes, by negotiating compensation possibilities in terms of wages, training, job security, by fostering a climate of trust that allows the expression of employees and by ensuring a supporting role social. Indeed, some evidence that the detrimental effects of changes on workers' job anxiety vanish when union representatives are involved in their process of introduction have been found from a large British employer-employee dataset [10].

Second, the unions may have a revealing influence on the consequences of the changes. The presence of employee representatives contributes to the development of a cognitive context that encourages the expression of criticism [30]. Information exchanges between union delegates and the workforce reflect the difficulties and defects associated with organizational changes and negative perception is likely to be increased. If the changes involve increased efforts, higher skills obsolescence or more job insecurity, then the balance at the root of the feeling of equity and security felt by the members of the organization may be broken. Furthermore, if management does not properly involve the unions in the process of negotiating the implementation of changes or refuse to study their demands, employees may interpret the process of changes as unfair. Unions at the workplace may then act either as a *regulator* when their participation to the process of the changes mitigates their adverse effects for employees or as a *pointer* when they reinforce the perception of their negative consequences.

The capacities of unions to interfere within the process of organizational changes depend on their local strength [31] and on institutional features. Differences in the legal requirements to negotiate within private and public organizations explain the uneven capacity of employee voice to accompany the progress of innovative projects. Thereby, the right to negotiate in the private sector for unions and the topics of bargaining alike differ from those in the state civil service.

In fact, union representatives are entitled to the right of negotiation in the private sector while they only have the right of consultation in the French public sector. Hence, we could say that their *regulating* power in administrations is restricted. However, this legal restriction is in fact not as clear because the law authorizes quasi-negotiations about working conditions [32]. The bilateral overviews, informal consultations, working groups and preparatory meetings usually organized before meetings of the *Joint Technical Committee* (Comité technique paritaire) are part of these quasi-negotiations [33]. Those committees involving employer and employee representatives are required to transmit a consultative advice about the general organization of public services, tools and methods of work, major evolution of professional activities, and especially the use of new technologies. Furthermore, in the private sector since 1982, the Auroux laws create a set of obligations to negotiate but a large fraction of firms do not fulfill this legal requirement. Therefore, it is difficult to decide whether union representatives have more power to *regulate* in the private sector or in the public sector.

However, some reasons plead for a more *regulating* influence of union representatives in the private sector. Because of their obligation to negotiate in the private sector, union representatives would have more influence on changes. Organizational changes are also more likely to be *regulated* through compensation, as it is possible to negotiate wages within firms while pay raises are negotiated at a national centralized level in the State civil service. Likewise, union delegates may negotiate employment protection against the active participation in the implementation of management and ICT changes. The most important changes in the organization of the State civil service were decided by the legislative route and mainly impossible to negotiate at the local levels (for instance the LOLF- organic law of the finance law of 1 August 2001- and the e-administration). Conversely, the detailed information transmitted by well-informed public sector unions may explain why the changes, and especially management ones, have negative impacts on the evolution of work involvement and the feeling of work recognition.

In fact, unions are more established in the state civil service. Statistical figures from the COI survey show that 38% of public agents have a union affiliation against only 15% of private employees. Moreover, 73% of these private employees declare the presence of a union representative in the firm against 90% of the employees of the state civil service.

To explore the moderating effect of trade union presence on the relationship between changes, evolution of involvement and feeling of fair work recognition, we add to specification (1) a dummy variable that reflects the specific effect of union presence in private companies or administrations, and interact this dummy variable with indicators of ICT and management changes. The significance of the interaction terms reflects the moderating influence of trade union presence on the relationship between changes and the evolution of the subjective relationship to work. Table 7 reports for the average employee in the public and private sectors the marginal effects of changes, according to trade union presence.

Table 7. Effects of ICT and management changes according to trade union presence

		Private Sector		**Public Sector**	
		Evolution of involvement	**Fair work recognition**	**Evolution of involvement**	**Fair work recognition**
No trade union presence	Ch. ICT	0.125	0.001	-0.129	-0.002
		(0.141)	(0.988)	(0.501)	(0.991)
	Ch. Mangt	0.152	0.035	-0.060	0.015
		(0.153)	(0.647)	(0.752)	(0.387)
Total sample	Ch. ICT	-0.061	**-0.107***	-0.004	-0.069
		(0.201)	**(0.064)**	(0.954)	(0.274)
	Ch. Mangt	**0.174*****	**0.122*****	**-0.153****	**-0.139****
		(0.005)	**(0.006)**	**(0.020)**	**(0.032)**
Trade union presence	Ch. ICT	**-0.120****	**-0.131****	0.043	-0.079
		(0.038)	**(0.042)**	(0.629)	(0.237)
	Ch. Mangt	**0.179****	**0.139*****	**-0.160****	**-0.175****
		(0.023)	**(0.008)**	**(0.039)**	**(0.017)**

Data sources: COI 2006/INSEE-DARES-CEE, COIFP 2006/DGAFP-DARES-CEE
Coverage: Stable employees (one year of service) from productive units of 20 or more employees in the private sector and 10 or more employees in the public sector.
Note: Average effects from regressions in table A3, significance level: *** p<0.01, ** p<0.05, * p<0.1.

In the private sector, the positive effects of management changes on the subjective relationship to work seem to be explained by the *regulating* effect of trade union presence. In firms without unions, there is no more significant influence of management changes on the evolution of involvement and the feeling of fair recognition. In the public sector, we can observe the opposite effect: in public administrations trade unions, have a revealing influence, informing civil servants on the adverse impacts of management changes. In the absence of trade unions, the effects of management changes on the evolution of involvement and the feeling of fair work recognition would be the same in both sectors. The different moderating roles of trade unions facing management changes contribute to explaining the observed divergence in the evolution of the subjective relationship to work.

For ICT changes, the presence of trade unions accentuates the deterioration of involvement and of the feeling of fair work recognition in the private sector but has no specific influence in the public sector. Hence, in the private sector, union delegate would have a higher capacity to regulate management changes than ICT changes.

5. Conclusion

Using the linked employer employee survey on organizational change and computerization (COI), we analyzed the effects of organizational changes in the private sector and the State civil service, examining indicators of work intensification, skill development, and subjective relationship to work. We summarize organizational changes with two continuous indicators describing on one hand the evolution in the use of ICT tools, on the other one the evolution in the use of management tools. We use a model that takes into account the self-selection of employees in each sector and a quadratic form for ICT and management changes, allowing for threshold effects beyond some intensity level as well as for a complementarity between the two types of changes.

We first show that organizational changes were more intense in the State civil service than in the private sector, which confirms how important are the changes in the work environment of civil service officials in the context of the modernization of the State. However, these reforms have not translated into a systematic intensification of work. It is therefore necessary to achieve very high levels of change to record an increase in pace constraints or more frequent activity peaks. Thus, only employees for whom their administration has introduced radical changes, i.e., the cumulative adoption of new ICT or management tools have to cope with work intensification.

In the private sector, the changes were on average less intense and not significantly associated with variations in the intensity of work. They appear to be related to an enrichment of work that does not lead to the accumulation of new skills. Indeed, employees report that their skills are used more than before but do not report more opportunities of learning new things at work.

It is in the more subjective areas of employee involvement and fair work recognition that the differences between the private sector and State civil service are the highest. Employees of the State express discouragement when faced with changes. An average intensity of change in management tools and a high intensity of ICT changes lead to a decline in employee involvement. In addition, a combination of changes in both domains has an additional negative effect on the evolution of involvement. This result is even more noticeable that in the private sector, on the contrary, organizational changes create an increase in employee involvement as long as their magnitude is not too high.

Change in both sectors also influence employees' assessment of the fairness of treatment at work. Private sector employees reported a feeling of fair work recognition that decreased with an increasing use of ICT tools. Similarly, the balance between the investment in work and the benefits obtained appears to deteriorate if the changes in management are high. However, the combined presence of changes in both domains weakens this effect in the private sector, in contrast to the public sector, in which this effect reinforces the perception of an effort-reward imbalance.

We tested four possible explanations on the causes of this sector-based divergence in the area of the subjective relationship to work. We ruled out two of them: the role of the specific sources and paths of changes in the public and private sector and the divergence in the consequences of performance pay. Two other ones partially explain the seemingly more virtuous nature of management changes in the private sector and thus contribute to the explanation of the divergence. First, we took into account the fact that dissatisfied workers could leave their company while public agents where more stable because of strong employment protection. Second, we checked the differing moderating role of trade unions and we found that if unions regulate management changes in the private sector, they tend to raise the critic about them in the public sector. Furthermore, in the private sector, union delegates seem to have a higher capacity to regulate management changes than ICT changes, which have overall consequences that are more ambiguous.

These results suggest that the human sustainability of ICT and management changes depends on their intensity and on how their implementation takes into account the institutional context of the organization.

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Appendix:

Table A1. Diffusion of ICTs and management tools in productive units

	Private sector		Public sector		Private sector baseline metric
% of productive units	**2003**	**2006**	**2003**	**2007**	
ICTs					
Website	61.2	73.3	68.0	88.6	0.065
Local Area Network	61.3	66.7	91.3	96.7	0.071
Software or firmware for HRM	63.4	65.3	90.2	95.3	0.064
Intranet	47.9	57.8	84.1	97.5	0.084
Software or firmware for R&D	47.4	49.8	41.1	45.5	0.041
Tools for data analysis	39.5	47.1	37.8	51.5	0.065
Electronic data interchange system (EDI)	36.2	45.8	38.3	47.5	0.060
Database(s) on for HRM	34.5	38.5	74.9	89.3	0.082
Extranet	25.0	30.2	51.8	66.6	0.081
ERP	26.6	29.6	40.3	51.1	0.059
Databases for R&D	26.1	28.8	30.7	37.9	0.075
Tools for interfacing databases	21.1	28.6	24.2	47.9	0.067
Tools for automated data archiving or research	21.4	27.4	18.4	32.7	0.087
Tools for collaborative work (groupware)	15.1	21.0	28.1	59.8	0.099
Tools for process modelling (workflow)	8.8	12.7	12.0	26.3	0.111

Management tools					
Contractual commitment to provide a product or a service or customer service within a limited time	66.1	68.5	18.0	42.4	0.087
Long-term relationships with suppliers	51.7	54.7	58.6	72.8	0.076
Requirement for suppliers to meet tight deadline	51.5	53.5	61.0	69.9	0.090
Quality certification	36.3	41.4	5.5	21.5	0.092
Satisfaction surveys of customers	32.9	38.7	27.0	47.5	0.079
Teams or autonomous work groups	30.7	33.8	30.2	40.8	0.089
Tools for tracing goods or service	28.3	32.9	9.5	31.5	0.075
Tools for labelling goods and services	28.3	30.8	7.5	25.4	0.093
Call or contact centres	25.5	28.0	24.6	30.4	0.080
Just in time production	22.9	24.3	17.7	20.8	0.071
Methods of problem solving (FMECA)	17.3	20.9	6.1	7.2	0.114
Customer relationship management (CRM)	9.7	14.3	2.0	7,1	0.072
Environmental or ethical certification	9.7	12.9	19.5	64.6	0.107

847 Data source: COI 2006/INSEE-DARES-CEE, COIFP 2006/DGAFP-DARES-CEE
848 Coverage: Productive units of 20 or more employees in the private sector and of 10 or more employees in the
849 public sector. Weighted data.
850 Note: MCA coefficients come from the MCA applied in 2006 to the private sector. It is the reference metric for
851 2003 in the private sector and for 2003 and 2007 in the State civil service.

852

853 **Table A2: The moderating effect of performance pay**

	Private sector		Public sector	
	Evolution of Involvement	Fair work recognition	Evolution of Involvement	Fair work recognition
Ch. ICT	-0.064	**-0.104***	-0.007	-0.070
	(0.174)	**(0.062)**	(0.918)	(0.289)
Ch. ICT²	-0.018	0.005	**-0.309****	0.042
	(0.833)	(0.942)	**(0.019)**	(0.720)
Ch. Mangt	**0.173*****	**0.121*****	**-0.144****	**-0.140****
	(0.005)	**(0.006)**	**(0.027)**	**(0.036)**
Ch. Mangt²	**-0.265***	**-0.250*****	0.027	**0.331*****
	(0.063)	**(0.001)**	(0.846)	**(0.005)**
Interaction Ch.	**0.439*****	0.178	**-0.502****	-0.269
	(0.004)	(0.113)	**(0.005)**	(0.122)
Performance pay	**0.087*****	0.003	0.129	-0.133
	(0.009)	(0.900)	(0.458)	(0.211)
Ch. ICT* Performance pay	0.075	0.074	-0.343	**0.545*****
	(0.599)	(0.525)	(0.196)	**(0.008)**
Ch. ICT²* Performance pay	-0.191	**-0.316***	-0.040	-0.583
	(0.413)	**(0.093)**	(0.932)	(0.209)
Ch. Mangt* Performance pay	0.236	-0.218	0.050	-0.260
	(0.151)	(0.136)	(0.844)	(0.156)
Ch. Mangt²* Performance pay	0.308	0.322	0.020	0.436
	(0.270)	(0.166)	(0.953)	(0.136)
Interaction Ch. * Performance pay	-0.439	-0.130	-0.870	0.379
	(0.255)	(0.682)	(0.215)	(0.594)
Lambda	0.262	**-0.191***	**-0.757*****	-0.158
	(0.167)	**(0.061)**	**(0.004)**	(0.386)
Observations	11,731	11,731	946	946

854 Data sources: COI 2006/INSEE-DARES-CEE, COIFP 2006/DGAFP-DARES-CEE
855 Coverage: Stable employees (one year of service) from productive units of 20 or more employees in the private sector and 10
856 or more employees in the public sector.
857 Note: Controls included for employer and employee level characteristics and for employee self-selection, weighted
858 regressions, significance level in parentheses: *** p<0.01, ** p<0.05, * p<0.1.

Table A3: The moderating effect of trade unions

	Private sector		Public sector	
	Evolution of Involvement	Fair work recognition	Evolution of Involvement	Fair work recognition
Ch. ICT	-0.047	**-0.092***	0.0098	-0.072
	(0.306)	**(0.064)**	(0.896)	(0.239)
Ch. ICT²	-0.051	-0.008	**-0.340*****	0.061
	(0.549)	(0.908)	**(0.006)**	(0.528)
Ch. Mangt	**0.168*****	**0.106*****	**-0.157****	**-0.141****
	(0.003)	**(0.006)**	**(0.020)**	**(0.024)**
Ch. Mangt²	-0.218	**-0.226*****	0.022	**0.340*****
	(0.100)	**(0.001)**	(0.866)	**(0.003)**
Interaction Ch.	**0.421*****	0.161	**-0.440****	**-0.278***
	(0.003)	(0.116)	**(0.013)**	**(0.087)**
Trade union presence	-0.021	**-0.046***	0.023	-0.030
	(0.400)	**(0.055)**	(0.827)	(0.751)
Ch. ICT* Trade union presence	**-0.238****	-0.129	0.164	-0.096
	(0.018)	(0.137)	(0.420)	(0.586)
Ch. ICT²* Trade union presence	**0.416****	0.092	-0.354	**-0.948****
	(0.038)	(0.519)	(0.556)	**(0.028)**
Ch. Mangt* Trade union presence	0.024	0.107	-0.091	**-0.291***
	(0.853)	(0.253)	(0.674)	**(0.0921)**
Ch. Mangt²* Trade union presence	-0.239	0.082	0.049	0.349
	(0.386)	(0.610)	(0.913)	(0.273)
Interaction Ch. * Trade union presence	0.477	0.336	0.445	**1.480*****
	(0.158)	(0.156)	(0.539)	**(0.001)**
Lambda	0.271	**-0.184***	**-1.318*****	0.049
	(0.155)	**(0.072)**	**(0.001)**	(0.863)
Observations	11,731	11,731	946	946
R^2	0.032	0.074	0.082	0.083

Data sources: COI 2006/INSEE-DARES-CEE, COIFP 2006/DGAFP-DARES-CEE
Coverage: Stable employees (one year of service) from productive units of 20 or more employees in the private sector and 10 or more employees in the public sector.
Note: Controls included for employer and employee level characteristics and for employee self-selection, weighted regressions, significance level in parentheses: *** p<0.01, ** p<0.05, * p<0.1.