

# WORLD-CLASS MANUFACTURING AND PRODUCTIVITY

## An assessment of the literature

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### **Abstract**

*The paper presents a literature review of the characteristics of a new form of work organization, known as world-class manufacturing (WCM), with respect to traditional Taylor-Fordist organization, and its impact on productivity. The analysis is primarily developed with reference to the world of manufacturing firms, focusing particularly on the roles established by organizational design based on processes, high-involvement work practices, positive industrial relations and ICT technologies while also considering their complementarities. The new organizational configuration that emerges as effective is in line with the lean production paradigm insofar as it is characterized by innovative bundles of different 'ingredients'; **but** in the pursuit of efficiency and performance it also enables the employer and/or manager to choose the ingredients and their weights in a variety of possible combinations.*

*While the superior performance of this new work organization is acclaimed by a number of econometric studies, this paper also highlights that some methodological questions remain open and should be resolved.*

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# 1. Introduction

Empirical research has widely documented, virtually without exceptions, enormous and persistent measured productivity differences across firms or establishments, even within narrowly defined industries. Syverson (2004), for example, demonstrates that within 4-digit SIC industries in the U.S manufacturing sector, the ratio of total factor productivity among plants at the 90<sup>th</sup> percentile of productivity distribution is in the order of 2 to 1 with respect to the 10<sup>th</sup> percentile, namely, *twice* the amount. However, this accounting refers to the average 90-10 range: taking into account the range's standard deviation, a plant at the 90<sup>th</sup> percentile of productivity distribution is over *four times* as productive as a plant at the 10<sup>th</sup> percentile in the same 4-digit sector.

Mainstream economic theory attributes different productivity levels, as well as different changes, to a set of factors such as: (i) capital accumulation per employee or per hour worked (capital deepening); (ii) new investments as a mechanism to transmit new ideas (technological progress embodied in capital goods); (iii) exogenous (or disembodied) technical progress flowing mainly from one or more sources of learning such as learning-by-doing, learning-by-using, learning-by-interacting and learning-by-searching; (iv) returns to scale; (v) R&D activity; (vi) externalities (infrastructures, intra-market competition, regulations, schooling system, public administration, etc.). However, the cornerstone of this theoretical approach has always been (vi) allocative efficiency (see: Foster *et al.*'s, 2001; Maksimovic and Phillips, 2002; Lentz and Mortensen, 2008; Bartelsman *et al.*, 2009),<sup>1</sup> in spite of Leibenstein's effort (1966) to draw the attention of scholars to the fact that «*the data suggests that in a great many instances the amount to be gained by increasing allocative efficiency is trivial while the amount to be gained by increasing X-efficiency is frequently significant*» (*ibidem*: 413). Unfortunately, Leibenstein's warning has been largely neglected, with the consequence that work organization, such as job and workplace design, and human resource management, has also been largely neglected – both from a theoretical and modelling perspective – as a potentially powerful source of productivity.

Only quite recently has empirical evidence begun to appear on the scope of different forms of work organization and human resource management practices, as well as on their effects on firm productivity, based on econometric estimates using different types of data (firm or establishment level, panel or cross-section datasets). We devote section 2 to a detailed survey of this literature, but we can already disclose that the key results converge in sustaining a positive association between *new* work organization – including just-in-time, team working, job rotation within and across teams, participation in problem-solving groups, suggestion systems, job design and delayering, the existence of multiple incentives to boost motivation such as performance-related pay and participation in decision making – and firm productivity.

However, the empirical results are not without problems, to the point that at times they have given rise to diverse interpretations and extremely critical evaluations (Godard, 2004). For example, as concerns new work practices, a distinction is not always made between the *extension* of their adoption amongst the population of firms, which can be represented by a simple dummy variable, and the *intensity* of adoptions of each work practice, which instead requires a *scalar variable*. At the same time, a given work practice can have several dimensions, which in turn need to be treated with a *vector variable*. In addition to these problems, the extension and intensity of new work practices that a researcher measures need to be clearly understood as both their size and their effects could depend on a set of factors such as: (i) firm starting conditions, (ii) time spent from the beginning of the re-

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<sup>1</sup> Caveats can be raised in respect of these aforementioned works since they do not explain the reason for the productivity increase of firms located on the frontier.

engineering process, and (iii) the internal resistance that Schumpeterian employers and/or managers face during the re-engineering process. The risk is dealing with variables that capture, at the time of a given empirical survey, an incomplete implementation either of a new work practice, or of a bundle of these, thus fostering potentially divergent effects and interpretations.

An aspect of the relationship between workplace characteristics and firm productivity that should be pointed out is the existence of complementarity (or super-additivities, according to the terminology used by Milgrom and Roberts, 1995) among work practices, which would imply that implementing (more of) any one of these should increase the returns to implementing (more of) the others (*ibidem*: 181). Complexity increases when complementarity encompasses other features of the firm, such as new technology and industrial relation «regimes». The questions of *how* a bundle forms, *which* elements form part of the bundle, *what* intensity of each element fits better and whether a «best and wider bundle» exists, are still far from fully answered; we will address these questions in section 4.

A relevant question to confront is whether these bundles are consistent with the ‘contingency approach’ or are they of a ‘universalistic’ nature, regardless of the structural shape of the organizational form of the firm. In the first case, different bundles implemented in different firms could be interpreted as a result of the ‘degree of freedom’ in combinations contingently selected by managers according to some relevant ‘state of the world’ or simply to their «weltanschauung». An alternative way of looking at the question is whether these bundles are a set of building blocks used to re-engineer the organizational form, passing from a traditional model, based on functions, towards an innovative model based on processes. In the latter case, it would be useful to recall that each bundle implemented in a given firm (and as such, observed by the researcher with his empirical investigations at a given point in time) should more likely be considered as part of a long process, where the sequence of building blocks to be implemented could have a unique path. If this were the case, the violation of this path could be responsible for the inefficacy of some bundles of new work practices simply because the preceding part of the process may have been omitted.

When jointly implemented, new organizational work design, new work practices, positive industrial relations and ICT represent a clear departure from existing traditional practices; they give rise to a different configuration of the firm and new lifeblood, raising the question of whether the new firm configuration should be considered as the point of reference for a «*new one best way*». To our understanding, an interpretation and explanation of the *dynamic* nature of the new firm configuration requires going beyond Nelson and Winter’s (1992) evolutionary approach, passing through the J-firm (Aoki, 1990), and arriving at Nooteboom’s cognitive theory of the firm (2009): in fact it does not appear to be a matter of selecting the most efficient routines, but rather of seeing how – in a context where hierarchical monitoring and control is substituted by alignment of goals, values and motives through loyalty and intrinsic motivation, enhanced, and, at least in part, enforced by high involvement and material incentives – competence building, learning and innovation simultaneously and interactively take place since they are among the most powerful contenders to explain the survival and development of the firm.

A new key view that could emerge from the literature we are going to critically survey seems to have been clearly anticipated by Grandori (2005) when asserting that organization design has to be at the root and at the *core* of organization science. At the same time, empirical investigations on organizational design in this period seem capable of enlightening and enriching not only the reasons for structural productivity dispersion among firms, but also internal factors that may contribute to determining the heterogeneous *dynamics* of productivity. This is the case especially if taking into consideration that bundles of new work practices and new organizational features of firms, in addition to ICT, are to a certain extent responsible on one side for both knowledge creation and diffusion,

which lead to product and process innovations (Michie and Sheehan, 1999, 2003; Gritti and Leoni, 2011; Santangelo and Pini, 2011), and on the other, the informal development of key competences (Green *et al.*, 2001; Leoni, 2012).

The determinants of productivity are manifold, and the aim of the paper is to survey and evaluate recent empirical studies concerning the contribution of alternative ways of work organization on manufacturing firm productivity, irrespective – given our aim – of any other sources. The paper is structured as follows: section 2 examines the new form of organization; precisely, the origin of the new approach (in 2.1), the pillars of new work organization and their complementarities (in 2.2), and the role of ICT (in 2.3). Section 3 looks at the critical aspects of the diffusion of new work organization, while section 4 considers some relevant and still-open questions. Some final remarks are offered in section 5.

## **2. The new form of work organization: origin, evolution, main characteristics and performance.**

Various acronyms have been coined to represent the new features of work organization in summary form, such as HPWO (High Performance Work Organization), HPWS (High Performance Work System), HPWP (High Performance Work Practices), TQM (Total Quality Management), as well as several new terms, such as Toyotism and lean production. While largely evoking the same elements, each new word tends to attract attention to some of these elements, considering them from time to time as having more distinct value. Throughout this paper we will refer to the acronym WCM (World-Class Manufacturing), which is the internationalized and institutionalized point of reference of the lean production model indicating a full range of organizational elements of production that characterize firms competing in the world market, but also embodies the concept of a dynamic organization in continuous and rapid movement.

### **2.1 *The origin of the new approach***

Academic research usually attributes the growth of Western economies in the 1945 to 1970 period to cumulative productivity gains brought about by the inter-relationship of a number of factors including: dedicated technology; a Taylorist factory and labour organization system; some revenue sharing between workers and firms; consumption linked to the growth of real wages, and finally, investment dynamics based on the accelerator principle, together with the notion that improvements in technology would be incorporated in the last vintage of capital (Appelbaum and Batt, 1994: 14).

Subsequently, however, the system broke down as a result of the ability of some new emerging countries (see Japan) to compete on price in the product market. The outstanding performance of Japanese companies, especially Toyota and Ohno's lean production model, led an MIT Commission (Dertouzos, Lester and Solow, 1989) to investigate the productivity differential in U.S. and Japanese firms, paying particular attention to organizational factors. The fear of foreign domination of the American market (Womack *et al.*, 1991: 274), generated in the course of the 80's, prompted managers of the largest corporations to first seek public barriers against Japan's competitiveness, and then to understand and imitate the way of organizing the enterprise. The most striking example is the joint venture between General Motors and Toyota, which gave rise to the extraordinary success of NUMMI

(*ibidem*: 278), based on American technology but with Japanese organizational management.<sup>2</sup> This example set a fashion, getting rid of the weak attempts to keep the old production system alive with margin adjustment operations, prompted on one side by psychological organizational behaviour theories, by motivation and job enlargement and job enrichment, and on the other, by the idea of cutting costs through reducing the workforce employed for an indefinite period, the extensive use of programmable machine tools, outsourcing and the use of atypical workers.

The remarkable productivity results, product quality and satisfaction of workers attained inspired not only the organizational efforts of two other pilot schemes, GM's Saturn project, also in the USA, and Volvo's factory in Uddevalla (Sweden), but also the proliferation of articles in the most prestigious management journals, which *de facto* accredited the greater universality and portability of this organizational model in other countries and thus facilitated its spread in many American and European firms. The main characteristics of the new corporate production model are summarized by a stream of studies known as lean production (or world-class manufacturing). Lean is not only a set of tools that assist in the identification and steady elimination of waste, followed by quality improvements, and production time and cost reductions. Lean also means a flow or smoothness of work, thereby steadily eliminating unevenness throughout the system instead of waste reduction per se. In addition, on the management side, lean also means abandoning three of the most important traditional management techniques, respectively *standard costing* in favour of *activity-based costing*, *management-by-objectives* in favour of *activity-based management*, and finally traditional planning and control in favour of *activity-based budgeting*, all relatively well known concepts and tools that here require no further articulation. It seems important instead, for the purposes of our aim, to dwell on two aspects: organization based on processes and multi-valence/multi-competencies.

The former is a profound reversal of the way of understanding the organization of activities, passing from functions to processes. This is defined by Hammer and Champy (1993) as the sequence of all activities (from planning to production and marketing) that absorb resources (one or more inputs) and create output value for the customer. Compared to pyramidal organization, where the individual 'functional' units are structured as real silos with their own hierarchies on top, organization 'by processes' recomposes into units the various activities that cross over the functional units, putting them in the hands of a manager (the process-owner) who relates on the one hand as a real supplier with the customer, and on the other as a real customer with internal suppliers (constituted by support activities). Indeed, for Coriat (1991), organization as intended by Toyotism's founder (Ohno, 1988) is actually 'designed in reverse' in that it begins from the customer, while the sequence of activities designed to please the customer are recomposed in reverse. The most important partner of this approach is modern ERP technology (Enterprise Resource Planning), a software system that supports not individual functional areas but the entire business process.

The second aspect concerns the multi-competencies of employees; effective towards their construction are mentoring, job rotation (within and among production islands/teams), on-the-job training (directing classroom training to respond to Lundall and Johnson's (1994) *know-why* criterion), and finally, short-term economic incentives (designed to recognize and encourage learning rather than to achieve immediately results: thus, input-oriented rather than output-oriented incentives). The objective is to build the roles and competencies that are closest to those required, which include – in this new context – not only the execution of certain actions, but also the maintenance of the

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<sup>2</sup> According to Adler *et al.* (1998), Toyota's decision to enter into partnership with GM in the NUMMI project can be viewed as the attempt by Japanese management (followed by other Japanese companies) to overcome the trade dispute with the U.S. and build factories in America. From here begins the story of the Japanese transplants, first in the U.S. and then in Europe, that have tended to privilege greenfield rather than brownfield investments.

technology of the postings (both white and blue collar), ensuring that the role holder acquires mastery of the structure, functions, the operating mechanisms of the artefact and the production process as well as quality control exercises at each manufacturing stage of processing, identifying the defects and their causes from when they first form (Koike, 1994). All this involves dismantling the traditional quality control system carried out for statistical sampling at the end of the product's construction in favour of ongoing control. Work competencies thus constructed are no longer ascribable to only those pertaining to implementation, the identification of defects and causes, and troubleshooting, but also include those related to changes (fluctuations in production volumes, new products, new production methods) and the problems that arise from these.

## ***2.2 The pillars of new work organization: new organizational design, new work practices, positive industrial relations and their complementarities***

Lean production is a multi-dimensional approach that encompasses a wide variety of work practices and organizational designs, which differ markedly from the Taylor-Ford tradition. Lean production can be described from two perspectives: the first is a philosophical perspective relating to guiding principles (Womack and Jones, 1996); the second is a practical perspective of a set of organizational design and work practices that are linked to better performance and can be directly observed. However, since lean production focuses not only on setting a goal for a specific level of leanness, but also for a continuous improvement process (Fujimoto, 1999), it would be inappropriate, in our understanding, to set a definition of the lean production model starting from the instruments or superficial characteristics of the organizational structures – such as Kanban, *andon cords* or similar instruments, which so many outsiders have emphasized – in that they not only represent a temporary response to specific problems, but risk being used by theoreticians to establish an interpretation. It is more fruitful to remain on those autopoietic mechanisms that the new work organization is endowed with.

Much of the literature, however, provides an interpretation of the new work organization that very much leans on the side of human resources and work practices, emphasizing the 'high involvement' dimension underlying the new work practices. The core set of practices commonly identified as composing the high-involvement model and generating higher productivity includes on-line teams, participation in problem solving groups, multiple incentives to boost motivation such as performance related-pay and participation in decision making, suggestion systems, selection based on psychometric tools to single out transversal and technical competencies, extension training on relational, managerial and cognitive competencies: see, for example, Huselid (1995), MacDuffie (1995), Ichniowski, Shaw and Prennushi (1997), Black and Lynch (2001, 2004) and Boning *et al.* (2007) for the US; Patterson, West, Lawthom and Nickell (1997) and Guest *et al.* (2003) for the UK; Bauer (2003) and Zwick (2004) for Germany; Greenan and Guellec (1998), Janod and Saint-Martin (2004) on French data, Caroli and Van Reenen (2001) on both French and UK data; Cristini *et al.* (2003), Piva *et al.* (2005) and Mazzanti *et al.* (2006) for Italy; and Bloom and Van Reenen (2007) for several industrialized countries (namely, the US, UK, France and Germany), and Rizov and Croucher (2008) for European firms.

In order to control for whether return from investments in high involvement work practices exceed their costs (of labour and others), by lower employee turnover and greater productivity, with a consequent enhancing of financial performance, some researchers focused alternatively on Tobin's  $q$ , and gross rate of return to capital (Huselid, 1995) or returns on investment (i.e., ROI) (Colombo *et al.*, 2007), as a dependent variable, finding positive results. Other studies focused on the distribution of

productivity gains between firms and workers, finding mixed results: for example, Black and Lynch (2004) and Osterman (2006) find higher performance and higher wages, while Freeman and Kleiner (2000) and Freeman *et al.* (2000) find weak effects on productivity but strong and positive effects on workers' well-being; similar results are supported by Gardell *et al.* (1991) for Scandinavia.

The emphasis of this literature is on new work practices practiced by workers and hence on the supply side of labour.

Several studies have already endeavoured to synthesize the literature with a narrative review (Huselid and Becker, 1966; Ichniowski *et al.*, 1996; Wood, 1999; Addison, 2005; Becker and Huselid, 2006; Ichniowski *et al.*, 2009; Bloom and Van Reenen, 2010). Methodological issues are at the core of well-known critical aspects, to which we will return selectively in section 4. Here it is worthwhile recalling a couple of new and fascinating critical issues dealt with in the last two surveys. In the first, the authors place strong emphasis on the fact that all empirical studies are *non-experimental*, and as such lack random assignment, undermining with this the causality link. Their argument is that researchers normally control for selection bias – for example using Heckman's two-step procedure or another adoption equation – between respondents and non-respondents, controlling for endogeneity and thereafter testing the treatment effects between those firms adopting and not adopting new management practices; but these are the traditional problems in using non-experimental data, i.e., survey data. Ichniowski *et al.* (*ibidem*) observe that unfortunately «we can't know the unobserved counterfactuals about what would have happened if non-adopting firms adopted some new management practice or if adopting firms had not adopted» (*ibidem*: 7). In the second survey, the novel experiment by Bloom *et al.* (2011), as providers of free management consulting to a random set of Indian textile firms, effectively test the 'genuine' treatment effect of lean manufacturing practices randomly assigned across different plants. They found a strong and positive productivity effect in the treatment group compared to the set of control firms that were not recipients of the intervention. This is surely a very positive step towards controlling for selection bias, but a further step would be to also randomly select both managers of different production units and individual workers (or groups of workers) within the same unit. This objective, however, runs the risk of being ineffectual if managers do not adopt new practices randomly, or if they do not adopt single practices but multiple practices that complement each other, or if the performance of the individuals or groups of workers 'treated' are not isolable.

The second of the two above-mentioned surveys focuses on studies (most signed by the same authors) relating management practices to productivity. Bloom and Van Reenen's (2007) database is very appealing: over 700 managers of medium-sized firms in the US, UK, France and Germany, with the measured practices revolving around day-to-day and close-up operations rather than broad strategic choices made on the executive level. Information was probed on 18 specific management practices in four broad areas: operations, monitoring, targets and incentives. Bloom and Van Reenen's (2010) database is extended further to cover nearly 6000 firms in 17 countries. The emphasis is placed on management practices activated by managers (expressed as practices requested of workers and thus on the demand side), and whether the positive productivity effect is due to the talent of the managers themselves or the quality of their practices (seen as managerial inputs). This is an interesting but still open argument, since most of these practices derive from recommendations of the management consulting industry. The novelty of the results is that management practice scores are lower when the firm is family-owned *and* primogeniture has determined the current CEO's succession, i.e., he is the eldest son of the firm's founder. This variable and that reflecting best-practice management affect competition in the firm's market, which in turn influences the firm's outcomes (productivity included).

These two factors are responsible for explaining most of the differences between the productivity of firms and countries.

The transversality of the adoption of practices typical of lean production and the positive results arising therefrom, measured in firms belonging to different industries and countries (industrialized and developing), argue against a contingency view of the organizational and managerial practices, which instead illustrates that every firm adopts its own best practices given the circumstances in which it finds itself.

The great majority of the above-mentioned studies tend to concentrate on work practices (supply side) or on management practices (demand side) with respect to employees. Scant attention is paid instead to organizational design in the strict sense, such as, for example, internal organization (by process versus function), just-in-time, hierarchical levels versus job autonomy, job design (extended versus reduced job demarcations), team work versus individual work in relation to both productivity and other outcomes (job satisfaction, illness and injuries, firm propensity to innovation, etc.). However, a few studies include, among the covariates, variables reflecting organizational factors that mirror the new form of work organization. Amongst others, Bresnahan *et al.* (2002) Zwick (2004), Cristini *et al.* (2003), Bauer (2003), Bertsek and Kaiser (2004), Rajan and Wulf (2006) find that teamwork and flattening the firm's hierarchy (i.e., delayering) have a positive effect on productivity. Despite its crucial and characterizing role in lean production models, no studies (to our knowledge) have tested the discriminant value of organization based on processes rather than on functions. On the contrary, in several of these studies, complementarity between innovative human resource management systems and some traits of new organizational design, namely, the *joint* effect on productivity, has been proven.

As regards industrial relations, more precisely, the 'collective involvement' of human resources, a distinction needs to be made: involvement may imply a direct relation between manager and employee, and an indirect relation between manager and worker representative (unions, works councils, etc.). While the former is a management instrument, and as such is usually included among human resource management techniques emphasizing high-commitment employment practices, the latter refers to the workplace activities of worker delegates or shop stewards as an autonomous and collective voice.

Within traditional organizational regimes, in the 1980s and 1990s, unions decreased both in prevalence and in power, at least in Europe and in the so-called 'liberal market economies' (USA, Canada, Australia, New Zealand and the UK) (Visser, 2003). With significant changes induced by business process reengineering, the union was presented with an opportunity to recoup its role, collecting information on the preferences of all workers and aggregate them to determine the social demand for shared and new working conditions. It is likely that without a collective type 'voice', workers have too little incentive to reveal their preferences when the outcome of such significant changes is due to several choices and the behaviours of a wide variety of agents. However, Freeman and Medoff (1984, p.65), drawing on the theoretical work of Hirschman (1970), assert that the 'voice' cannot succeed without an appropriate response from management (and vice versa: from unions in response to any changes proposed by management). At the same time, they predict that "some managers will adjust to the union and turn unionism into a positive force at the workplace; others will not ... [admonishing that] ... over the long run, those that respond positively will prosper while those that do not will suffer in the market place" (*ibidem*). The argument is extendable to include transaction costs, according to which unions can reduce these, when employers/managers are facing big changes: i) by lowering resistance to organizational changes, paving the way for the introduction and development of productivity-enhancing practices in exchange for some benefit (pecuniary and non-

pecuniary); ii) by improving organizational coordination through improving information flows to decision makers; iii) by reducing the cost of motivation of employers/managers towards workers; and iv) by lessening the moral hazard of supervisors (Willman *et al.*, 2006). Paraphrasing Greenberg (1987) on organizational justice theories, we retain that unions not only pursue *distributive justice* (by reacting to unfair distribution of both rewards and income, between profit and wage), but are also interested in *procedural fairness* (that is, fairness of procedures pursued to make organizational decisions and to implement those decisions, postulating that unions and workers would be more satisfied if they had process control with respect to when they do not) as well as in *relational fairness* (which concerns the nature of the relationship between the parties involved in organizational change, and the consequences of organizational changes on the social harmony of group members). These dimensions of the exchange between workers and employers/managers constitute the prerequisites of an employment relation characterized by mutual trust and respect, similar to a form of ‘gift exchange’ (Akerlof, 1982), which may induce unions to legitimize the ensuing organizational changes (Bryson *et al.*, 2005) when not assisting the counterparty in their management functions (Kochan and Orterman, 1994; Willman *et al.*, 2006). In these contexts, collective bargaining at firm level may take the form of information exchange, consultation or negotiation around changes. Unfortunately, empirical research is not always instructive on the distinctive forms of these issues, leaving the question open of which of these actions is most efficient – providing that there is only one, and not various actions – based on the different industrial relations previously accumulated in managerial and organizational change projects and closely linked to the formal and informal exercising of power.

Studies that identify direct evidence on the combined impact of new organizational design, new work practices and the pro-active role of unions on productivity are: Black and Lynch (2001, 2004), Metcalf (2003), Cristini *et al.* (2003), Zwick (2004), Bryson *et al.* (2005), Mazzanti *et al.* (2006), even if it should be recognized that at times elements of the first two categories are mixed and not precisely the same.

Despite some concerns, due to some insufficiencies among the dataset used and heterogeneous methodologies applied in testing theoretical propositions, we retain that the empirical evidence (broadly considered) supports the positive and complementarity role of new organizational design, innovative work practices and pro-active workers’ representation. Among the insufficiencies, longitudinal data is most cited, except for Germany, even if in this case a different shortcoming intercedes: industrial relations are often measured by the *presence* (or non) of works councils, almost always present in medium and large establishments, instead of measuring trade union behaviours at the level of the workplace. The quality of information on organizational and work practices also matters. To these and other limitations, we shall return further on.

Before concluding, it seems appropriate to point out the risk of WCM coming adrift, above all in Europe, motherland of ‘social dialogue’ between labour and capital ‘social parties’, often working in concert with government to choose social and economic policies. The risk relates to a possible attempt to forcibly break this tradition, which – paradoxically – constitutes precisely the most fertile ground for the full deployment of the virtuous effects of WCM itself. Originating in the Japanese economy, more aligned to the EU institution-affected system than the more market-driven U.S. (Freeman 2007, p. 221), the WCM model rests on two major assumptions. On the one hand, *organizational principles* such as just-in-time, automation and systematic monitoring of the economic-production parameters of the production process, driven by the calculability and predictability of production factors aimed at the full and efficient use of resources. On the other, *organizational behaviours*, such as the continuous improvement and management of variances (events that go beyond the range of proceduralized treatments), which require quick decisions and in close proximity to the locations where they arise, but for which greater independence is required. The activation of this autonomy requires, in turn,

incentives but also active involvement and cooperation. The recognition of the new content of work positions that no longer consist of only implementation skills but also problem solving skills (for variances and improvements), as well as employee involvement, shift systems and overtime management, require the legitimacy and collective consensus that trade unions can offer – in the traditional 'social dialogue' channel – on condition that a role is recognized to them. An underestimation of this dimension is likely to undermine the rationalization potential of WMC, directing it towards the afore-mentioned drift.

### **2.3 *ICT as a new pillar of complementarities***

It is widely recognized that the traditional work organization, based on extensive hierarchy, low levels of delegation and narrow skills, is inadequate to fully exploit the potential of general-purpose computer-based technology (ICT). The diffusion of the latter – spurred by sharp declines in real prices – is expected to have a pervasive impact on the firm's life, causing both technical and organizational changes, which in turn affect work practices and industrial relations. Higher computation speed on the one hand allows processing a large quantity of data and on the other enables new work techniques based on sophisticated and flexible machines and equipment (such as CNCs, flexible manufacturing systems, robotics, group technologies, automated stores). As concerns the first dimension (computational speed), to exploit the increased amount of computer-processed information, more employees are empowered and given some decisional control (Brynjolfsson *et al.*, 2002; Breshnan *et al.*, 2002), communication is facilitated, information sharing among employees and between employees and managers is encouraged and this enhances employee involvement, autonomy and discretion. Participative industrial relations facing the new technological and work organization determine the new role of human resources, and strengthen the exchange of reciprocal trust.

As concerns the second dimension (new work techniques), positive effects on productivity are generated since ICT: i) allows more customized manufacturing products and services; ii) improves the efficiency of all stages of the production process by reducing setup times, run times and inspection times (making it less costly to switch production from one product to another and consequently supporting the customization of products to meet individual requirements); and iii) increases the competency requirements of machine operators (technical and problem solving competencies), inducing the adoption of new work practices that implicitly and informally develop these competencies (Bartel *et al.*, 2007; Leoni, 2012). Overall, these events are expected to trigger major re-organization processes within the firm: middle and line managers become crowded out, flattening the hierarchical structure; new workplace practices entailing employee involvement are adopted; competencies in technical, relational and cognitive skills are upgraded by training and job rotation<sup>3</sup>, and trust is mutually exchanged.

The decreasing cost of information technologies is not enough to produce a net productivity gain if not accompanied by new workplace design, new human resource practices and pro-active industrial relations. Only simultaneous changes in the four components are expected to raise the productivity and quality of factors, enabling cost reduction, endorsing knowledge creation and eventually spurring innovation and firm growth. If the net gain to the firm's payoff is positive, investments in the four components are said to be complements.

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<sup>3</sup> It is worthwhile noting that, using US data, Askenazy (2001) observes a positive correlation between the adoption of new technologies and new HRM practices (mainly job rotation) on one side and injuries and illness on the other; similar results are also obtained by Askenazy *et al.* (2001) for France. These are outcomes of a certain concern and would deserve close examination but are outside of the scope of this paper.

This broad-brush progression of events is rather well observed and documented by the empirical literature, even if numerous studies exist that analyze the impact on productivity of a single component (for example, ICT: Athey and Stern, 2002; Brynjolfsson and Hitt, 2003; Hubbard, 2003) or two components (ICT and competencies, or ICT and new work practices: for the former, Caroli and van Reenen, 2001; Autor *et al.*, 2003; for the latter, Black and Lynch, 2001; Bresnahan *et al.*, 2002; Cristini *et al.*, 2008). More difficult to find directly and explicitly are all four components simultaneously: usually one or two of the four are inferred in the sense that they are assumed coherent with the variable in question, or the three non-technological components are merged into a single set of variables, clearly due to the primary interest of exhaustively treating the technological variable, or finally, due to the implicit difficulty involved in dealing with very complex causal models, controlling for resulting endogeneity, heterogeneity and self-selection in the adoption of work practices.

It is worthwhile recalling that most of the quoted literature recognizes that firm specificities render each re-design process particular; a fully standardized re-organization scheme is difficult to conceive for various reasons: firm characteristics such as size, age, and the technical aspects of production may determine complementarity gains to a different extent. Due to the given firm characteristics, the reorganization process still involves some discretionary actions by managers, particularly if different strategies are possible; some complementary changes may be of a sequential rather than a simultaneous nature. Consequently, complementarity between the introduction of ICT and firm reconfiguration (implying organizational re-design, new work practices and positive industrial relations) is ultimately idiosyncratic and the complementarity-induced gains are firm specific. This could be interpreted as evidence in favour of a contingentist approach according to which there is not one absolute best organizational structure: the attractiveness of a model depends on its fit with the environment in which the firm operates. We do not fully agree with this interpretation, but will return to this argument later.

The distinctiveness of each firm renovation process explains why the empirical analysis is essentially of the micro-type, based on either case studies or firm-level data. In this regard, the latter type of data, if available for representative samples, allows more general conclusions than those obtained from case studies, but usually provides less detail on qualitative and non-accountable information. This is particularly limiting for the analysis in object since the reorganization of the workplace entails complex interactions of practices that concern various aspects of firm life.

There is also a time dimension, however, which is very important. Any workplace redesign, associated with investments in ICT, can be viewed as a process that evolves over time and takes some time to be completed. The lagged and time-phased effects of investments in the four components may give origin to results that do not always converge and are even negative in cases (see, for example, Cappelli and Nuemark (2001) where the estimates are made when the process of adjustment has not yet been completed, and the likely adjustment costs outweigh the gains. We shall return to this issue in section 4.

One of the most controversial issues concerning complementarity between organizational innovation and ICT investments is the underlying relationship between ICT and skills, on which at least three distinctive schools of thought contend against another. The first is recalled above, in this and the previous section, which views the WCM organizational design as *per se* empowering the role and the skill of each worker (core as well as rank-and-file workers), with ICT legitimizing the empowerment process. The second school of thought is the neoclassical human capital theory in its most recent and sophisticated variant, intervening in the de-skilling/up-skilling debate on the nature of technological progress, precisely 'skill biased technical change'. According to this, information technology capital on the one side replaces workers in carrying out a limited and well-defined set of cognitive and

manual activities, those that can be accomplished by following explicit rules (called ‘routine tasks’). On the other side, complementing workers in carrying out problem-solving and complex communication activities that are non-repetitive and cannot be reduced to a set of unambiguous rules (non-routine tasks) (Autor et al., 2003; Bresnahan et. al., 2002; Acemoglu and Autor, 2010). The consequence is an increasing demand for higher skills and qualifications, which in turn drives up wages, and reduced demand for intermediate and low skills, with a consequential reduction in real wages. However, job polarization and consequent wage inequality (Michaels at al., 2010) obtained different explanations according to factors that are not related to technical change. For example, Gos et al. (2010) argue that the ‘offshoring’ of routine middle-skill jobs associated with the growing importation of labour-intensive goods from low-wage countries may have reinforced the inequality between high and low-skill workers, while Lafer (2002) points out that in all developed economies a range of institutional factors and structural changes interceded such as for instance a large reduction in union density, to which Card and DiNardo (2002) add minimum wage trends. Last but not least, the generalized presence of the over-qualification phenomena in industrialized countries, with the potential waste associated with over-education (Leuven and Oosterbeek, 2011), is an enigma in human capital theory and does not fit well with skill biased technical change.

The third school of thought contending the previous explanations is that of the neo-institutionalists, who stress that the acquisition of high and intermediate skill levels by a large proportion of the workforce depends on a set of inter-locking institutional arrangements governing not only training but also industrial relations, industry policy, education and welfare (Crouch et al., 1999). Institutions would self-reinforce each other by creating economic incentives, legal and social obligations for workers and firms to invest in particular forms of workforce training, and for firms to adjust their production systems and products to these particular types and levels of skills (Hall and Soskice, 2001). Unfortunately, countries do not present uniform institutional characteristics, which prevents dealing with an ideal-type model. Consequently, the institutional literature causes problems, in the sense that it does not provide clear guidance to policymakers intent on change.

### **3. The diffusion of new work organization and the modern firm between hybridization, managerial fashions and resistance to change**

The positive results accredited by literature at times elicit scepticism and incertitude due to the fact that the new work organization is not as diffused in Western as it is in Far-East economic systems, and in Europe as it is in the USA. Moreover, even in its variegated diffusion, implementation has not occurred linearly and swiftly, and with the intensity that might have been expected following the initially promising performance. We find different explanatory reasons in the literature, related to some extent to aspects that may lay some foundations for contingencies, which will be briefly described hereafter.

According to the first, new work organization had to confront itself in Europe with some models that had already partly evolved – with respect to Taylor-Fordist tradition – independently of Japanese benchmarking. We here refer to the Swedish socio-technical model, the German co-determination and diversified quality models, the Italian models of flexible specialization and industrial districts, which *de facto* incorporated some of the characteristics of the Japanese model: team production in the Swedish case, the involvement of participative trade unions in the German case, relational capital within district firms in the Italian case. This prevented grasping the full scope of the lean model, and its revolutionary reversal of the traditional model. To this are added the captivating traits of the TQM movement, accrediting the gradualism of changes, rendering the cost of change more manageable

since it can be diluted over time, compared to the radical but indispensable changes through BPR (Business Process Reengineering), to achieve the real implementation of the new form of organization. Both BPR and TQM place focus on the process and on the customer, but rather than substituting one another, as often occurred, they should have been seen as complementary: in fact, BPR is a means of converting ‘functions’ into ‘processes’ while TQM is nothing but an organized Kaizen, namely, continuous improvement activities carried out by improvement groups (or quality circles) and by the suggestion system from the bottom, improvements that must be continuously pursued, in Japanese tradition, even after transforming the company into a lean organization. Moreover, the Western applicative nuances have rendered TQM a little different from the Japanese declination: more limited and more oriented to products in the former compared to the broader and more people-oriented (customers and employees) of the latter, thus reducing the impact of TQM.

The second reason is the enthusiasm surrounding the first positive findings, which soon transformed the re-engineering process into a managerial fashion and into a panacea of corporate performance problems, giving rise to at least three negative consequences: i) any action to reduce inefficiencies and optimization along the internal phases within individual organizational units has become ‘re-engineering’, distorting the concept and scope of the BPR – a prelude to many failures; ii) a BPR is mostly interpreted as a stand-alone practice, neglecting both incipient conflicts and complementarities with other governance practices; iii) the BPR proposal was also weakened by the misbelief that organization based on processes was only feasible in medium-large industrial enterprises, which relegated industrial SMEs, service firms and public organizations to the storeroom, despite the fact that re-engineering is nothing more than rethinking the way to organize internal activities, and as such is applicable to all organizational sizes. The same proponents of BPR (Hammer and Champy, 1993, ch. 13) were nonetheless aware of the profound knowledge and skills needed to complete the required changes (WCM) and to obtain the expected results, to the point that they predicted a 50% failure rate due to a series of approximation risks that the managers and various stakeholders could have been incurred in the 19 issues examined.

The third reason does not concern diffusion as such, but rather the difficulty of measuring and interpreting elsewhere the diffusion of the lean model. It cannot be seen as a ‘cloning’ of the original model since it developed in a cultural, legal and institutional context differing from that of the economic-productive systems and countries that have adopted it. Thus, it should not be surprising that there are different degrees of hybridization in the applications (from the production to the administration sphere, from that of relationships with suppliers to industrial relations, and so forth), as documented by the literature on lean production case studies in the US and Europe.<sup>4</sup> The diffusion took place with greater progression first in the US and then later in Europe, albeit with different levels of completeness: as noted by Ichniowski *et al.* (1996), analyses should distinguish between the adoption of single innovative practices and the incidence (or extension) of the practice itself, namely, the degree of its application to the various organizational units or the workforce employed, since if adoption by the firm is via a single practice and not a group of complementary practices (bundles), and if extension is not on a significant level, the expected effect on firm performance is practically zero. The metric used in empirical surveys is not always the same, and this prevents a stringent comparison of the degree of real diffusion of new work practices among different firms operating in different economic systems (sectors and countries). For example, Coriat (2001), in reviewing the results of four

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<sup>4</sup> For example, Koike (1998) in comparing the experience of three production departments operating in NUMMI, in California – which was supposed to be the exact copy of the Japanese Toyota production system – and Takaoka (one of Toyota’s original factories) highlights some significant differences not only in work practices, but especially in the incentive system, much more developed in the Japanese than in the American factory.

European national surveys completed in the second half of the 90s (Germany, Denmark, United Kingdom and France), pointed out a number of underlying conceptual pitfalls to various changes and innovations being measured and investigated. This demonstrates the heterogeneous theoretical interpretations circulating in the old continent on the lean model, even prior to its operational level.

The fourth reason corresponds to obstacles and resistance. Despite the positive results generated by organizational innovation, in terms of reduced costs and improved quality of products and services as well as motivation, commitment and competency development of workers, the reasons for the limited and variegated diffusion of the promising model were rightly questioned through both specific questionnaires (European Commission, 2002) and critical theoretical analyses. From the former, four major issues emerged. The first is linked to the differing intensity of competitive pressure to which firms are exposed, which affects the willingness of top management to implement a BPR process. The second issue relates to the fact that not all firms have the financial resources and expertise to address the significant costs of the changes in question. The third relates to the fact that knowledge in this area (BPR and lean organization) is poorly codified and disseminated, and firms can only access it by using consultants or turning to specific organizations. The fourth issue is that this type of change involves the system's hierarchical structure and the firm's governance, and thus the entire social structure as such is variously involved in the perception of risk of loss of status and professional power in a BPR operation: from managers to foremen and finally to line workers. The significance of the effects of inertia and resistance is proven by the preference of several firms, in wanting to move along the WCM path, to invest in so-called greenfield plants, where the adoption of new designs and new organizational practices is actually higher than in brownfield plants. However, Japanese 'transplants' in Western countries, activated by Japanese multinationals operating at the forefront in using these practices, have encountered difficulties in adopting the complete system of management practices in use at their parent company in Japan (Doeringer *et al.*, 2003), largely due to the differences in the industrial relation systems between the host countries.

Rapid innovation as well as the replacement of products on one side and the internationalization of business on the other, increase uncertainty and render formal governance, especially governance by contracts, difficult to specify, performance difficult to judge and conduct more difficult to understand. This increases the importance – according to Nooteboom (2002) – of collaborations based on trust, although trust does have its limits and as such should not be, and indeed seldom is, blind or unconditional. In addition, modern information technology can channel information horizontally as well as vertically, enabling moving decisions, together with any additional information needed, to key information points, without loss of control. Hence, the widespread and effective use of information systems for control purposes renders the centralization of decisions ineffective, allowing a radical flattening of the hierarchy and reducing (internal) transaction costs. At the same time, subordinates enjoy an information advantage since being part of a common network allows them to make operating decisions, especially those of an *urgent* nature (Radner, 1993), with an awareness of the wider consequences of their decisions. A system of decision-making decentralization can be complemented, if necessary, with incentive schemes to enforce the realignment of subordinates' objectives with those of the principal (Athey and Roberts, 2001).

From a theoretical point of view, given that the centralization of decisions becomes relatively ineffective, the re-engineering of a pyramidal organization into a flat and lean one with increased delegation of authority to – or an empowerment process of – subordinates, has been strongly legitimized by the economics of (internal) transaction costs. In spite of several favourable arguments, the phenomenon of inertia must be taken into account: factors that slow down changes (for example, crystallization of knowledge in routine, Nelson and Winter, 1982; the 'hold-up' problem, Menezes-

Filho and Van Reenen, 2003; internal resistance against changes, Zwick, 2002) could also apply to new work organization.

The quality of these and other theoretical arguments (consider those linked to agency theory, to transaction cost economies, to property rights theory) are not often taken into account in either designing questionnaires (which should include specific questions) or in explanations of why new organizational configurations are diffusing so slowly, in spite of their promising outcomes, thus preventing reliable policy prescriptions. Conversely, we must recognize that for some theorizations it is very difficult to turn concepts into empirical measures.

The awareness of the positive results of WCM on the dynamics of productivity, but also of resistance, costs and barriers that meet their implementation, has prompted several European governments, mainly in the Centre-North, to pursue industrial policies to encourage organizational innovations across the board, simultaneously supporting a policy of industrial relations based on partnerships between firms and unions. Aloisini (2009) provides a comparative analysis of strategies aimed at promoting workplace innovation in nine national and regional European contexts in the last few years, raising crucial issues for promoting learning across national borders in workplace development.

## **4. Some critical questions**

To fully answer the question on whether lean organization is really more efficient and more profitable than Taylor-Fordist organization, with more robust and incontrovertible estimates, researchers have to compete with the set of ambiguities, aporias and methodological doubts that still exist in the empirical literature. As mentioned in section 2.2, some studies have already attempted to synthesize the literature through a narrative review, highlighting several critical aspects that are fairly diffused in literature, such as: omitted-variable bias, heterogeneity bias, response bias, subjective *versus* objective measures, the role of responders (top-level managers *versus* multiple responders at different levels and in different roles within the organizations), identifying bundles, longitudinal *versus* cross-sectional datasets, unit of analysis (firm, establishment or workplace) and endogeneity.

Rather than replicating a similar exercise, in the following we draw attention to three issues, which are rather neglected or poorly understood in the literature, and as such risk perpetuating an unsatisfactory way of completing further empirical researches.

### ***4.1 Ways of combining single practices to represent the multi-dimensional nature of WCM: the identifying bundles***

A crucial aspect of the research process concerns the effort of turning concepts into workable, valid and reliable survey questions. It is not uncommon in numerous surveys to see single respondents from each organizational unit being asked to provide a single numerical rating that describes each practice on a unit-wide basis. Broad and profound concepts cannot be reliably measured with a single question (or single item) asking whether or not a given practice is implemented, or a given management tool is used: a series of specific questions are required on the components or the dimensions of a given practice. Naturally, the end user of a survey is constrained by the survey designer's choices upstream of the process.

As an example, some questionnaires ask respondents whether or not there is a 'joint consultative committee' concerned with consultation in their organizational unit. Other questionnaires go further, asking, for example, how often meetings are held (indicating a rising number, for a given period),

what proportion of meetings were attended by senior management (again, indicating a rising percentage, sometimes in size-bands) and what issues had been discussed (again, listing a varying number of issues). Unfortunately, however, the metric used changes from questionnaire to questionnaire, with the risk of providing a different empirical picture even if apparently under the same or similar construct.

The dimensions of the various organizational practices under investigation are delineated and measured in a similar way.

There are mainly two ways to combine individual practices to represent a multi-dimensional phenomenon. However, before proceeding in this direction, an important preliminary step (largely neglected) consists in checking the 'internal consistency' between the items forming a single practice or a bundle of practices: this can be achieved by estimating Cronbach's  $\alpha$  coefficient, which indirectly shows the degree to which a set of items or practices measure a single unidimensional latent construct (that is, if we are measuring the *same things*).

a) *From items to single practices*

To deal with a multidimensional phenomenon, the most frequently used method (see, for example, Osterman, 1994; MacDuffie, 1995) is the 'additive' index, which summarizes several items, generally expressed in terms of dichotomy dummies, forming a scalar variable that depicts a given single practice for each single organizational unit. Perplexingly, a more powerful tool such as factor analyses is less used at this level of data elaboration.

b) *From a single practice to a bundle of practices*

Exploratory or confirmatory factor analyses are instead much more frequently used to form orthogonal and unidimensional factors, starting from several single practices. A factor (called bundle in our context) refers to a systematic interrelationship (namely, mutually reinforcing the effects of multiple elements) among the variables under investigation. It is worthwhile emphasizing that bundles in themselves are thus already conceptualized as complementary among the elements that compose them; in other words, complementarity is 'internal' to the various practices that form the bundle in an implicit (in the case of the sum of the items) or explicit form (in case of factor analysis). Instead, when looking for interaction between bundles, complementarity becomes explicit and 'external', and is sought using the 'multiplier' form of the same, verifying whether the effect of the impact is more or less proportional.

c) *The 'nature' of bundles*

A final word must be reserved for the *nature* of bundles, in the sense that – in the estimated models – bundles that differ in nature should be contrasted (for example, innovative versus non-innovative), or – despite operating with a single bundle, operationalized with a continuous variable (for example, with a factorial variable) – clarifying which part of the distribution of the variable in question captures the 'innovative' and the 'non-innovative' dimensions (for example, high values of the distribution of the variable may be linked to the high intensity of innovative elements, and vice versa). All this should, moreover, refer to both human resources management practices and organizational design.

Similar arguments have to be extended to industrial relations (participative *versus* adversarial) and ICT (new *versus* more traditional technologies), to the extent that they are dealt with in terms of

bundles, and the interest is in searching for the complementarity of the new organizational configuration of the firm, the renowned WCM.

In this way, one can identify and deal with the dual nature of a given bundle or of different bundles (innovative and non-innovative). In doing so, a researcher is in a position to question whether a complementarity relation between two or more bundles exists, driven by the idea that logical and operational coherency is critical for the identification of both production system models and their efficiency.

#### **4.2 Adoption of changes: *simultaneously altogether or a sequence of adoptions?***

The bundling of practices finds empirical and theoretical support from the review developed above. However, whether practices that form a bundle, identified at the time of a survey, reflect the adoption of practices simultaneously implemented or whether they are simply steps along a ‘unique’ sequential process of adoption is still an open and relevant question. On the one hand, the existence of different initial conditions, or different constraints or even the different worldviews of managers, could induce each firm to start the process of change by adopting different practices from other firms, so that the bundles identified at a point in time (precisely, at the time of the survey) differ between firms or groups of firms. On the other hand, one might imagine that the path along which adoption starts and is completed is unique, but each firm, for a number of reasons (for instance, due to the crises favouring significant non-simultaneous changes) starts the adoption process at different times. The cross-sectional picture that emerges would be observationally equivalent to the previous picture but would in fact reflect a different adoption process. Unfortunately, the temporal dimension of studies on workplace practices typically suffer from poor data since no information on the time of adoption of each practice is usually available. Freeman *et al.*'s (2000) is an exception, since they know the number of years a practice has been in use. They find that the most diffused practices are those that have been in use for a longer period, suggesting that a sequential ordering of the practices may exist so that some practices form the basis for other subsequent (and probably more advanced) practices.

Using cross-section data, some information on the ‘sequential ordering’ of practices may be obtained by recording the inter-correlation among practices. Let *a*, *b* and *c* be three practices in decreasing order of frequency, then counting, among firms that have adopted practice *a*, those that have adopted practice *b* and those have adopted practice *c*; by repeating the count for all practices a matrix of data is obtained (Freeman *et al.*, 2000). If the order of frequency reflects the (unobserved) order of adoption, and this is unique, then we expect that all firms that have adopted practice *b* have already adopted practice *a*, where a lesser percentage has already adopted practice *c*; if this happens exactly, all numbers above the diagonal should be 100 and those below should be less than 100 and decreasing.

All this complicates the framework of analysis: we imagine that the productivity growth of enterprises requires not only investments in ICT but also investments in complementary organizational changes and that these changes not only see sequential-type adoption, but also time-lagged returns (due to the learning time of new human resource roles, which according to estimates by Bauer (2003) and Basu *et al.* (2004) may well go beyond 4-5 years). It follows that the comparison of two firms (or sectors), at a given point in time, may reveal that – for the same investment in ICT – a firm shows an acceleration of its TFP and another a deceleration for the simple fact that the former could have made

investments in complementary organizational capital in some previous period,<sup>5</sup> or because the latter has violated the sequential adoption of new practices.

### 4.3 *The temporal and staggered lags of effects*<sup>6</sup>

We expect that investments in general-purpose ICT are a *relatively* low cost and an easy change to make whereas other changes, specifically those relating to organizational changes and new work practices, are both costlier and slower to activate. Another argument holds that some time needs to elapse for new workplace systems to show their entire effect on productivity: employees need to acquire the necessary competencies, become familiar with the new work methods, get used to the new role, responsibilities and decision-making before performing in the new organizational environment. Thus, it is possible that complementarity between contemporaneous ICT and organizational changes does not emerge or may even be negative in some cases, signalling, for example, that the process of adjustment has not yet be completed or that the adjustment costs outweigh the gains. Usually, where investigations can rely on panel data, a considerable time lag between adoption and productivity results is observed. The Danish Ministry of Business and Industry (1996) documents that the implementation of both ICT investments and organizational changes induce a positive and rising impact on productivity from the fourth year after adoption; Brynjolfsson *et al.* (2002) find that the performance effect of the interacted ICT-reorganization term rises appreciably in the third year. With regard to bundles of workplace practices, the time lag appears to be even longer: Kato and Morishima (2002) find that complementary participatory human resource management practices lead to a significant increase in productivity only seven years after their introduction; similarly, Bauer (2003) demonstrates that the productivity effect of implementing high performance workplace practices rises over time and has a positive impact on labour efficiency only in the long run (from three to four years).

Moreover, adjustment costs may depend on the extent of reorganization: a situation where the workplace is undergoing extensive renovation (many dimensions are being changed) differs considerably from a situation where only a few changes have to be introduced, although the sign of the difference is not clear. For example, one expects that where many changes are being undertaken, potential complementarity gains are higher<sup>7</sup> although employees, in this case, may need more time to learn and adapt to the new environment or may even resist the change, thereby reducing the benefits of restructuring.

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<sup>5</sup> This is precisely the situation that emerges in the comparison between the US and UK in the work of Basu *et al.* (2004), who ask themselves whether ICTs are able to explain why the US has accelerated in its TFP while the UK — which has the same rate of investment in ICT as the US — has decelerated. The answer lies in the different rate of investments in organizational change in the US and the UK and the time lag. This is because the US had already begun to invest in ICT and organizational changes in the 80s, while the UK only joined the rhythm of investment in ICT in the 90s. Moreover, in this latter period, the data rightly shows the divergent TFP dynamics of the two countries.

<sup>6</sup> According to some evidence, the diachronic nature of firm reorganization implies that practices are adopted sequentially, stepping from those most largely diffused and easy to adopt to those more difficult and costly to implement (Freeman *et al.*, 2000). If this is the case, and if it is possible to identify a single, although imperfect, reorganization meter, then the set of practices in existence in a firm at a point in time also indicates the firm's advancement in the reorganization process itself.

<sup>7</sup> Milgrom and Roberts (1990, p. 513) cite various works according to which “the full benefits are achieved only by an ultimately radical restructuring”.

## 5. Final remarks

Porter's (1985) distinction between two generic firm strategies, cost minimization and innovative/quality strategies, attributing the former to a Taylorist system and the latter to lean production, appears to be obsolete and inadequate in understanding market processes and the thwarting forces that operate in market economies. The former strategy, which in the first instance points to a reduction of monetary labour costs through outsourcing, currency devaluation or atypical contracts, gives rise to effects that are initially positive, but after a certain point quickly diminish over time: this is a short run and transient strategy, not able to procure a sustainable competitive advantage for the firm in the medium-long run.

Even the simple contraposition of the characteristic features of mass production models and those of modern manufacturing (e.g. Milgrom and Robert, 1995) does not *per se* seem greatly significant since it confines itself to singling out monolithic dimensions on which the two patterns differ, supplemented by a possible explanation of the frequency with which they occur together in successful manufacturing organizations and the timing of their adoption. The same mathematics of complementarity, which enables following sequential responses among an assumed set of interconnected variables, only affords conclusions of a static nature.

Finally, nor is the dispute very useful between those who think the non-Taylorist organization is a best-practice model – regardless of how it is constituted – and those who view its relevance as dependent on the organization's strategy and context. The main limitation in this dispute is that neither view fully acknowledges the different combinative possibilities (Grandori and Furnari, 2008). In fact, a new organizational performance practice or a new performance bundle of practices is the result not only of different ingredients but also of the different weights of each ingredient. Hence, the employer and/or manager has two levers: ingredients and their intensity of application, in potentially innumerable combinations to pursue efficiency and performance. For example, if one considers the impact effect on performance of a bundle composed of three work practices, measured by respective coefficients (three main effects and four interactive effects), in the presence of continuous variables, the marginal return depends on the value of each work practice, namely, the intensity of the adoption, which is firm specific. It follows that one obtains different results when reducing or increasing the mean value of one or more practices, or else when enlarging (to four practices) or restricting (to two practices) the bundle.

In other words, the latter dispute does not take account of the fact that the new organizational performance configuration has to be built on performance stemming from the 'internal chemistry of the firm' (Grandori and Furnari 2008), and from factors of a dynamic nature such as 'social capabilities' (Abramowitz, 1989), which primarily include learning and knowledge creation. These are internal primary sources of innovation that are not easily transferable and require – to become powerful – appropriate workplace design, specific new work practices and organizational well-being (namely, good and trusting industrial relations), which empirical research has recently identified and documented as improving firm performance, competences of employees and innovations.

Recognizing as a stylized fact that lean production performs better than the traditional form does not mean that we are facing a *new* one-best way (which is a non-sense category): the persistent heterogeneity across firms, and even more, across countries, in their abilities to develop, imitate and adopt organizational and technological innovations is an equally robust stylized fact, which leads to predictions of – irrespective of old or new forms of organizing – interfirm heterogeneity in innovative patterns, asymmetries in innovative performance across firms, possible path-dependency and lock-in phenomena.

From an analytical perspective, the fact that international research has not yet endorsed well-established complementarities among organizational design, new work practices, industrial relations and new technologies across firms, seems to keep the idea of ‘contingencies’ alive, namely, there is not ‘one-best way’ to *organize* a flexible firm. This paper has documented that the incomplete and imperfect implementation of the new performance configuration may be due to several reasons, quite different when compared to those used by contingentists. If so, then several contingent elements may be viewed as transient, or as changeable elements belonging to different layers of organization building.

All this appears to be in perfect harmony with the thought of Grandori (2005), who strongly supports the emerging movement to reconstitute to organization design the central position it deserves, at the same time renewing the approach to it. Lingering on a ‘contingency’ approach has prevented organization theory not only from readily grasping the structural capacity of the new ‘lean production’ organizational form with respect to the Taylor-Fordist, but also from contributing to developing design tools in a creative, generative, problem-solving, architectural sense (*ibidem*, p.52), and the emerging new theory of ‘organizational combinations’, which recognizes the existence of some ‘basic elements’ (governance, coordination mechanisms) that – as in chemistry – can give rise to different (exterior) forms mainly due to different combinative possibilities (*ibidem*, p. 58).

The World-Class Manufacturing model clearly involves fundamental shifts with respect to traditional firm organization: the turning point may be glimpsed in leveraging the participatory circuits of knowledge development, through which tacit knowledge becomes explicit and codified, and thereafter incorporated into new products, new services and new ways of working (Nonaka and Takeuchi, 1995; Nooteboom, 2000). Yet, these developments cannot happen in any undifferentiated work environment: Kenney and Florida (1993) highlight that WCM (even in its numerous ‘chemistry’ versions) has precisely the characteristic of mobilizing the intelligence of a larger number of workers involved in the enterprise, creating a new and qualitatively better synthesis between manual work and mental work, compared to the traditional model. Intelligence is all the more necessary, precisely because it is required of both individuals and production organizations in a context of constant change, high volatility and substantial uncertainty (Cainarca and Zollo, 2001). Lester and Piore (2004) note in this regard how ‘analytical processes’ are at work when the alternative outcomes are well understood and can be clearly defined and distinguished from each other, while the ‘interpretative processes’ are activated when possible outcomes are not known, i.e., when the task is precisely to create the results and determine their properties. The two processes are somehow opposed to each other, but the distinctive competence is in the integration of the two processes, namely, thinking of them independently but managing them simultaneously. The work organization structure that best stimulates and assists in this integration of the two processes is a flexible form of world-class manufacturing, provided that intelligence in production engineering and in productive methodologies is complemented with intelligence in workshop social governance (i.e., individual and collective involvement, and participative industrial relations). A potential deficit of the second type of intelligence implies an authoritarian torsion to WCM – incongruent with the model itself – which can also give rise to an increase in performance in the short run, but is very unlikely do so in the medium-long run.

The two types of intelligences working together is a precondition to achieving a learning organization, where individuals, but also individual production units within the organization, relate to each other in a more complex but also more fruitful and sustainable way than is possible through the classical mechanism of hierarchy or the market-price mechanism.

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