Changing workplaces, individual performance and work satisfaction. An investigation on Italian employees

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XXI AIEL Conference of Labour Economics
Udine, 14-15 September 2006

Abstract

The paper explores the relationship between employees' performance, skills and satisfaction at changing workplaces. Based on individual data, the paper argues that skills significantly affect firm performance, but skill levels strongly depend on skills evolution and perceived satisfaction. The introduction of innovative technologies and high performance work practices to improve employee performance should therefore take into account the impact of workplace change on both skills and satisfaction. Empirical tests base on an original archive of over 3,600 Italian employees from the private sector, which provides detailed information about workplace features, skills, and working experience.

Keywords

Skill – Skills change – Individual performance – Technological change – Organisational change –Empirical analysis

1. Human resources: a key to success or a black box?

The search for new production paradigms to overcome the decline of by the Fordist-Taylorist model has been accompanied by the quick diffusion of a wide range of management techniques focused on organisational decentralisation, delayering, employees' polyvalence, or teamwork. All the proposed approaches share a common emphasis on employees as the key resource to meet the demand for continuous adaptation posed by an ever-evolving competitive environment. Not surprisingly, the arising managerial techniques have been soon labelled as High Performance Work Practices (HPWP) (Appelbaum and Batt, 1994; Osterman, 1994). The diffusion of new technological solutions, primarily focused on flexible automation and Information and Communication

Technologies (ICTs) has meanwhile accompanied organisational change. The pervasive nature of both technological (Malone and Smith, 1988) and organisational innovations favoured their fast diffusion not only in manufacturing industries, but also in the service sector. As a matter of fact, a growing number of studies resorts to similar models and tools to approach the effects of technological and organisational changes in industrial sectors (Brynjolfsson and Hitt, 2003) and service ones (Bertschek and Kaiser, 2004; Hempell, 2005).

The economic literature agrees on recognising a skill-biased nature to the ongoing change, driving a growing demand for higher skills. A frequently reported evidence is that the diffusion of HPWPs and ICTs favours high-skill employees and marginalises low-skilled people who do not or cannot update their competencies (Haisken-DeNew and D'Ambrosio, 2003). By pointing out the specific source of change identified by different approaches Piva *et al.* (2003) propose a useful framework to classify the growing body of literature on skill-biased change. The Authors distinguish between technological skill-biased change (Pianta, 2003), organisational skill-biased change (Ichniowski *et al.*, 1997), and combined technological and organisational change (Brynjolfsson and Hitt, 2000; Bresnahan *et al.*, 2002), which includes most of recent studies.

Independently from the specific source of change, the theoretical framework the literature on skill-biased change bases on identifies the increased skills of employees as the *trait d'union* between the workplace change induced by technological and/or organisational innovation and the improvement of firm performance. However, the declared theoretical focus on human resources often corresponds to empirical analyses which assume a mechanical and deterministic model of the human contribution. Employees are still often modelled as a "black box" that deterministically reacts to exogenously provided stimuli – be they technological change or new management techniques (Ramsay *et al.*, 2000). In a similar way, a gap between the emphasis placed on human resources by management rhetoric and the reality of management practices has long been known (Grugulis and Stoyanova, 2005).

After the seminal paper by Ichniowski, Shaw and Prennushi (1997), several analyses explored the relationship between technological-organisational change and firm performance, implicitly assuming that employees would "automatically" comply with the new skill requirements expressed by the firm. A noteworthy exception is provided by Ramsay, Scholarios and Harley (2000), whose empirical analysis assesses the positive impact of a bundle of HPWPs on labour productivity and costs, on firm financial performance and on the quality of products and services, but also the parallel increase of individual effort and perceived stress. Ramsay, Scholarios and Harley point out the possibility that the improved firm performance after the introduction of HPWPs follows not only from increased employee skills, but also from a more "traditional" intensification of work.

Also contributions explicitly focused on the relationships between workplace change and the evolution of employee skills often risk to represent labour as a black box, instead of enlightening its evolutionary paths. As a matter of fact, the change of individual skills is often measured by changes in the labour force structure. The most explored dimensions concern the balance between white-collars and blue-collars (see *e.g.* Piva *et al.*, 2003), or the adjustments in the distribution of qualifications (Falk, 1999). However, despite significant, those changes do not necessarily correspond to an actual increase of employee skills. Moreover, detected changes say nothing about the employees' motivation to keep up with the evolving needs of companies.

Other studies assess the evolution of the employees' skills by apprising changes in required skills (see, *e.g.*, Greenan, 2003) or in the provision of tools to assist skill evolution. For example, Whitfield (2000) reports a positive correlation between the intensity of training provided by firms and the number of changes at the workplace. Once more, the examined variables constitute only proxies for the impact of workplace change on employees and provide no information about firm performance. In addition, skill requirements or skill development tools reflect firm choices rather than autonomous employees' behaviours. Their use to apprise the effects induced by technological and /or organisational change on firm performance equals to assuming the passive acceptance of the proposed changes by the workforce.

In any case, the literature on the skill-biased change has produced some important and widely shared results, first of all by identifying a positive correlations between technological or organisational change on the one hand and firm performance on the other one, especially when bundles of innovations are simultaneously introduced[1] (Shaw, 1987; Ichniowski *et al.*, 1997; Laursen and Foss, 2003). Nonetheless, systematic analyses on the impact of technological and organisational change at the individual level are still missing. Grugulis and Stoyanova (2005) stress that typical measures of performance represent organisational outcomes rather than individual results.

The reasons of this gap primarily root in the scarce availability of adequate data at the individual level. However, also when detailed information exists, general consensus is still missing on a satisfactory measure of individual skills (Allen and van der Velden, 2005) and their evolution under changing workplace conditions. The attention to skill change represents a comparatively recent research issue, also because for a long time

[1] For a recent survey, see Piva *et al.* (2003). Despite general agreement, significant controversial positions still exist. For example, Freeman and Kleiner (2000) report the positive impact of employee involvement techniques on the satisfaction level of workers. At the same time, they detect a negligible or insignificant effect of employee involvement techniques on firm performance. Two are the justifications the authors put forward to explain the apparent independence of firm performance from employee involvement techniques. One is technical: the examined sample could be too small to outline the relationship between employee involvement and firm performance. The other addresses the theoretical framework underlying skill-biased change: employee involvement techniques may actually fail to affect the performance of the firm and their rapid diffusion just depends on the employees' will to improve the quality of their workplace.

policy-makers, as well as policy-oriented research, focused on firms birth and survival as the primary source of jobs creation and preservation (Shaw, 1987). Only in the latest years the evolution of production and consumption models has shifted the attention to the concept of employability, *i.e.* the acquisition and the continuous adaptations of employee skills to guarantee the permanence of individuals on the labour market along their whole professional life (McQuaid and Lindsay, 2005).

In any case, the appraisal of how technological and organisational change affect individual skills and competencies represents a compulsory target for economic and organisational analysis. If the contribution of employees constitutes a structural component of firm performance, only the continuous adaptation of their skills to the evolving competitive environment can guarantee the sustainability of the company achievements in time and, in a wider perspective, the competitiveness of the economic system. The benefits initially accrued thanks to new technologies or management techniques would otherwise progressively disappear as time goes by and additional evolutions of the competitive environment take place.

In order to understand how firms can sustain their employees' motivation to continuous learning and skill adaptation, the paper assumes a direct impact of individual skills on firm performance and explores how skill-biased change intertwines with other variables to affect skill stocks owned by individual employees. In particular, the paper claims that the skills to enable a sustainable high firm performance depend on two complementary, yet distinct factors. The first one concerns the evolution of the general and specific skills typically applied in daily operations. The second factor concerns the satisfaction level perceived by individual workers, which translates potential capabilities into an excellent performance. The role of satisfaction to sustain the employees' motivation in time was already included in Akerlof's 1982 model of "partial gift exchange" between employer and employees[2]. Not surprisingly, Aoki (1988) based on this framework to explain the apparently irrational commitment of employers and employees in the model of the stylised Japanese firm.

The empirical test of the above propositions bases on an original archive recently developed by ISFOL (the Italian institute for training) through computer assisted personal interviews held in May 2004 with over 3.600 Italian employees in private manufacturing industries and services (agriculture, mining, and personal services excluded). The collected information allows to apprise the match between company needs and employees' skills, as well as their transferability. Despite based on cross-section data, the ISFOL archive also allows to appreciate the evolution of the employees' skills, since it also collects information about past work history, as well as training experiences.

[2] Akerlof (1982) develops a model of efficiency wages based on shared behavioural norms. Also in a strictly bureaucratic workplace, the Author tests the possibility of a "mutual gift exchange" between employer and employees: in change of higher wages than those corresponding to full employment equilibrium and lower minimum required effort, workers autonomously supply higher effort levels.

After framing the issue in the present Section, the paper specifies the research hypotheses and provides a more detailed description of the available data (Section 2). Section 3 defines the variables used to appraise individual skills, skill change, and satisfaction level and presents the research methodology. Section 4 describes the empirical analysis and discusses the obtained results. Based on the proposed evidence, Section 5 offers some concluding remarks.

2. The research hypotheses and the ISFOL archive

The above Section has outlined how the interest in opening the "black box" of individual skills and performance springs from the dynamics of continuous adjustments between constantly evolving skill requirements and actually supplied skills (Benson and Debroux, 2004). In order to easy the match between labour demand and offer, firms and policy makers are increasingly interested in understanding which factors drive the evolution of labour contents and the employees' motivation to adapt their skills to the company needs.

Several empirical studies, based on different measures, defend the beneficial effects of a more skilled workforce on the company performance and consequently support technological and organisational changes aimed at rising the employees' skills (for an extended survey, see Tamkin, 2005). However, it is not clear if a better skilled workforce can actually improve the odds of *sustaining* firm performance in time. A deeper understanding of how skills evolve and how firms could better benefit from implemented workplace changes is still missing. With the purpose of providing some preliminary evidence, the paper develops an empirical analysis to assess the relationship between workplace change and individual skill levels. By skill level we do not mean the breadth or the deepness of employee skills, but rather the effectiveness by which employees apply their knowledge and capabilities to perform their job.

The proposed interpretive framework, depicted in Figure 1, models firm performance in a changing environment as depending on employees' skills. On turn, available skills depend on three clusters of independent variables: workplace change, individual characteristics, and workplace- and job-specific features. In order to highlight the role of individual skills, the framework mediates the impact of the independent variables on firm performance through skill change, satisfaction level, and skill level.

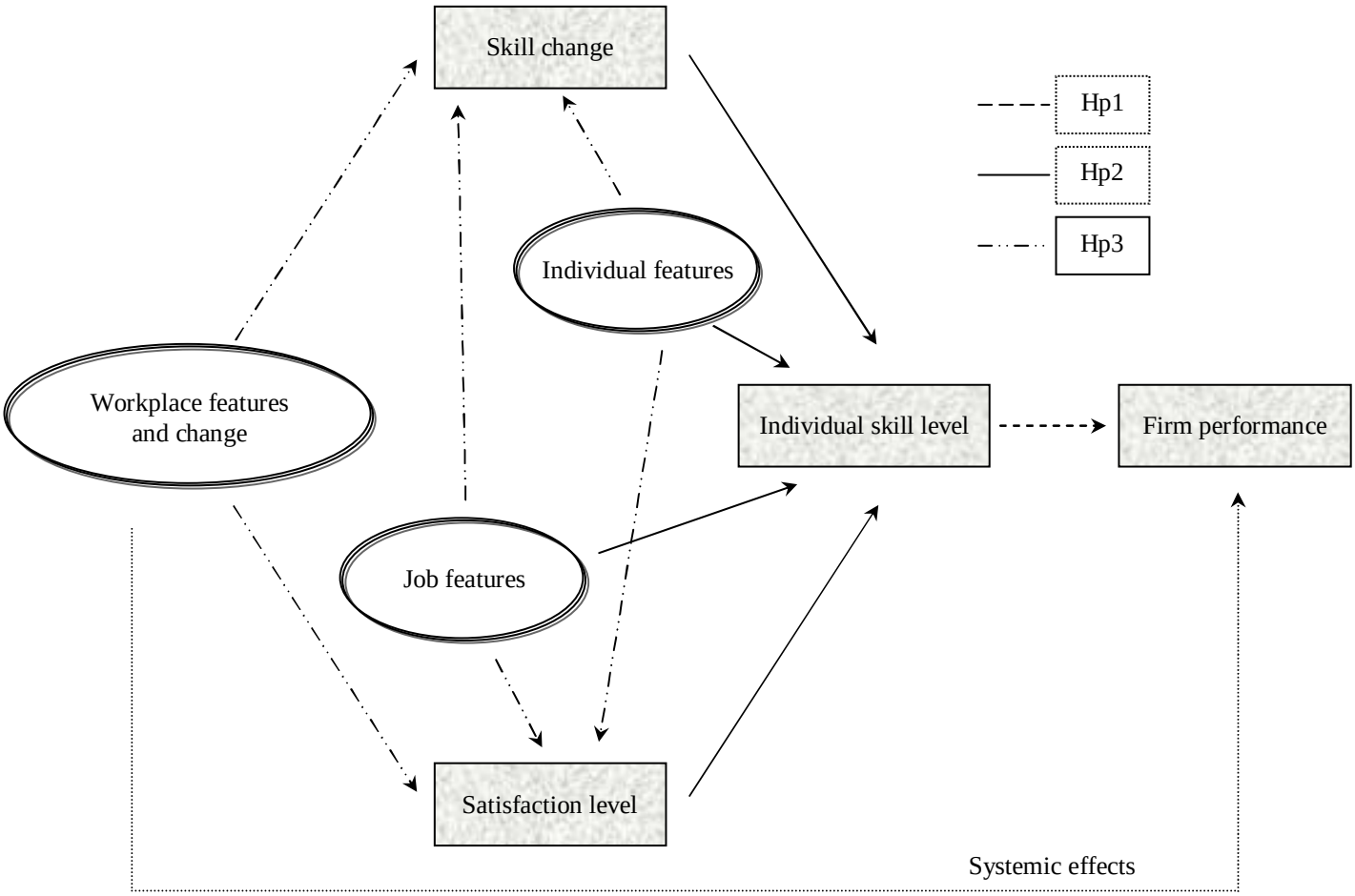
Our first hypothesis concerns the relationship between individual skill level and firm performance. If more effective and appropriate skills actually correspond to better firm performance, firms should award the employees supplying the most critical skills[3]. Oth-

[3] Of course, this statement applies to any workplace. It is interesting to remind that also the pay scheme initially proposed by Ford specifically targeted the most critical skills required to assembly line workers, *i.e.* punctuality and responsible behaviour. The pay of five dollars a day "equalled 62.5 cents an hour. Each worker received a minimum of 34 cents an hour; the additional 28.5 cents was viewed as a share of profits, and was only available to married men living with and taking good care of their families, single

erwise, we might suspect the better performance to depend on the systemic effects caused by workplace change. The automation of storehouse operations or the rationalisation of labour shifts could increase labour productivity, hence firm performance, without affecting the skills actually provided by employees (Freeman and Kleiner, 2000).

Hp 1: Firms value the skills of their employees as a source of competitive advantage.

Figure 1. Workplace change, individual skills, and firm performance



After connecting individual skill levels and firm performance, the proposed framework turns to the determinants of skill levels themselves and argues that, besides on skill change, they also depend on perceived satisfaction. The dimension of "satisfaction"

men over twenty-two of proven thrifty habits or single men under twenty-two supporting a relative" (Batchelor, 1994).

deeply relates with individual self-fulfilment through work and organisational role. It could be argued that while skills represent the explicit dimension of performance, satisfaction represents the implicit, intangible one. Perceived satisfaction deserves special attention because the social dimension of labour represents the primary source of enthusiasm and shared values – or, vice-versa, frustration. It is the trigger of "gift exchanges" at the workplace and supports the will to keep on learning and adapting/updating skills. According to our framework, satisfaction represents the dimension of individual performance able to explain why HPWPs affect incentive structures and allow better results than traditional management techniques (Ichniowski *et al.*, 1997, pp.312-3), why employee involvement techniques improve the quality of life (Freeman and Kleiner, 2000, pp.222-3), but also why HPWPs can lead to labour intensification and higher stress (Ramsay *et al.*, 2000).

The complementarity between skill change and individual satisfaction reminds of the super-additional effects due to contemporary investments in technology and organisation already stressed by literature (see Milgrom and Roberts, 1990 and 1995). In a similar way, we assume that the sustainability of skills depends not only on the development of additional technical or managerial skills (skill change), but also on the parallel consolidation of satisfaction levels. If the innovation of organisational and technological processes corresponds to increased skills, but low satisfaction, the sustainability of skill updating is at risk, because the motivation to keep on learning could fade away.

Hp 2: Both skill change and individual satisfaction significantly affect skill levels.

The third research hypothesis explores the determinants of skill change and satisfaction level. According to the proposed framework, we expect that both workplace change, individual characteristics, and workplace- and job-specific features affect skill change and satisfaction level. However, we also expect skill change and satisfaction level to be complementary rather than substitute factors and to be consequently explained by different combinations of independent variables. In particular, skill change should be mainly affected by the use/adoption/demise of specific technologies or organisational tools, while the most significant determinants of SATISF should concern "soft" items such as the quality of the social environment at the workplace or the perceived employment security.

The empirical confirmation of this hypothesis would carry significant practical implications. If a specific workplace innovation differently affects skill change and satisfaction level, the net effect on skill level and firm performance could significantly diverge from initial plans.

Hp 3: The impact of skill change and individual satisfaction on skill level display complementary rather than substitute effects.

The empirical test of the proposed hypotheses bases on a new archive developed by ISFOL, which provides a sample of 3,605 Italian employees, representative of over 9,100,000 employees occupied in private manufacturing industries and services. The database addresses the relationship between work organisation, education, and skill development. In particular, interviewed people answered questions concerning (i) their position and their job; (ii) the organisational model driving their company; (iii) owned general and specific skills and required ones; (iv) decision power; (v) training tools and models; (vi) job and workplace changes in the last three years before the interview.
Apart from the description of the firm activity and the job performed by the interviewed person, all questions involved closed answers. When appraisal was required, the questionnaire resorted to a seven-point Likert scale[4]. The ISFOL archive allows to compare the distribution of provided against required skills and to appraise their transferability across internal as well as external labour markets. Moreover, the sample of the 3,245 employees already working three years before the interview allows to perform dynamic analyses in search for evolutionary paths and recent trends[5]. Table 1 reports the main statistics for the whole sample and the sub-sample of 3,245 people already in employment in May 2001.

Table 1. The ISFOL archive: Basic descriptive statistics

		Whole sample		People employed in 2001	
Variable		**N**	**%**	**N**	**%**
Age class	15-29	691	19.2	465	14.3
[years]	30-44	1,711	47.5	1,615	49.8
	45-64	1,203	33.4	1,165	35.9
Sex	Male	2,256	62.6	2,064	63.6
	Female	1,349	37.4	1,181	36.4
Position	Blue-collars	1.534	42,6	1,353	41.7
	White-collars	1.034	28,7	927	28.6
	Managers	1.037	28,8	965	29.7
Firm size	1-49	1.842	51.1	1,065	49.46
[employees]	50-99	267	7.4	245	7.6
	100-499	537	14.9	482	14.85
	≥ 500	751	20.8	719	22.2
	n.a.	208	5.8	194	6.0
Job location	North-West	960	26.6	878	27.1
	North-East	1,017	28.2	932	28.7
	Centre	795	22.1	706	21.8
	South	833	23.1	729	22.5
Total		3,605	100.0	3,245	100.0

[4] The ISFOL inquire aimed at "taking a picture" of individual perceptions rather than screening positive or negative attitudes towards the examined issues. The choice of an uneven number of reference points along the Likert scale reflected the will of setting an "average" reference point, while the use of seven points targeted a wider distribution of opinions.
[5] Most of existing studies base on cross-section data (Handel, 2003; Bauer, 2002). Even when longitudinal data exist, most times subsequent statistical surveys do not involve the same individuals.

A further peculiarity of the ISFOL archive is the attempt to outline not only which skills firms require, but also which skills employees actually apply in their daily operations. Literature already suggested that the stronger the importance of on-the-job experience, observation, or participation to communities of practice, the wider the gap between requested and supplied skills (Handel, 2003). However, systematic empirical evidence is still missing and the ISFOL archive could contribute to fill up this gap.
Given that external observers inevitably fail to appreciate "applied skills", their measure necessarily requires difficult and often controversial processes of self-evaluation by skill-performers (Allen and van der Velden, 2005). The main problem posed by self-evaluation consists in the risk of manipulation, be it deliberate (will to transmit a certain image of oneself) or not (deriving from subjective judgment). Similarly to what happened for other large scale surveys (see, *e.g*, Felstead *et al.*, 2002), the ISFOL inquiry reduced this risk by choosing appropriate questionnaire tools and interview techniques[6].
The risk of systematic biases in answers is further reduced by the choice to investigate not only the skills required by firms, but also those applied by employees. The latter, depending on education, on-the-job and off-the-job training, working experiences and also on the organisational configuration of the firm (Green *et al.*, 2001; Tijedens and Steijn, 2005), link collected data to actual work experience, consequently increasing data reliability.

3. The empirical methodology

3.1. Value for skills

The first research hypothesis concerns the value firms attach to the skills of their employees as a source of competitive advantage. If skills actually contribute to firm performance, we expect firms to reward more effective skill levels. However, consensus is still missing on which measure represents an adequate proxy for skill appreciation by firms. By providing a large survey of literature on the relationship between skill and performance, Grugulis and Stoyanova (2005) outline the extremely diversified metrics to apprise firm performance, with organisational outcomes (such as labour productivity or product quality) and financial and stock-market measures (from return on assets to stock value) largely prevailing over parameters directly related with human resources.
Wage is often regarded as a proxy for the value attached by firms to their employees. The ISFOL archive reports the net monthly wage for 85% of interviewed people, but we regarded this measure as excessively biased by hard to control non-skill related issues,

[6] Allen and van der Velden (2005) suggest some general rules to minimise the risk of answer manipulation. The Authors recommend to avoid "critical situations" such as questions which call for "socially desirable" answers, Likert scales missing a short explanation to clarify the meaning of their points, questions which target different issues/dimensions, or questions whose true answer makes the interviewee feel uneasy.

such as labour contract or job security. We therefore turned to promotions and/or career advancements received by interviewed employees between 2001 and 2004 (PROMO), considering that promotion usually signals the appreciation for the potential contribute of the employee skills in the new job.

3.2. Skill level, skill change, satisfaction level and changes at the workplace

Additional indicators to test the proposed hypotheses include skill levels, skill change, satisfaction levels, and workplace change. Due to the need of information about skill change and workplace change, the empirical analysis focused on the 3,245 employees in working conditions in May 2001, for whom proper data were available.

In order to assess individual skill levels in May 2004 the ISFOL archive reports a list of 44 tasks and organisational behaviours whose completion requires both general and specific skills in different knowledge domains. The latter span from job-specific techniques to physical capabilities, relationship management, planning and control, leadership, and autonomy. For each item, interviewees were asked to declare the relevance for their position and, if so, to rate the frequency they performed it effectively in a scale from 1 ("Seldom") to 7 ("Almost always"). For each interviewed employee, the ISFOL archive identifies irrelevant skills as empty cells[7].

The occupational diversification of the examined sample imposes to compare the self-evaluation of skills provided by each employee with the results achieved by people performing the same job. Absolute measures present indeed two problems. First, effectiveness being equal, employees in different jobs are expected to present diversified skill profiles, and absolute measure would privilege richer jobs. Second, also the relevance of skills varies across occupations, with job-specific capabilities presenting a higher probability of being reported as relevant by people performing the same job.

Following the above remarks, the proposed index to appraise self-assessed skill levels in 2004 weights the score given to each item by the average score achieved within the corresponding occupational group and by the frequency the item is declared as relevant by people performing the same job. For each worker, the corresponding competence level $SKILL_i$ is defined as:

$$SKILL_i = \sum_{K=1}^{44} \left(W_k^n * \frac{S_{ik}^n}{\sum_{i=1}^{N} \frac{S_{ik}^n}{N}} \right), \text{ with } W_k^n = \frac{\left(N - M_k^n\right)}{\sum_{k=1}^{44} \left(N - M_k^n\right)}.$$

S_{ik}^n represents the score given to the k-th skills by the i-th worker, who belongs to the n-th occupational group together with other (N-1) sampled individuals. M_k^n is the number of employees in the n-th occupational group who regarded skill k as irrelevant for their

[7] Contrary to other studies (Scarpetta *et al.*, 2002; Leoni *et al.*, 2005), the adopted codification of information prevents from resorting to factor analysis in order to measure and rank the employees' skills

job. Consequently, W_k^n represents the relative weight of the k-th skill for the n-th professional profile. The identification of occupational groups based on the three-digit UK Standard Occupational Classification[8] (SOC).

Also the indicators to measure skill change between 2001 and 2004 (ΔSKILL) and perceived satisfaction level (SATISF) weight the opinion given by interviewed employees by the average score reported for their occupational group. In particular, skill change is assessed through the answer to the following question: "Did the position you occupied three years ago require higher, lower, or comparable skills?" Workers recognising higher skill needs were further asked if their own skills achieved adequate increases.

The ISFOL archive provides several proxies for the employees' perceived satisfaction in May 2004, because numerous questionnaire items investigate workplace quality. Due to the high correlation rates displayed by the available measures, a single indicator was preferred to a composite index. SATISF is consequently measured as the weighted agreement on a seven-point Likert scale to the following statement: "I'm proud to work for this company".

The assessment of the impact of workplace change on skill change and perceived satisfaction required to classify the recent changes reported by interviewed employees. To this aim, the ISFOL questionnaire asks if during the last three years the workplace was affected by organisational changes, by the introduction of new production techniques, or by new ICTs. Eight dummy variables (NO_CHANGE, ORG_ONLY, TECH_ONLY, ICT_ONLY, ORG_TECH, ORG_ICT, TECH_ICT, and ALL) identify the possible combination between the types of workplace change reported in the last three years. 740 of interviewed people declared no change, while a lower share reported changes involving organisation only (208 cases), production techniques only (140 cases), or ICTs only (62 cases, the smaller group). Workers also reported combinations between different types of workplace innovation, including the joint introduction of new organisational solutions and ICTs (104 cases), production techniques and ICTs (83 cases), and new organisational solutions and production techniques (124 cases). Finally, with 1,784 observations the largest group represents employees declaring that the experienced changes at the workplace simultaneously involved organisational tools, production processes, and ICTs.

Table 2 reports the main statistics for the above described indicators.

3.3. Individual characteristics, job-specific features and workplace-specific factors

Besides workplace change, also individual characteristics, job-specific features and other workplace-specific factors contribute to explain the key variables defined in the above paragraphs. Table 3 describes and reports the main statistics for these additional explanatory variables.

[8] For additional details, see http://www.statistics.gov.uk.

Table 2. Skill level, skill change, satisfaction level and changing workplaces

Variable	Description	μ	σ	Min	Max
PROMO	*Dummy for promotion in 2001-2004*	0.571	0.495	0	1
SKILL	*Skill level in May 2004*	0.832	0.215	0.029	1.397
ΔSKILL	*Skill change in 2001-2004: 0=lower skills; 1=same skills; 2=inadequately increased skills; 3=adequately increased skills*	1.000	0.354	0.308	1.875
SATISF	*Satisfaction level in May 2004, growing between 1 and 7*	1.003	0.251	0.178	1.573
NO_CHANGE	*No changes at the workplace in 2001-2004*	0.228	0.420	0	1
ORG_ONLY	*Workplace change due to organisational innovation*	0.064	0.245	0	1
TECH_ONLY	*Workplace change due to new production techs*	0.043	0.203	0	1
ICT_ONLY	*Workplace change due to ICTs*	0.019	0.137	0	1
ORG_TECH	*Workplace change due to organisational innovation and new production techs*	0.032	0.176	0	1
ORG_ICT	*Workplace change due to organisational innovation and ICTs*	0.026	0.158	0	1
TECH_ICT	*Workplace change due to new production techs and ICTs*	0.038	0.192	0	1
ALL	*Workplace change due to organisational innovation, new production techs, and ICTs*	0.550	0.498	0	1

3,245 observations

In addition to the usual variables to capture individual effects (age, sex, qualification, tenure), the proposed analysis also includes PC skills in 2001 and the worker evaluation about the appropriateness of the required education level to perform the current job. Due to the pervasive and ever increasing diffusion of ICTs across different working environments, past PC capabilities are expected to condition the evolution of skills for most workers. On the contrary, the match between the firm and the employee perception about the proper education to occupy one's role is expected to impact on the satisfaction level. Perceived over-qualification may generate frustration while, on the contrary, under-qualification could make employees feel uncomfortable[9].

Job-specific variables address both the situation in 2004 and the evolution between 2001 and 2004. A first group characterises the labour contract (temporary or fixed, part-time or full-time job), also appraising the entry in or the exit from specific situations in the three years before the interview. Three additional variables illustrate job, employment, and labour market security by assessing, respectively, if similar jobs were cut in recent years, if job loss is a credible risk, and if owned skills are easy to transfer to the external labour market.

[9] However, the success in performing tasks for which higher qualifications are usually required could also increase the self-esteem and the satisfaction perceived by under-qualified employees.

Table 3. Individual, job-specific and workplace-specific variables

Variable	Description	μ	σ
Employee-specific variables			
SEX	Dummy for female workers	0.364	0.481
AGE	Age in May 2004 (years)	40.052	9.559
QUALIFICATION	Education level, from 0 (basic school) to 4 (degree and over)	2.120	0.837
FIRM_TENURE	Classes of firm tenure, from 0 (up to 3 years) to 3 (20 years and over)	1.598	0.961
PAST_PC	PC capabilities in 2001, from 1 (no skill) to 5 (expert)	2.577	1.225
EDU_MATCH	Perceived usefulness of required education level, from 1 (No use) to 7 (Essential)	4.666	1.631
Job-specific variables			
TEMP	Dummy for temporary work contract	0.047	0.211
TEMP_IN	Entry into temporary contract in 2001-2004	0.019	0.137
TEMP_OUT	Exit from temporary contract in 2001-2004	0.048	0.214
PTIME	Dummy for part time work contract	0.101	0.301
PTIME_IN	Entry into part time in 2001-2004	0.032	0.177
P TIME_OUT	Exit from part time in 2001-2004	0.027	0.161
JOB_CUT	Dummy for cut of similar positions in 2001-2004	0.616	0.487
UNEMPLOYMENT	Unemployment risk in a year, from 1 (No risk) to 7 (Almost sure)	2.344	1.387
EXT_MKT	Skill transferability to the external labour market, from 1 (Almost impossible) to 7 (No problem)	3.281	1.352
BLUE_COLLAR	Dummy for blue collar	0.417	0.493
TIME2LEARN	Time to learn the current job, from 1 (less than 1 week) to 7 (over 2 years)	3.527	1.957
RESPONSIBILITY	Dummy for formal responsibility on the job	0.912	0.283
ΔPC	Importance of PC decreased (0), stayed the same (1), or increased (2) in 2001-2004	1.059	0.991
ΔPLANNING	Importance of planning decreased (0), stayed the same (1), or increased (2) in 2001-2004	0.866	0.981
ΔCHOICE	Decisional power decreased (0), stayed the same (1), or increased (2) in 2001-2004	1.097	0.961
ΔCTRL	Control over the job decreased (0), stayed the same (1), or increased (2) in 2001-2004	1.092	0.545
ΔEFFORT	Provided effort decreased (0), stayed the same (1), or increased (2) in 2001-2004	0.831	0.956
Workplace-specific variables			
LG_SIZE	Firm size (log of employees)	4.285	2.620
NO_STRESS	Dummy for no stress sources at the workplace	0.352	0.478
ΔSTRESS	Job stress decreased (0), stayed the same (1), or increased (2) in 2001-2004	0.546	0.869
INFORMAL_TR_IDX	Length of informal training after hiring, from 0 (no training) to 6 (over 4 months)	2.270	2.292
FORMAL_TR_IDX	Length of formal training when entering the current job, from 0 (no training) to 6 (over 4 months)	1.657	2.705
INFORMAL_UPDATE	Dummy for skill updating via informal training	0.087	0.281
FORMAL_UPDATE	Dummy for skill updating via formal training	0.215	0.411
SELF_UPDATE	Dummy for skill updating via self-training	0.198	0.398
TEAM	Dummy for teamwork	0.478	0.500
TEAM_IN	Entry into teamwork in 2001-2004	0.061	0.240
TEAM_OUT	Exit from teamwork in 2001-2004	0.083	0.275
QLTY_CIRCLE	Dummy for involvement in quality circles	0.095	0.293
QLTY_IN	Entry into quality circles in 2001-2004	0.047	0.213
QLTY_OUT	Exit from quality circles in 2001-2004	0.015	0.122
FORMAL	Dummy for formal appraisal of performance	0.288	0.453
FORMAL_IN	Entry into formal performance evaluation in 2001-2004	0.094	0.292
FORMAL_OUT	Exit from formal performance evaluation in 2001-2004	0.051	0.219
MEETINGS	Dummy for periodical manager-workers meetings	0.573	0.495

3,245 observations

Other variables explore the nature of performed tasks (BLUE_COLLAR), the complexity of the performed job, measured by the length of time needed to achieve a satisfactory performance (TIME2LEARN), and the span of control over different issues (RESPONSIBILITY). The last set of job-specific variables checks the existence and the direction of changes in the requirements for one "hard" skill (PC use) and four "soft" skills (planning capabilities, discretional power, autonomy, and physical effort).
The explanatory variables to characterise the workplace include structural factors such as firm size (LG_SIZE), the quality of the working environment (measured by the lack of stress sources, NO_STRESS), and its recent variations (ΔSTRESS). However, most variables concern the use of specific HPWPs (initial training, continuous training, teamwork, quality circles, performance appraisal, and employees-managers meetings), also appraising their introduction or demise in the three years before the interview.
Eventually, we also took into account sector-specific and region-specific effects by means of dummy variables.

3.4. The econometric tests

The relationship between the appreciation of the i-th worker by her/his employer (Y_i^*) and its determinants (transposed vector $\overline{X_i'}$) argued by Hypothesis 1 can be described as a linear model in the following form:

$$Y_i^* = \overline{X_i'}\,\overline{\beta} + \varepsilon_i ,$$

where ε_i is a random error with zero mean and unity variance. However, we do not observe Y_i^*, but the binary variable $PROMO_i$, which records if the i-th employee received a promotion or a career advancement between 2001 and 2004:

$$PROMO_i = \begin{cases} 1, \text{ if the i - th employee is awarded a promotion} \\ 0, \text{ otherwise} \end{cases}$$

If the employer appreciation Y_i^* is lower than an unknown hurdle rate μ^*, the i-th employee will receive no promotion ($PROMO_i = 0$). On the contrary, when $Y_i^* \geq \mu^*$ the employee skills are rewarded with a promotion ($PROMO_i = 0$). The probability of receiving a promotion between 2001 and 2004 is estimated via a binary model with a logistic cumulative distribution function in the following form:

$$P(PROMO_i > 0 \,|\, X_i) = \frac{e^{\overline{X_i'}\overline{\beta}}}{1 + e^{\overline{X_i'}\overline{\beta}}},$$

where $\overline{X_i'}$ is the transposed vector of the values assumed by the explanatory variables for the i-th employee, including skill level and some control variables, and $\overline{\beta}$ is the coefficient vector to estimate. The regression tests if the coefficient of skill level is significant and positive.

The assessment of Hypotheses 2 resorts to an OLS regression to check the positive and significant impact of ΔSKILL and SATISF over the 2004 skill level:

$$SKILL_i = a_0 + a_1 * \Delta SKILL_i + a_2 * SATISF_i + \overline{IND'_i} * \overline{\alpha_1} + \overline{JOB'_i} * \overline{\alpha_2} + \overline{WP'_i} * \overline{\alpha_3} + \varepsilon_{1i}$$

$\overline{IND'_i}$, $\overline{JOB'_i}$ and $\overline{WP'_i}$ are transposed vectors of, respectively, individual, job-specific, and workplace-specific variables. The regression tests if coefficients a_1 and a_2 are significant and positive, as well as the non-nullity of coefficient vectors $\overline{\alpha_1}$, $\overline{\alpha_2}$ and $\overline{\alpha_3}$.

In a similar way, the test of Hypothesis 3 looks for the determinants of skill change and satisfaction level by running two linear regressions in the following form:

$$\Delta SKILL_i = c_0 + \overline{IND'_i} * \overline{\gamma_1} + \overline{JOB'_i} * \overline{\gamma_2} + \overline{WP'_i} * \overline{\gamma_3} + \varepsilon_{1i}$$

$$SATISF_i = d_0 + \overline{IND'_i} * \overline{\delta_1} + \overline{JOB'_i} * \overline{\delta_2} + \overline{WP'_i} * \overline{\delta_3} + \varepsilon_{1i}$$

Complementarity between DSKILL and SATISF would imply a different distribution of zeros between $\overline{\gamma_1}$ and $\overline{\delta_1}$, $\overline{\gamma_2}$ and $\overline{\delta_2}$, $\overline{\gamma_3}$ and $\overline{\delta_3}$.

4. The results of the empirical analysis

Tables 4, 5, and 6 report the results of the regression estimates[10]. In general terms, the findings support all the research hypotheses.

First, after controlling for inter-industry and inter-regional differences, SKILL significantly affects the probability of receiving a promotion. The binary logit model (Table 4) confirms that, given an equal increase of independent variables, SKILL has the highest impact on the likeliness of being promoted, with an odd ratio of 1.544. However, the effectiveness of the supplied skills is not the only driver to build up the firm judgement. Even if SKILL expresses the employee skill level relative to respondents in the same three-digit job classification, people with higher qualification still enjoy consistently higher chances of promotion. The positive impact of QUALIFICATION could signify that firms attach significant value to the learning potential of better educated people.

The working environment displays significant influence, too. Promotions between 2001 and 2004 were less likely for people employed at workplaces where no organisational or technological innovation was introduced in the same period. It has to be noted the non significant impact of firm size (coefficient of LG_SIZE not significant), also when focused on specific groups of employees (LG_SIZE*BLUE_COLLAR).

We can therefore argue that, for the examined sample, firms on average recognise the contribution of skills to their competitive advantage. However, this evaluation is significantly affected by individual and workplace features.

[10] For the sake of synthesis, correlation matrixes are not included. Anyway, also when significant, the low detected correlation rates do not prospect risks of multicollinearity.

Table 4. Promotions award the skill level

	β	Standard error		e^{β}
SKILL	0.434	0.167	**	1.544
QUALIFICATION	0.245	0.048	***	1.278
NO_CHANGE	-3.453	0.153	***	0.032
LG_SIZE	-0.015	0.019		0.985
LG_SIZE*BLUE_COLLAR	0.016	0.021		1.016

3,051 observations; 8 sector dummies and 3 regional dummies included
Dependent variable: PROMO; binary logit regression
Correctly classified cases: 78%
-2 Log likelihood: 3074.671; Cox & Snell R^2: 0,315; Nagelkerke R^2: 0,420
**** p<0.001; ** p<0.05; * p<0.10*

Once assessed the first research hypothesis, we turned to examine the determinants of the skill level, assuming a significant role for ΔSKILL and SATISF. The linear regression reported in Table 5 confirms the expectations: the estimated coefficients for ΔSKILL and SATISF are both positive and highly significant. Somehow surprisingly, the coefficient of SATISF is over 80% higher than the coefficient of ΔSKILL: the effectiveness of the employee performance seems more reactive to variations in the perceived satisfaction than to the acquisition of additional skills and capabilities.

Some of the individual- and job-specific explanatory variables introduced in this regression confirm the findings of other studies: temporary workers and part-timers suffer from a comparative disadvantage in terms of skill levels, also within their own occupational group. However, no comparative disadvantage for women arise[11]. The significant and positive coefficient of Age/100 (age in years, divided by 100) signals the importance of time as a source of worthy work experience[12].

Not surprisingly, the longer the time required to learn the job, the higher the effectiveness of provided skills. However, sampled employees seem to have learned their job primarily via self-training, given the non significant impact of initial informal training and the low impact of initial formal training (β = 0.001, significant only at the 0.90% level).

The estimated regression also confirms the helpfulness of "putting some pressure" on employees to turn their potentialities into effective performances: being all other factors equal, the lack of sources of stress at the workplace involves a reduction in the effectiveness of provided skills. Given the comparable coefficients of ΔSKILL and NO_STRESS, we could argue that, in a relaxed workplace, the increase of an employee's skills could fail to translate in any better performance – at least from the firm point of view.

[11] Contrary to other analyses (see, *e.g.*, Felstead *et al.*, 2002 for the British case), we did not detect significant disadvantages for part-time female employees against full-time ones. This result may descend from the comparatively low diffusion of part-time contracts in Italy, also among women.
[12] We detected no significant difference in marginal returns to age.

The last four explanatory variables control for the impact of typical HPWPs at the workplace: as previous studies already suggested, also for the examined sample the use of tools such as team-working, quality circles, formal evaluation of performance, and periodical managers-workers meetings significantly increase the effectiveness of provided skills. We could argue that a substitute effect potentially exists between individual contribution and firm contribution to skill level. "Planned communication" via periodical meetings could substitute for poor mutual adjustment due to low satisfaction levels. In a similar way, teamwork could substitute for the inadequate increase of individual capabilities.

Table 5. The determinants of the skill level

	β	Standard error	
Constant	0.509	0.023	***
ΔSKILL	**0.047**	**0.010**	***
SATISF	**0.084**	**0.013**	***
SEX	-0.005	0.007	
AGE/100	0.107	0.036	***
TEMP	-0.034	0.016	***
PTIME	-0.028	0.012	***
TIME2LEARN	0.025	0.002	***
NO_STRESS	-0.042	0.007	***
INFORMAL_TR_IDX	-0.002	0.002	
FORMAL_TR_IDX	0.002	0.001	*
TEAM	0.036	0.007	***
QLTY_CIRCLE	0.062	0.012	***
FORMAL MEETINGS	0.029	0.008	***
	0.091	0.007	***

3,245 observations; dependent variable: SKILL; OLS regression
*F-test: 70.3940***; Adjusted R^2: 0,230*
**** p<0.001; ** p<0.05; * p<0.10*

The confirmation of Hypothesis 2 justifies the further analysis of the determinants of ΔSKILL and SATISF. The latter enter as dependent variables the linear regressions in Table 6, based on the same list of explanatory factors. The comparison of partial models points out several interesting pieces of evidence.

First, only in a limited number of cases the explanatory variable displays a similar impact on ΔSKILL and SATISF. This holds for ΔPC, ΔCTRL, FORMAL_UPDATE and QUALITY_IN. It is perhaps surprising that high levels of past PC skills negatively affect both ΔSKILL and SATISF: one may argue that the diffusion of ICTs and computer-based applications deluded the expectations of early professionals and did not stimulate them to keep on learning.

Table 6. The determinants of skill change and satisfaction

Dependent var	ΔSKILL (skill change)						SATISF (satisfaction)					
	Full model			Partial mode			Full model			Partial model		
Explanatory vars	β	Std error		β	Std error		β	Std error		β	Std error	
(Constant)	0.878	0.036	***	0.896	0.021	***	0.996	0.027	***	0.986	0.027	***
FIRM_TENURE	-0.019	0.006	***	-0.020	0.006	***	0.023	0.005	***	0.024	0.005	***
PAST_PC	-0.030	0.005	***	-0.031	0.005	***	-0.014	0.004	***	-0.012	0.004	***
EDU_MATCH	-0.003	0.004					0.006	0.003	**	0.006	0.003	**
TEMP_IN	-0.065	0.042					-0.032	0.032				
TEMP_OUT	0.095	0.027	***	0.099	0.027	***	-0.012	0.021				
PTIME_IN	-0.023	0.032					0.015	0.024				
P TIME_OUT	0.021	0.036					0.002	0.027				
JOB_CUT	-0.013	0.017					-0.050	0.013	***	-0.047	0.009	***
UNEMPLOYMENT	0.005	0.004					-0.025	0.003	***	-0.026	0.003	***
EXT_MKT	0.003	0.004					0.008	0.003	**	0.009	0.003	***
RESPONSIBILITY	0.012	0.021					0.054	0.016	***	0.059	0.016	***
ΔPC	0.044	0.006	***	0.043	0.006	***	0.009	0.005	*	0.012	0.005	**
ΔPLANNING	0.062	0.007	***	0.061	0.007	***	0.007	0.005				
ΔCHOICE	0.066	0.007	***	0.066	0.007	***	0.004	0.006				
ΔCTRL	-0.026	0.011	**	-0.025	0.011	**	-0.026	0.008	***	-0.027	0.008	***
ΔEFFORT	0.019	0.007	***	0.019	0.007	***	-0.008	0.006				
INFORMAL_UPDATE	0.021	0.021					0.040	0.016	**	0.037	0.015	**
FORMAL_UPDATE	0.043	0.016	***	0.039	0.014	***	0.051	0.012	***	0.045	0.011	***
SELF_UPDATE	0.000	0.016					0.016	0.012				
TEAM_IN	0.026	0.024					-0.023	0.018				
TEAM_OUT	-0.022	0.021					-0.015	0.016				
QLTY_IN	0.079	0.027	***	0.083	0.027	***	0.039	0.020	*	0.042	0.020	**
QLTY_OUT	-0.060	0.046					-0.049	0.035				
FORMAL_IN	0.052	0.020	***	0.052	0,019	***	0.014	0.015				
FORMAL_OUT	-0.002	0.026					-0.002	0.020				
ΔSTRESS	0.026	0.007	***	0.026	0.007	***	-0.010	0.005	*	-0.012	0.005	**
ORG_ONLY	0.013	0.026		0.006	0.025		-0.022	0.020				
TECH_ONLY	0.063	0.029	**	0.067	0.029	**	0.018	0.022				
ICT_ONLY	0.071	0.042	*	0.072	0.042	*	-0.015	0.032				
ORG_ICT	0.066	0.034	*	0.063	0.034	*	0.028	0.026				
TECH_ICT	0.059	0.037		0.062	0.037	*	0.046	0.029				
ORG_TECH	0.091	0.032	***	0.087	0.031	***	0.013	0.024				
ALL	0.061	0.020	***	0.055	0.014	***	0.007	0.015				
F-test	24.763	***		42.394	***		8.180	***		19.168	***	
Adjusted R^2	0.195			0.195			0.068			0.068		
Test on restriction		H_0: F(14, 3212) = 0.868 p < 0.594, H_0 accepted						H_0: F(20, 3212) = 1,036 p < 0.414, H_0 accepted				

3,245 observations; OLS regressions
**** p<0.001; ** p<0.05; * p<0.10*

Second, the regressions markedly evidence the complementary nature of ΔSKILL and SATISF. While the former is mainly explained by workplace features and innovations,

the latter depends on individual features and job-specific variables mainly related with the social dimension of work.

Among the independent variables affecting ΔSKILL only we list the exit from temporary contracts[13], the introduction or the increased use of HPWPs in the three years before the interview and, most notably, the type of innovations introduced at the workplace. While the introduction of organisational innovations only involves no significant difference from no change, all the other combinations present positive and significant coefficients. However, the similarity in the magnitude of coefficients prevents from claiming super-additional effects of workplace change on skill change when different types of innovations are introduced.

The independent variables affecting SATISF only look all related with the social dimension of work[14] and include EDU_MATCH, JOB_CUT, UNEMPLOYMENT, EXT_MKT, RESPONSIBILITY, and INFORMAL_UPDATE.

Third, Table 6 also points out that two variables have significant but opposite impact on ΔSKILL and SATISF. The correlation with firm tenure is positive for SATISF (probably due to better contract conditions and to the development of organisation-specific knowledge), but negative with ΔSKILL: the older the employee, the lower the incentive to learn. On the contrary, the growth of stress at the workplace (ΔSTRESS) increases ΔSKILL and lowers SATISF. This evidence suggests that firm should carefully consider the introduction of stress-augmenting solutions, because the negative impact on satisfaction levels could disrupt the positive effect of skill change over the effectiveness of provided skills.

5. Concluding remarks

The evidence provided in the above paragraphs confirms that skills matter. Firms do actually show a propensity to reward the employees who more effectively apply their skills at the workplace. Assuming that firms follow on average rational behaviours, we can conclude that effective individual skills correspond to better firm performance.

The empirical tests provide evidence about the dynamics of skill update at changing workplaces. A sustainable skill performance involves more than the sole renewal of technical capabilities. It also requires the employees' motivation to learn and change, sustained by satisfaction about their working activity. If skill change represents the "explicit side" of performance updating, perceived satisfaction at the individual level constitutes the implicit dimension that any "gift exchange" between employer and employee bases on.

[13] It is somehow surprising that variations in temporary and part-time working conditions display no effect on the level of perceived satisfaction.

[14] The difficulty to capture the factors affecting such an intangible concept is witnessed by the low percentage of the variance of the dependent variable explained by the proposed independent variables. For both full and partial models the adjusted R^2 achieves 19.5% for ΔSKILL, but only 6.8% for SATISF.

The binary logit model also shows that the positive impact of skill effectiveness on firm reward persists despite significant inter-industry effects. If the relationship among skills, satisfaction, and performance spans across all industrial and service sectors, every company should take into account the complementarity between the drivers of skill change and perceived satisfaction.

As the title of the paper underlines, the proposed analysis concerns the Italian case. The international validation of the resulting evidence is still to be proven. the future agenda of our research programme therefore includes the test of the proposed framework on international data. Of course, the development of proper indicators to describe multifaceted concepts such as skills, skill effectiveness, skill change, and satisfaction represents the preliminary step to any international comparison.

What many already suspected in the past is now becoming unavoidable. If labour is more than routine, if employees are more than material inputs to production processes, if skills are more than items in a checklist, we just have to open the black box of human resources and develop the proper tools to pursue this goal.

Acknowledgments

We are grateful to ISFOL for providing access to the OAC database. We also thank the FIRB research grant RBNE039XKA_005 for financial support.

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