

Organizational Innovations and Firm Performance. Evidences From the Case of Medium-Sized Milanese Firms

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Organizational Innovations and Firm Performance. Evidences From the Case of Medium-Sized Milanese Firms*

Edoardo Della Torre e Luca Solari

The empirical evidence of the past fifteen years has shown the existence of a positive relationship between the adoption of organizational innovations and a firm's economic results. Yet there is less consensus on the conditions which make it possible for innovations to be converted into better performance. The dominant theory maintains that the effects are greater if the new practices are introduced in 'bundles', and if they are designed consistently with the firm's other strategies, particularly those related to technological innovations. A broad strand in the economic literature argues for the existence of complementarities between the two types of innovation. However, it is still unclear what strategies are actually adopted by firms, and especially so in the case of Italy. Through analysis of an original sample of medium-sized firms in the Milanese area, this paper shows that organizational innovations have been introduced in a large part of firms, but in many cases the process of organizational change is not yet complete, so that the situation is largely one of 'transition'. Analysis of the relationships with business performance instead shows that the firms which have achieved the largest productivity increases in the past five years are those which have combined investments in the new organization of work with advanced technologies. This therefore supports the dominant theory.

1. Introduction

Study of the effects exerted by new work practices on the productive, economic and financial performance of firms is probably the main strand of inquiry into High Performance Work Practices (HPWPs).

Since the mid-1990s, the international economic literature has reported increasingly robust results in support of the idea that the new 'high commitment' or 'high involvement' organizational models stand in a positive relationship with firms' economic results. In particular, a recent body of theoretical and empirical studies shows that firms obtain the best results when the innovations are introduced according to a logic of complementarity: that is, not concentrating on certain single measures but privileging a systemic vision of change (organizational, technological, etc.) (Milgrom and Roberts 1990, 1995, McDuffie 1995, Becker et al. 1997, Ichniowski et al. 1997, Black and Lynch 2001, 2004).

Nevertheless, although there is a large amount of evidence at international level in this regard, and although it is now widely acknowledged that issues concerning the organization and management of work are of crucial importance for firms' competitiveness, these matters have received little attention in Italy (especially in the political and economic, but also academic, debate). This has been mainly because of the scant information sources available.

By using data from a survey carried out by the Centro Studi Assolombarda on more than 100 medium-sized firms in the Milanese area, this paper seeks to answer the following questions.

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Is there a relationship between the adoption of organizational innovations and a firm's economic results? if so, what are the strategies that yield the best performance? To what extent is it important for planning to be consistent with other corporate strategies? The analysis was conducted in two steps, in terms of both the variables considered and the statistical analysis. First, exploratory analysis was made of the relations between organizational innovations and certain business performance indicators, paying particular attention to the role of technological innovation. The results obtained were then validated using the multivariate technique of classification trees. This enabled identification of the business strategies associated with the best results in terms of labour productivity and overall economic performance.

The empirical part of the paper also considers the diffusion of organizational innovations, and is preceded by a description of the definition of HPWP used in this survey and by a brief review of the current literature.

2. HPWPs: a world of shifting boundaries

We said at the outset that the majority of current studies report results which support the existence of a positive relation between the adoption of HPWPs and better business performance. It is well known, however, that various methodological obstacles considerably hamper the extendibility of the results obtained, and therefore the possibility of reaching general conclusions. Moreover, this is a problem which affects the entire strand of studies on HPWPs, and not just the studies analyzing the relations between HPWPs and firm performance.

A specific problem of studies analysing the relations between HPWPs and firm performance is the variety of the indicators used to measure the latter. The two indicators most frequently used are productivity, usually of labour, measured as the number of units produced in a particular interval of time or as value added per employee, and the quality of products or services, which in the manufacturing sector is mainly measured as the percentage of defective products in total output, and in the tertiary sector as the disservices furnished. In many cases, the two indicators – labour productivity and the quality of output – are considered jointly (McDuffie 1995, Banker et al. 1996, Ichniowski et al. 1997, EF 1997, Appelbaum et al. 2000, Ramsay et al. 2000, Godard 2001, Gittel et al. 2004). Other indicators used to measure organizational performance are financial results (Brown et al. 1992, Pini 2005a, Antonioli and Pini 2004, Addison et al. 2000), improvements in the behaviour of workers, which mainly refers to reduced absenteeism (EF 1997, Ramsay et al. 2000, Godard 2001), and variation in the number of employees in the firm (EF 1997 and Addison et al. 2000).

Another aspect to be considered is the presence of numerous studies that rely exclusively on the perceptions of interviewees (EF 1997, Addison et al. 2000, Ramsay et al. 2000, Godard 2001), generally plant managers or CEOs. Although there is some evidence that the perceptions of interviewees correspond to the actual balance sheet data (Pini 2005), it cannot be denied that spontaneous statements may be influenced by numerous contingent factors (for instance, the mood of the interviewee).

However, the main problem encountered in the study of new work practices is the lack of an unambiguous definition of what falls under that heading. The terminology used to denote the set of new work practices also varies greatly: 'high performance work organization', 'new

forms of work organization', 'employee involvement practices', 'new work organization', 'high commitment organizations', are some of the expressions currently employed. A certain degree of consensus can be found in the literature only at a general level; in this regard, a valid example is that of the European Work Organization Network (EWON),¹ which adopts the following definition of New Work Organization:

"New Work Organisation is the application of principles and practices within enterprises which aim to capitalise on, and develop the creativity and commitment of employees at all levels in achieving competitive advantage and in meeting the business and service challenges posed by the social, economic and technological environment in which an enterprise exists" (EWON, 2002, p. 5)

The differences of institutional contexts among countries, and the different approaches taken by researchers even within the same country (each survey of practices has its own methodology), not only make it rather difficult to proceed by cumulative results in investigating the phenomenon (Bordogna and Pedersini 2001), they also hamper comparison among the results obtained. On the one hand, in fact, studies on HPWPs refer to very different practices; on the other, even when they deal with the same practices, they do not use directly comparable indicators.

It should be said, however, that because every firm adopts its own particular practices, or ones tailor-made for its organization, it is largely pointless, as well as difficult, to draw up a systematic list of what practices can be considered to belong to the category of HPWPs. Instead, it is much more sensible to identify a set of features shared by such practices. In this regard, the changes brought by the new forms of work organization can be arranged along three main dimensions, each with its own component (EC 2002), viz.:

- the ways in which work is organized in regard to operational activities, including, for example, multi-skilling, job rotation, and semi-autonomous work groups.
- the ways in which work is coordinated within the organization, including, for example, measures to flatten hierarchies, information flows, interactions between workforce and management (participation), and measurement of performance.
- personnel management policies including investments in training and performance bonuses.

Therefore, in order to be considered such, new work practices must at least partly change the way in which work is organized, coordinated or managed. Adopting and integrating the scheme used by the European Commission's study (2002), Box 1 shows the dimensions and the components of 'a high performance work system' as understood here.

¹ The "European Work Organization Network" was created by the European Commission following publication of the Green Paper *Partnership for to New Organization of Work*. With a view to promoting new forms of work, the network's activity consists in the collection and analysis of emerging 'good practices' within their contexts, and the exchange and dissemination of the best of these practices, together with the methodology for their effective implementation. The scheme is aimed at enterprises, workplaces and workers of all levels. At the same time, the analyses provide support for social partners, public authorities and the European Commission itself.

Box 1. Dimensions and components of a 'high performance' work system

1. Ways in which operational activities are organized:

- Work groups: groups are responsible for achieving targets and they decide how the work is to be carried out. They may be *autonomous* (the leader is selected by the group) or *semi-autonomous* (the leader is selected from outside and/or there is a certain amount of external influence/control over the group)
- Multi-skilling: the workers are able to perform more than one task within the organization and the boundaries among tasks are less clearly marked out.
- Job rotation: the workers regularly rotate among different tasks.

2. Ways in which work within the organization is coordinated

- Greater autonomy in the carrying out of tasks: decision-making is decentralized and pushed down to the lowest possible level.
- Information sharing: workers (at all levels) are given detailed information about the organization's performance (financial, productive etc.).
- Workforce involvement: besides the meetings foreseen by the collective agreement, there are other occasions for the consultation of workers or their representatives by management on various issues (organization, quality, production process, etc.).
- Performance evaluation systems: the performance of employees is systematically evaluated according to a method known to the workers

3. Personnel management policies

- Investments in technical/specific training: (internal or external) training schemes to improve the skills and knowledge of workers concerning their tasks/activities in the firm.
- Investments in relational/behavioural training: (internal or external) training schemes to enhance the cross-skills (e.g. problem-solving or team-working) involved in the approach to work and the management of interpersonal relations.
- Internal labour markets: opportunities for workers to pursue careers within the organization.
- Incentivising reward systems: a significant portion of the wage (more than 5%) depends on individual or group performance.

Source: adapted from EC (2002).

3. HPWPs and firm performance: the literature

The organizational literature has convincingly shown that the diffusion, sustainability and success of the new practices are conditioned by the satisfaction of workers (senior and middle managers included) with their work; and that this satisfaction is mediated in its turn (Batt 2004) by workers' perceptions of the security (and discretion) of their jobs. On this view, moreover, the new work practices are important because they are the forms of control best suited to the new way of working, with a shift from the direct control of superiors to indirect control (Godard 2001). If a worker's wage depends to a substantial extent on performance (by him/herself, by his/her group, or by the firm), direct control by management (supervision and monitoring) is less necessary. This allows workers to carry out their tasks in ways more consistent with the new organization of work, with the variability of the wage acting as a guarantee of their commitment.

The economic literature has also shown that the performance of workers (productivity) is substantially improved with reward systems supported by innovative work practices such as flexible tasks, participation in problem solving, multiskilling, workplace safety, rigorous selections and communication processes (Ichniowski et al. 1997). Since the works of Milgrom and Roberts (1990, 1995), moreover, a growing body of studies maintain that if the new practices are to have positive effects, they must be introduced at system level, because the different 'clusters' of practices (as identified on the above three definitional dimensions) are interconnected by complementarities in relation to the effects on the firm's economic and productive results. This holds in terms of both internal coherence among the various 'bundles' of working practices and external coherence, i.e. with the other strategies pursued by the firm.

3.1. Internal coherence

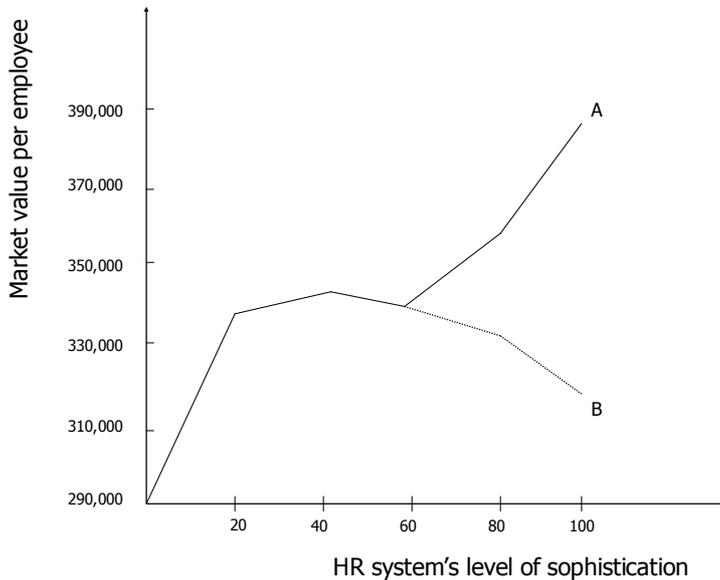
As regards internal coherence, the existing evidence suggests that the best results are obtained if the practices introduced are coherent with each other (Becker et al. 1997; Ichniowski et al. 1997), supported by suitable personnel management practices (Brown et al. 1992; Ichniowski et al. 1997; Becker et al. 1997), and designed consistently with managerial capabilities (Becker et al. 1997; Thompson and Heron 2005).

In one of the first studies to adopt this approach, Brown and colleagues (1992) used the expression 'SET System' for a workplace where the three elements of security, employee involvement and training are present. According to these authors, these three elements reinforce each other in a virtuous circle with positive effects on the firm's economic performance, whilst the absence of one of them complicates the operation of the other two, thereby also weakening the effects on performance.

Some research results also suggest that the relationship between the extent to which reforms are adopted and their effectiveness is not linear, but instead exponential. Becker et al. (1997), for instance, on studying more than 1500 American firms, have found that the returns on investment in HPWS grow greatly at an initial stage, when the firm takes its first steps towards adoption of a HPWS, diminish for levels of medium adoption, in which the marginal results are limited, and substantially increase at higher levels of adoption. Dividing the levels of adoption into percentiles, the best results are achieved between the first and the twentieth percentile, and between the sixtieth and the hundredth (curve A in Figure 1). At intermediate levels of adoption, the new practices have exhausted their positive effect due to the shift from a situation of absence, and therefore of impediment, to one of 'renewal'. In this situation, the effect on performance (measured as market value per employee) is not harmful, but has little marginal impact. At levels of very sophisticated adoption, the closer integration of the HRM system into the firm's operational fabric produces greater benefits.

Adopting a more critical approach, Godard (2001) analyses a longitudinal sample of 78 Canadian firms and argues instead that the economic results grow at moderate levels of introduction, stabilize at intermediate levels, and decline at high levels. Godard's results are therefore very similar to those obtained by Becker and colleagues (1997) up to the sixtieth percentile, but then assume the reverse pattern at the highest levels of sophistication (which can be hypothesised as similar to curve B in Figure 1).

Figure 1 – Impact of the HR value on market value per employee



Source: adapted from Becker et al. (1997, p.3)

According to McDuffie, for innovative HR practices to have positive effects on performance, three conditions must be fulfilled: a) the workers must possess knowledge and skills which the managers do not; b) the workers must be committed to applying the knowledge and skills (discretionary effort); c) the workers must decide to make this discretionary effort to fulfil the firm's productive (or business) strategy (McDuffie 1995). In conclusion, therefore, "the 'organizational logic' of flexible production links together a bundle of manufacturing practices (related to the minimization of buffers) with a bundle of human resource practices (related to the expansion of work force skills and motivation). The two bundles are complementary in that they affect separate aspects of a plant's operations and yet mutually reinforce each other" (p. 200).

Becker and colleagues (1997) also show that the combination of pay levels above the market average with the intense use of high performance management practices has a 50% greater effect than the use of the two practices separately. Likewise, the use of a system of internal promotions has significantly better effects on performance if it combined with suitable training and pay practices.

3.2. External coherence

Complementarity with other strategies instead requires that organizational innovations be coherent with the technologies employed and with the competitive strategies and the characteristics of the market in which firms operate (Milgrom and Roberts, 1990, 1995; McDuffie, 1995; Black and Lynch, 2001, 2004; Gittell et al. 2004; Godard 2004). This applies both to the effects that these variables (jointly) exert on the firm's economic and productive performance (Milgrom and Roberts 1990, 1995; Black and Lynch 2001, 2004; for the Italian

case see Pini 2006; Antonioli et al. 2007; Cristini et al. 2008), and to the effects that they exert on each other, i.e. in terms of the firm's overall innovative performance (Osterman 1994; Laursen and Foss, 2003; Mohnen and Röller, 2005; for the Italian case see Pini 2006; Antonioli et al. 2007; Giannetti and Madia, 2008).

According to Adams (2002), moreover, attention should also be paid to the characteristics of the market in which the firm operates, and especially to the volatility of orders. Adams's theoretical model, which is confirmed by the econometric analysis, establishes that the use of autonomous work groups of job depends on the intention to remove at least some decision-making power from the management ('off-line decision maker') and give it to the workers on the production line ('on-line decision makers'). Thus established is a trade-off between the rapidity of the decisions taken on-line and the greater slowness – though accompanied by the greater preparedness (in the sense of education, and therefore quality) – of the decisions taken off-line. The results show that, provided that training programmes are organized, firms employ work groups more if they have a very volatile production. Further corroborating the thesis of internal coherence is the finding that work groups and training programmes are integrated and reinforce each other. Also Becker et al. (1997) argue that there must be a close linkage between HPWPs and the firm's strategic and business initiatives if the workers' behaviour is to focus on the firm's key priorities and ultimately generate profits, growth and market value.

Other studies have shown that also organizational variables and the specific features of the firm warrant particular attention. On studying the effects of employee financial participation on productivity, Robinson and Wilson (2006) note that both profit-sharing (PS) and ownership-sharing (OS) suffer from a problem of free-riding by some workers. On the basis of their results, these authors state that closer controls (supervision and monitoring of workers) may obviate the problem in both cases. Likewise, the possibility for employees to intervene in the organization of work and technological choices may increase productivity in the presence of OS, whilst PS has harmful effects in the presence of a large male component and in white-collar environments. Overall, OS strategies are more productive than PS ones, but the effects are such because PS is adopted in contexts where the technological challenge is strong, workers have low-skilled profiles, and business prospects are uncertain, whilst OS is adopted in environments where the workers are higher-skilled and market pressures are less (Robinson and Wilson 2006).

Taking an economic policy approach in which conflict and cooperation are dynamic processes whereby the actors seek to realize their own interests, Godard (2004) argues that the large-scale adoption of reforms may not be as effective and as applicable as is often assumed. The institutional design of labour relations may not only decrease the utility to employers of resolving problems of legitimation and trust; it may also influence the degree of economic rationality in adopting reform programmes (Godard 2001)². This is certainly a very interesting aspect for analysis to comprehend the behaviour of firms. However, our purpose here is to increase understanding of the effects exerted by the adoption of HPWPs on the performances of firms operating in an institutional context still little investigated: that of Italy.

A previous survey on a sample of 234 manufacturing firms in Milan has shown that innovative firms combine high investments in organizational innovation with the adoption of advanced

² Also other authors have recently stressed the importance of a policy approach, and not only economic, to organizational innovations (see e.g. Batt 2004).

productive and organizational technologies (Della Torre 2008), thereby supporting the thesis of complementarity between the adoption of new work practices and investment in technological innovation. In the sections that follow, through analysis of a sample of 114 medium-sized industrial and service firms, we shall seek to augment the evidence on the Milanese economic system by verifying whether and how these corporate strategies have effects on firms' economic performance, particularly in terms of labour productivity.

3. Sample and representativeness

The analysis was conducted on 984 firms affiliated to Assolombarda, operating in the manufacturing and services sectors, and with between 50 and 250 employees. Given the predominance of studies which concentrate on the manufacturing sector, the fact that the present study also considers service firms indubitably gives it value added.

Some 114 firms agreed to cooperate, with a reply rate of around 12%. The survey was conducted by the Centro Studi di Assolombarda in the period April-June 2007 on the basis of a written questionnaire drawn up with the assistance of Assolombarda's trade-union section and sent to the owners of the firms. Some parts of the questionnaire were constructed on the basis of surveys carried out by other research groups in other local contexts.³ And this, given the methodological heterogeneity that characterizes the existing literature on these topics, is certainly one of the strengths of the inquiry.

In almost 70% of cases the questionnaires were compiled by personnel with staff functions, primarily by human resources managers. Among smaller firms, there were numerous cases in which governance and line functions were involved.

The final sample had an overall good representativeness if compared with the Istat Census of 2001. The results of the Marbach test (1992), reported in table 1, showed that overall the sample had a probability of more than 90% and was therefore acceptable. Of the two sectors, manufacturing (89% probability) was best represented, whilst in regard to size, representativeness was greater for the firms in the lower classes.

Table 1 – Results of the Marbach's test

	size of the sample	size of the population	margin of error θ	sample probability
Manufacturing firms	74	1204	0.1127	89%
Service firms	40	1582	0.1561	84%
Total	114	2786	0.0917	91%
50—99	54	1735	0.1340	87%
100—199	40	866	0.1545	85%
200—249	20	185	0.2117	79%

4. Adoption of new work practices

³ We refer in particular to the research groups at the University of Ferrara and the University of Bergamo, which have conducted repeated surveys on innovative dynamics in the local economic systems of Reggio Emilia, Ferrara and Bergamo. See Antonioli et al. (2007, 2008), Cristini et al. (2003, 2008), Leoni et al. (2004), Pini (2004, 2006).

Table 2 shows the frequencies of the use of the thirteen practices investigated by grouping them into 'bundles' as identified above. To be noted is the rather high frequency of personnel management policies, i.e. those practices intended to enhance the quality of employees' work. In particular, training to improve technical skills is the most widespread practice overall, being present in 82% of the firms in the sample. The second practice in order of frequency is career advancement through internal labour markets (80%).

Practices intended to decentralize decision-making power to lower levels in the organization are less widespread (they concern less than one firm in every three). Even less common are autonomous work groups (14.5%), which together with decision-making decentralization, probably represent the most marked forms of organizational 'flattening'. In both cases, therefore, these seem to be practices which require particular conditions if they are to be introduced, probably because of the greater connected risks with their use.

As for the degree of penetration by innovations, the practices adopted most intensely (i.e. involving at least 50% of workers) are information sharing, performance evaluation, and employee involvement. The practices related to work coordination are therefore those in which firms involve the greatest proportion of workers, whilst the degree of intensity is decidedly lower (without great differences between the two bundles), for work management and organization policies, showing that interventions in these two areas much more closely targeted.

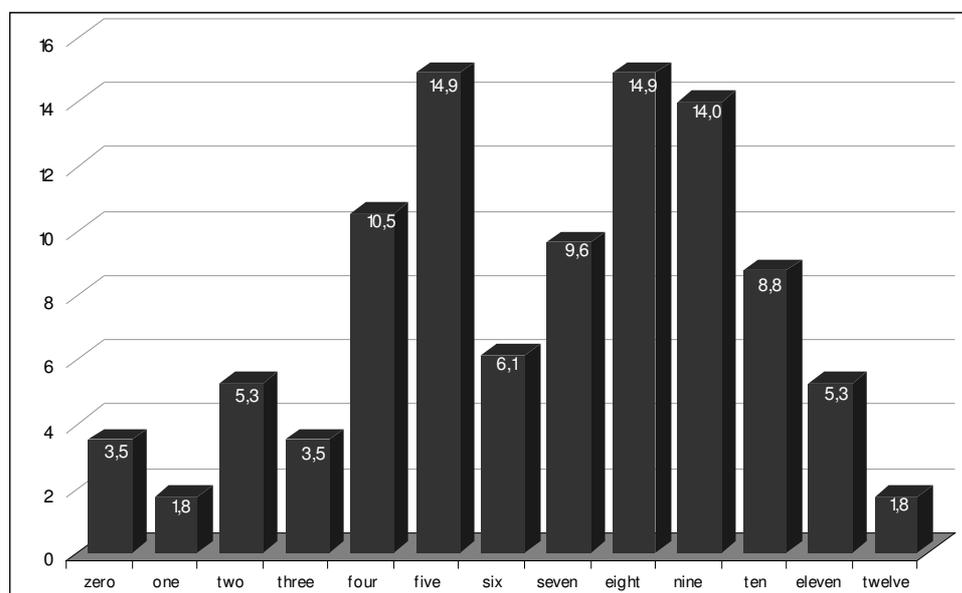
Table 2 – Frequency and intensity of the use of practices

	% of user firms	of which involving more than 50% of employees (%)
<i>Organization of work</i>		
autonomous work groups	14.5	28.6
semi-autonomous work groups	38.9	27.9
job rotation	32.7	27.3
multi-skilling	60.2	16.4
<i>Coordination of work within the organization</i>		
decentralization of decision-making	37.5	24.3
sharing of information	61.4	64.6
employee involvement	50.4	55.6
evaluation of employee performance	50.4	63.0
<i>Personal management policies</i>		
specific technical training	82.3	42.2
relational/behavioural training	50.9	25.0
internal labour markets	80.7	14.8
collective performance-related pay > 5%	57.1	13.3
individual performance-related pay > 5%	61.5	26.6

We now consider what happens within individual firms. Figure 2 and Table 3 show that almost 30% can be considered to have innovative work systems in that they adopt nine or more of the thirteen practices surveyed. However, only 2% of firms adopt twelve of these practices, and in no case are all thirteen practices used.

Figure 1 apparently shows two critical junctures in change processes: the first occurs in transition from moderate levels of use (up to five practices) to intermediate ones; the second from medium-to-high levels to the completion phase (more than nine practices). Finally, only 3.5% of firms do not use any of the new work practices.

Figure 2 – Percentage distribution of firms by number of practices used



The overall degree of organizational innovation by firms⁴ shows some relation to firm’s size (Table 3). Overall, almost 50% of the sample are in an intermediate phase definable as ‘transitional’, to use the European Commission’s term.

Table 3 – Degree of organizational innovation by size class. Percentage values

	moderate	average	high	total
50-99 empl.	33.3	38.9	27.8	100.0
100-199 empl.	15.0	57.5	27.5	100.0
200-250 empl.	20.0	40.0	40.0	100.0
Total	24.6	45.6	29.8	100.0

5. The relations between new work practices and firm performance

5.1. The effects of the individual bundles

The first step in the analysis involved description of the effects exerted by the individual bundles of practices on the trends in certain indicators of economic performance.⁵ This first

⁴ The firms were grouped into classes according to the number of practices used: from 0 to 4 = ‘moderate’, from 5 to 8 = ‘average’, from 9 to 13 = ‘high’.

⁵ Trends in economic indicators were defined in terms of declarations by management, which were not necessarily based on objective indicators drawn from the balance sheet. Each indicator related to the trend over the last five years; the firms could be rated on a scale from -5 (very negative) to +5 (very positive). The indicator ‘overall economic performance’ was a summary indicator constructed as the sum of the values recorded by all the indicators considered, and therefore assumed values between -30 and +30.

step of the analysis was useful for gaining a general idea of the effects of innovations, but above all for understanding whether, contrarily to the dominant theory, such effects can be related to specific types of practices and not to the overall degree of innovation undertaken by a firm.

On considering the practices related to personnel management policies (technical training, relational training, internal labour markets, individual performance-related pay, and collective performance-related pay) – which, as said, are the most frequent – there emerges a positive link with all the indicators (Table 4). With the exception of the trend in profits, the other indicators record the highest values in firms in which all five practices in the bundle are applied.

Table 4 – Number of personnel management practices adopted and economic performance

<i>personnel management practices</i>	market share	sales volume	assets	labour productivity	profits	fixed investm.	overall economic performance
0	0.8	0.0	-0.3	-0.2	-0.4	0.0	-1.8
1	1.5	2.0	1.1	1.0	1.0	1.1	7.2
2	0.8	1.9	1.2	0.5	0.4	1.2	5.8
3	1.5	2.2	1.4	1.6	0.8	1.2	8.7
4	1.7	2.0	1.5	1.5	1.3	1.3	8.7
5	1.8	2.3	1.5	1.8	0.9	1.4	10.2

However, the relationship appears to be linear only in the case of assets and fixed investments. In the other cases, performance improves at moderate levels of adoption of practices, stabilizes or decreases at intermediate levels, and achieves the best results at intense levels. This also applies to the summary indicator of the firm’s overall economic performance. Also to be noted is that, among the firms which have not adopted any practice, assets, labour productivity, profits, and the summary indicator record negative values.

The practices related to the coordination of work within the organization (decision-making decentralization, information sharing, employee involvement, performance assessment) also exhibit a positive link with economic performance. Once again, with the exception of sales volume, the best performances correspond to the use of all four practices in the bundle (Table 5). However, in this case the relationship is not linear, and for some indicators it appears more unclear than the relationship concerning personnel management practices: this is the case, for example, of labour productivity and profits, whilst the above considerations seem to hold for the other indicators (moderately positive effects at low levels, stable ones at intermediate levels, and strong ones at high levels of innovation).

Table 5 – Number of practices for work coordination and economic performance

<i>work coordination practices</i>	market share	sales volume	assets	labour productivity	profits	fixed investm.	overall economic performance
0	1.1	1.4	0.7	1.2	0.7	0.8	5.9
1	1.8	2.1	1.3	0.7	0.6	1.3	7.4
2	1.3	2.2	1.7	1.5	1.4	1.0	8.9
3	1.3	2.0	0.9	1.1	0.1	1.4	6.3
4	1.9	2.1	2.2	2.2	1.7	1.7	11.4

As Table 6 shows, the practices in the work organization bundle (autonomous and semi-autonomous work groups, multi-skilling and job rotation) do not seem to be significantly associated with better economic results.

In the case of assets and profits, the relationship seems to operate in reverse, because economic results worsen with an increase in the number of practices employed (it should be noted, however, that none of the firms in the sample used all four practices in the bundle). In the case of the other indicators, the lowest averages are recorded in firms in which no practice is used. But apart from this distinction, no significant differences are apparent.

Table 6 - Number of practices for work organization and economic performance

<i>work organization practices</i>	market share	sales volume	assets	labour productivity	profits	fixed invest.	overall economic performance
0	1.2	1.8	0.9	1.0	0.8	1.2	6.5
1	1.2	1.9	1.8	1.3	1.2	1.0	8.2
2	1.7	2.2	1.5	1.5	0.8	1.1	8.5
3	1.6	2.0	1.2	1.3	0.7	1.7	8.3

The results just described were confirmed by analysis of the linearity of the correlations between bundles of practices and economic performance. Table 7 shows that personnel management practices have a positive and significant relationships with labour productivity and the firm's overall economic performance, whilst the work coordination and organization practices do not have significant relations with the economic indicators.

Table 7 – Bundles of practices and economic results

<i>bundles of practices</i>	market share	sales volume	assets	profits	labour productivity	Invest.	overall economic performance
coordination	.065	.086	.169	.061	.167	.136	.0136
organization	.113	.075	.062	-.021	.089	.091	.086
management	.184	.155	.160	.158	.284(**)	.129	.250(*)

** Correlation significant at 001 level. * Correlation significant at 0.05 level.

This first phase of the analysis has therefore shown rather clearly that the effects of the individual bundles of practices on the firm's economic results are positive but not linear. A certain linearity in the relation emerges only in regard to the effects exerted by personnel management practices in improving labour productivity and the firm's overall economic performance. These results point to a first significant suggestion: the adoption of practices designed to enhance the quality of work is positively related with improved labour productivity. The effects are then reflected in the firm's overall economic performance. But the relation, though still significant, appears to be weaker in this case, probably because of the action of external factors which influence the other economic performance indicators.

Also the relations of non-linearity found for the other indicators, and for the other bundles of practices, furnish important insights: at levels of intermediate adoption – which is the situation of large part of the firms observed – innovations seem to exhaust their positive effect due to the change from a situation of absence, and therefore of impediment, to one of 'renewal'. In this phase, the effects on performance are not harmful, but they have a very low marginal impact. At very sophisticated levels of adoption, the closer integration of human

resources management systems with the firm’s operational fabric instead produces greater benefits.

5.2. The overall effects and the role of technological innovation

Having analysed the individual bundles of practices, we now turn to the overall degree of innovation by the firm. According to the dominant theory, the best economic results are obtained when all the bundles of practices are introduced to a significant extent, and therefore when the overall number of practices used is high.

The results shown in Table 8 confirm this view by showing that all the performance indicators improve with an increase in the firm’s degree of innovation. Only in the case of sales volume are slightly poorer performances recorded in the transition from an intermediate degree of innovation to a high one. Instead, the largest increases are recorded for labour productivity and fixed investments.

Table 8 – Degree of organizational innovation and economic performance

<i>Degree of organizational innovation</i>	market share	sales volume	assets	labour productivity	profits	fixed invest.	overall economic performance
moderate	1.2	1.4	0.8	0.7	0.5	0.9	4.8
average	1.5	2.2	1.5	1.3	1.0	1.1	8.6
high	1.6	2.1	1.6	1.7	1.0	1.7	9.0

This is certainly a rather superficial analysis, but its findings are rather clear. They seemingly confirm the idea that in order to obtain improved performance, innovations should be introduced at system level throughout the organization. They should not be restricted to human resources management alone.

The other aspects of interest to examine is the role performed by technological innovation in processes of organizational modernization and the possible complementarity between adoption of new work practices and technological advances in improving performance. The data available seem to confirm the existence of this linkage, showing that, in firms where the level of the technologies adopted is above the average for the sector, organizational innovations have stronger positive relationships with firm’s performance (Table 9). Conversely, in the presence of low technological levels, a high degree of organizational innovation may have counter-productive effects and worsen the firm’s economic results.

Table 9 – Effects of organizational and technological innovations on economic performance

<i>degree of organizational innovation</i>	market share	sales volume	assets	labour productivity	profits	fixed invest	overall economic performance
<i>Firms with a technological level ABOVE the sector average</i>							
low	2.0	1.8	1.3	1.3	1.0	1.8	9.0
medium	1.3	2.3	1.9	1.3	1.1	1.2	8.9
high	2.0	2.8	2.2	2.1	1.6	2.1	11.9
<i>Firms with a technological level BELOW the sector average</i>							
low	0.9	1.2	0.6	0.5	0.2	0.6	2.9
medium	1.6	2.1	1.2	1.5	1.1	1.1	8.6
high	1.3	1.3	1.0	1.2	0.3	1.3	6.0

Table 10 gives further information on the correlations among economic indicators, technological innovations, and organizational innovations.

Firms show that they are aware of the evidence just provided on the need to accompany investments in technologies with investments in organizational change. In fact, there is a positive and significant correlation between technological levels and number of practices used: as the level of technologies used by the firm increases so does the degree of organizational innovation.

Table 10 – Correlations among organizational innovations, technological innovations and economic performance

	assets	sales volume	fixed invest.	market share	labour productivity	profits	overall economic performance	total practices
total number of practices used	.173	.138	.154	.155	.239(*)	.092	.211(*)	1
technological level	.293(**)	.161	.190	.069	.155	.163	.215(*)	.263(**)

*** Correlation significant at 0.01 level. * Correlation significant at 0.05 level.*

Table 10 also shows that organizational innovations on their own are positively correlated with certain performance indicators. Considering both the individual bundles of practices and the general degree of innovation, the strongest relations with firm performance seem to be those to do with labour productivity and the firm's overall economic performance.

5.3. The strategies of firms with better performances

The results obtained from the descriptive analysis prompted us to investigate the characteristics of firms achieving the best results in terms of labour productivity and overall economic performance, i.e. the two indicators found to be most closely connected with the firm's level of organizational and technological innovation. The aims of the analysis and the characteristics of the data available suggested that we should use the multivariate statistical technique of classification trees. This would enable us to identify the distinctive characteristics of the firms achieving better performances. As suggested by the literature, the analysis also considered other factors which may have complementarity effects with technical-organizational innovations. Specifically, in small and medium-sized firm, an important role in determining the degree of innovativeness is played by the firm's embeddedness in stable relational networks with other firms.⁶

5.3.1. Methodology

The classification trees approach is a technique of hierarchical segmentation used to identify the membership of statistical units (in our case firms) in the classes of a dependent variable (labour productivity, overall economic performance) when knowing the values or the modalities of one or more explanatory variables (technologies employed, relationships of collaboration with other firms, bundles of practices used).

⁶ On Italy see Antonioli et al. (2007), Mancinelli and Mazzanti (2007).

The results of the segmentation are visualized by means of hierarchical structures called 'trees'. The literature proposes various techniques for the creation of the final segments. We used the CART (Classification and Regression Trees) methodology (Breiman et al. 1984) which was best suited to the characteristics of our data.

The basic idea behind the creation of classification trees is to select every subdivision of a set in such a way that each of the subgroups produced by the division is 'purer' than the initial set. The notion of 'impurity' refers to the heterogeneity of the statistical units in relation to the modalities of the dependent variable. In this technique impurity is measured by the Gini index. In operational terms, starting from the root node (or 'father' node) t , one looks for the variable that produces the best subdivision of the n cases contained in t into two 'child' nodes (t_l and t_r) of numerosity n_l and n_r . The two child nodes are more homogeneous than the father node. For each subdivision, each variable is evaluated to find the best 'cutting point' (in the case of continuous variables) or the best grouping of the categories (nominal and ordinal variables) on the basis of the 'improvement score' or the extent to which impurity has been reduced. The variables are then compared, and the one with the best improvement is selected for subdivision. The process is repeated recursively until a 'stop rule' is activated. In principle, in fact, the recursive splitting of the statistical units can continue until the terminal nodes contain only cases belonging to the same class as the dependent variable. All segmentation algorithms, however, foresee the possibility of stopping the procedure before this happens, the purpose being to avoid output whose complexity and scant syntheticity would be in clear contrast with the clarificatory aim of the segmentation analysis. It is therefore usual to fix stop rules able to restrict the extension of the tree and to draw an efficacious distinction among statistical units belonging to different classes. Among the various criteria available, owing to the characteristics of our sample we opted for a minimum number of 5 units in each node; below this threshold the estimates (mean value and variance) are not considered reliable.

The two dependent variables considered were therefore the indicator for labour productivity and the summary indicator for overall economic performance, both of which have been described above. Each indicator was related to the following explanatory variables:

- the main type of technology used (process, product, for work coordination);
- the technological level compared with the average for the sector (less advanced, the same, more advanced);
- the presence of collaborative relationships with Italian firms (no, yes with firms in the same group, yes with other firms);
- the presence of collaborative relationships with foreign firms (no, yes with firms in the same group, yes with other firms);
- the number of practices used for personnel management (from 0 to 5);
- the number of practices used for work organization (from 0 to 4);
- the number of practices used to coordinate work (from 0 to 4);
- the overall number of practices used (from 0 to 13).

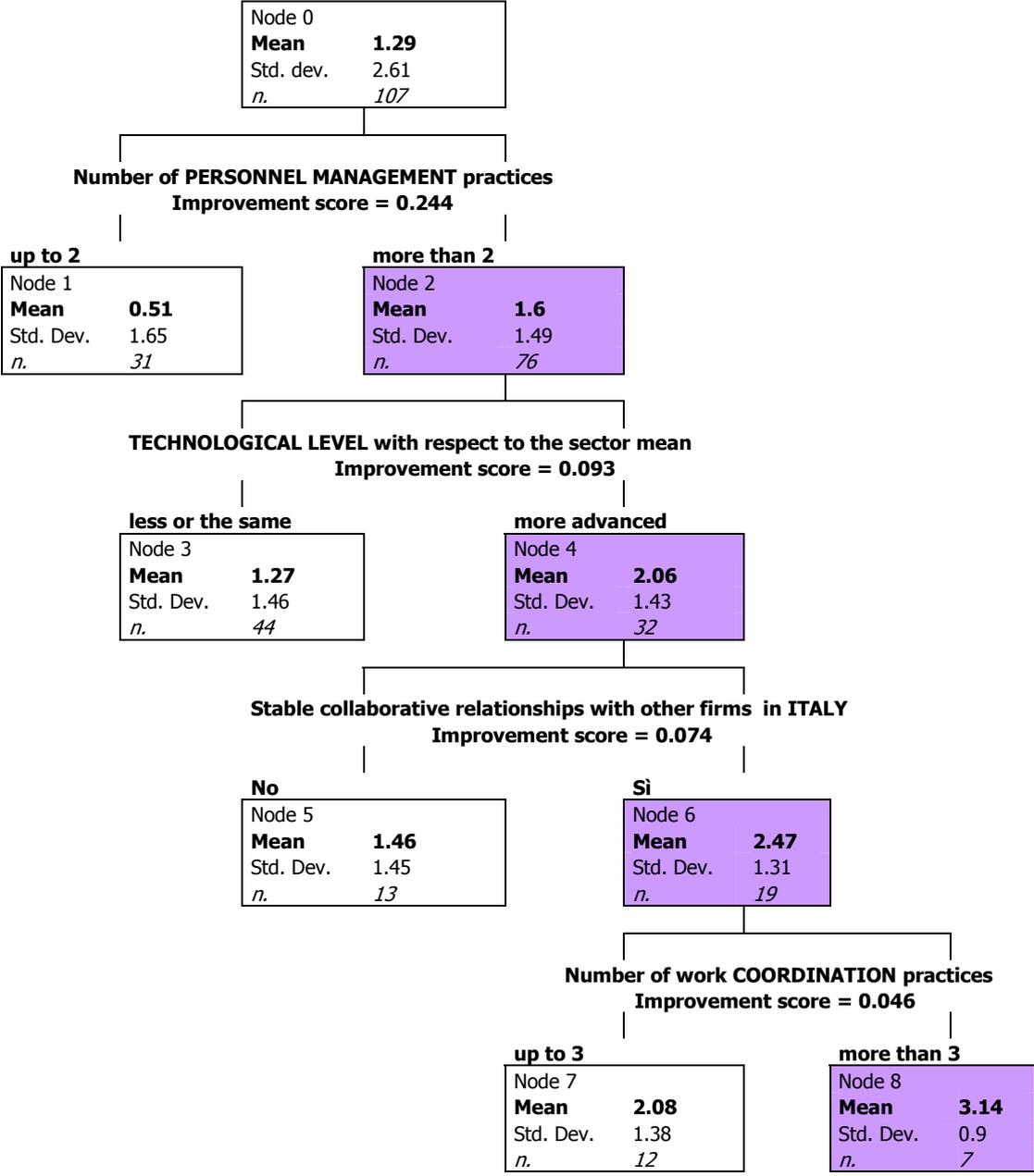
5.3.2. Firms achieving the best productivity performances

Considering labour productivity first, Figure 3 shows that it is possible to identify a group of firms which, by combining high levels of organizational innovation with high technological

levels and close relationships with other firms, have achieved trend in productivity substantially better than those of other firms.

In particular, the tree’s hierarchical structure shows that the variable which most discriminates among the productivity results is the number of personnel management practices adopted. Among firms using up to two practices, the mean in productivity trends is 0.5, whilst among those using three or more practices it is 1.6.

Figure 3 - Subdivision of firms according to labour productivity performance
Trend in labour productivity



Performances further improves if firms, besides investing greatly in the quality of work, also do so in technological innovation and develop stable collaborative relations with other Italian firms – that is, they network with other organizations sharing information, knowledge and

experiences. In fact, among the firms that have adopted a large number of organizational practices for personnel management, the high technological level pushes the productivity index up to an mean value of 2.1, as opposed to the 1.2 recorded among firms which do not accompany organizational investments with investments in technologies.

The presence of collaborative relationships with other firms improves performance up to 2.4, and a further increase in productivity is obtained by adding to these characteristics large-scale investment in innovations concerning practices to coordinate work: that is, investment in the adoption of practices of decision-making decentralization, employee involvement, the sharing of information with workers, and a structured system of performance assessment. When all these characteristics are simultaneously present, the productivity index reaches levels equal in mean to 3.4 (almost three times higher than the mean recorded for the entire sample).

It should also be noted that, in the presence of low adoption of personnel management practices, none of the variables considered in the analysis has explanatory value for increases in the index of labour productivity trend. These results confirm complementarity both among the different bundles of practices, and among these, technological innovations, and collaboration networks. In particular, if technological innovations are not accompanied by organizational innovations, the effects on labour productivity are not significant. Likewise, the intense adoption of several bundles of innovative practices is not significant if these strategies are not accompanied by large investments in advanced technologies.

However, these results also show that productivity is not simply tied to the overall degree of organizational innovation in the firm, an indicator which does not take account of the various dimensions of labour relations on which the practices intervene. Conversely, investments should be targeted on specific practices intended to enhance the quality of work and those designed to improve the coordination of activities and employee involvement.

As already reported in the descriptive analysis, there are no significant relations between practices related to work organization in the strict sense (work groups, job rotation and multi-skilling) and labour productivity. Finally, the results confirm the importance of networking for small and medium-sized firms. Also this factor, however, has significant relations with performance only if it is accompanied by large organizational and technological investments.

5.3.3. Firms achieving the best overall economic performances

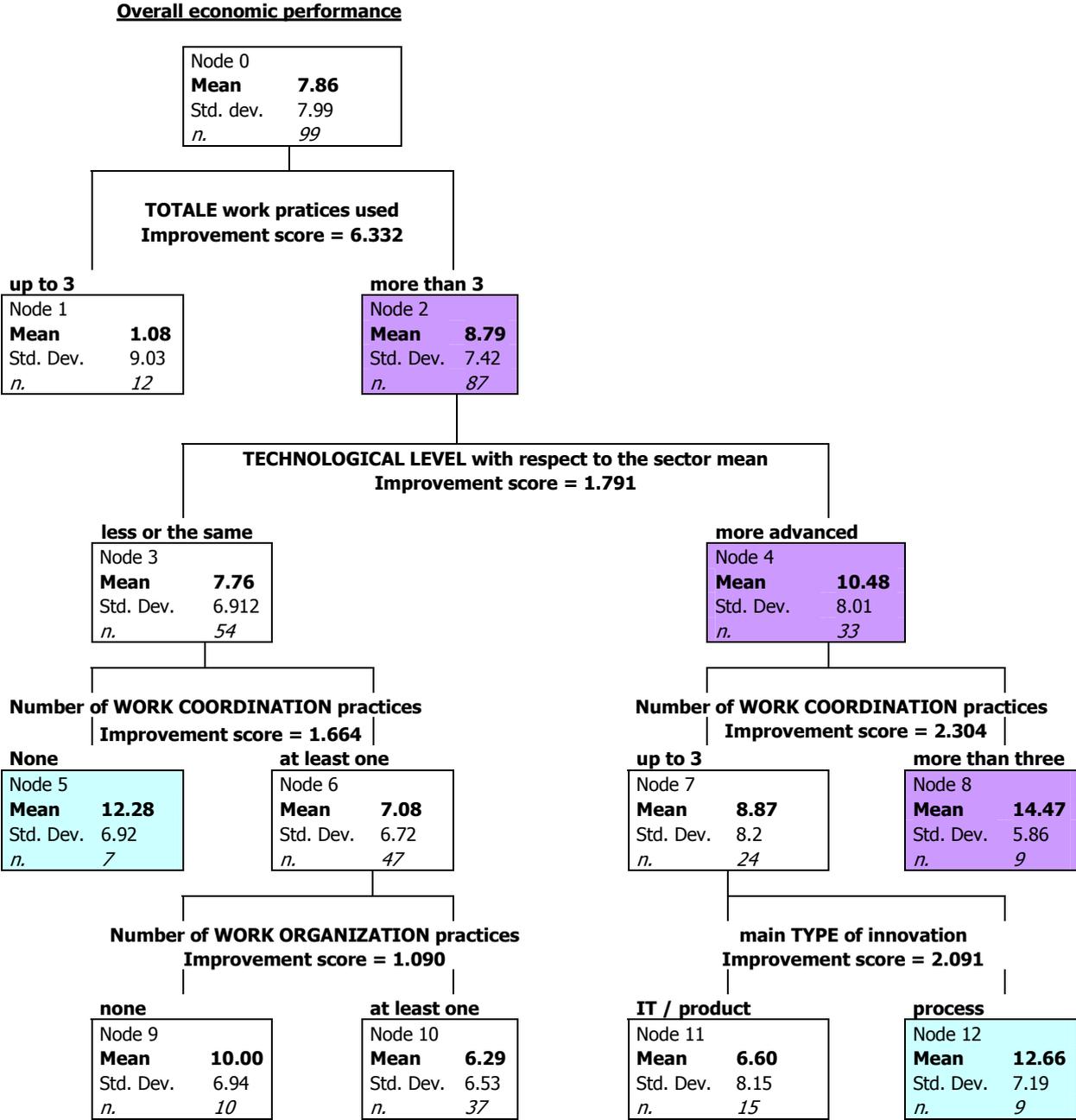
Turning now to the firm's overall economic performance (Figure 4), the results appear more differentiated but generally in line with the findings for labour productivity.

In this case, the variable that most discriminates among the performances of firms is the overall number of innovative practices used. Whilst in the case of productivity it is personnel management practices that record the most significant relations, the relations with overall economic performance are stronger if the various bundles are considered jointly, once again showing the importance of a systemic approach to organizational change.

However, the discriminating threshold is not particularly high. It is the firms adopting at least four practices (out of thirteen) that achieve the best results, with the economic indicator assuming values on mean equal to 8.8, whilst among those adopting fewer than four practices the mean for the indicator is 1.1. If the use of at least four innovative practices is combined with a technological level above the sector average, performances improve further, reaching an mean value of 10.5.

In confirmation of the finding for productivity, even better performances are achieved by adding to these two characteristics the intense use of innovative work coordination practices: the performance indicator now assumes an mean value of 14.8. In cases where a high technological level is not supported by innovations in work coordination practices, the best performances are achieved when technologies concern the product transformation process, not the coordination of activities (Information & Communication Technology) and the final product.

Figure 4 - Classification of firms according to overall economic performance and some business variables



Another finding to emerge from Figure 4 is that, where technological levels are low, the adoption of organizational innovations related to work coordination and organization may

have harmful effects on the firm's overall performance. In other words, if the technologies adopted are of traditional type, the best performances are obtained by maintaining organizational arrangements that are also of traditional type. Overall, in order to achieve good business performance, the levels of technological and organizational innovation must be coherent, and the more both of them are advanced, the better the results obtained.

In conclusion, therefore, the findings suggest the existence of a quite solid relationship between the adoption of new work practices and better business results, especially as far as labour productivity is concerned. However, the data have also confirmed the view put forward in the literature that the new work practices must be introduced at system level, i.e. on a large scale and coherently, and be accompanied with equally large-scale investments in technological innovation so as to exploit complementarities.

6. Final remarks

This study has examined organizational innovations in medium-sized firms in the area of Milan. The analysis has enabled us to separate two groups of results concerning (i) the current situation of organizational innovation and (ii) the relationship between organizational innovation practices and firms' performances.

In general, the sample analysed exhibits a good diffusion of organizational innovation practices. But there is a difference between personnel management practices, which are very widespread, and those to coordinate and organize work, which are less so. Overall, around half the firms in the sample are in a situation which can be called of 'transition' (EC 2002) towards a different organization model.

Firms prefer to invest in the quality of work and skills and greater rigidity in decision-making process. The most radical forms of organizational flattening (for example, decision-making decentralization and autonomous work groups) seem to need particular conditions to be introduced, probably because of the greater risks connected with their use. Nevertheless, when firms decide to invest in these organizational processes they do so with conviction, involving a larger share of the workforce compared with the case of the other innovative practices.

Analysis of the relationship between practices and economic results has identified a positive and significant relationship between the adoption of personnel management practices (technical and relational/ behavioural training, internal labour markets, incentivising reward systems) and performance in terms of labour productivity (Ichniowski et al. 1997). The effects on productivity are then reflected in the firm's overall economic performance. But the relationship, though still significant, is weaker, probably because of the influence of external factors affecting the other economic indicators.

As for the other bundles of practices (organization and coordination of activities), the relations with economic results are positive but not linear. This means that during the intermediate phase of change (the situation of around half the firms in the sample) innovations have a very low marginal impact on performance. The best effects are achieved in the initial phase, when the firm shifts from a situation of 'impediment' to one of 'renewal', and in the final phase of the change process, when integration of human resources management systems with the operational fabric of the firm is more profound (Becker et al. 1997).

Confirming the results reported by a large body of studies on the topic, the analysis of interactions between organizational and technological innovations has shown that in firms with a high level of technologies adopted, the effects of organizational innovations on the firm's performance are greater. Moreover, in the presence of high technological levels, the effects seem linear for most of the performance indicators (except for the indicators relative to the market share and investments). Conversely, with lower technological levels, a high degree of organizational innovation may have counter-productive effects by worsening the business results. Overall, the firms in the sample exhibit a certain awareness of the benefits derivable from the interaction between technologies and organizational innovation by accompanying investments in new practices with investments in advanced technologies.

Finally, also embeddedness in stable relational networks with other firms seems to be a factor which, if coherently combined with the other business strategies, yields superior performances. This finding is probably connected with the type of firm analysed (and is therefore not generalizable to firms), but precisely for this reason is of paramount importance for the strategies of firms.

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