Innovative Workplaces

MAKING BETTER USE OF SKILLS WITHIN ORGANISATIONS

OECD *Innovation Strategy*

OECD

Centre for Educational Research and Innovation

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MAKING BETTER USE OF SKILLS
WITHIN ORGANISATIONS

OECD

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Foreword

Human capital is at the heart of innovation. It is people who transform their creativity, knowledge and skills into innovations. We generally conclude that if education and training systems supply our societies and economies with well trained people, new ideas will bloom and innovation will thrive. This is true, but only if there is an appropriate environment, in particular companies and organisations that take advantage of the talent and innovative capacity of the people they employ. Designing organisations and management practices that are conducive to innovation is part of the challenge.

Why are learning and social interactions within companies important to innovation? To what extent do work organisations differ across countries? How can governments help foster innovative workplaces? These are some of the questions addressed in this book, which explores one of the policy principles of the OECD Innovation Strategy* in depth: fostering innovative workplaces.

The crucial importance of putting human resources to good use has long been acknowledged, but it has so far not played a key role in policy making. One possible reason lies in the lack of supporting data, as organisational learning and knowledge management are difficult to measure. Perhaps more importantly, the organisation of work largely falls out of the scope of policy making. This volume helps us to look at this issue differently. It offers some empirical data to underpin the importance of innovative workplaces, and points to some policy interventions and policy variables that can inspire policy making in this area.

This book is also about lifelong learning. Innovation sometimes leads to rapid obsolescence of skills and thus calls for regular workforce retraining. This is one traditional reason to support lifelong learning. The book emphasises another reason: those countries which are leaders in innovation are also those where companies offer more opportunities of learning and training to their employees.

* See OECD (2010), *The OECD Innovation Strategy: Getting a Head Start on Tomorrow,* OECD Publishing, Paris, *www.oecd.org/innovation/strategy*.

This report follows up on previous work: work on knowledge management carried out by the OECD Centre for Educational Research and Innovation (CERI), notably *Measuring Knowledge Management in the Business Sector: First Steps* (OECD, 2004); work on innovation by the OECD Directorate for Science, Technology and Industry (STI), notably *Innovation in Firms: A Microeconomic Perspective* (OECD, 2010).

Nathalie Greenan (Centre d'Études de l'Emploi and TEPP CNRS) and Edward Lorenz (University of Nice, CNRS) co-authored this report under the editorial supervision of Stéphan Vincent-Lancrin (CERI) and Fabienne Cerri (STI) of the OECD Secretariat.

This work is co-published by the Directorates for Education (EDU) and for Science, Technology and Industry (STI) as a contribution to the OECD Innovation Strategy and to the upcoming OECD Skills Strategy. The study stems from a collaborative effort between the "human capital" and "culture" working groups of the OECD Innovation Strategy, led by Ester Basri and Stéphan Vincent-Lancrin (human capital) and by Fabienne Cerri and Vincenzo Spiezia (culture). The report has benefited from useful comments from Ester Basri, Beñat Bilbao-Osario, Sarah Box, Bo Hansson, Kiira Kärkkäinen, William Thorn and from many other OECD analysts. It has also been discussed on various occasions by country delegates and international experts who provided comments. Dirk Van Damme, head of CERI, and Alessandra Colecchia, head of STI's Economic Analysis and Statistics Division, are gratefully acknowledged for their sustained commitment to the project. Finally, the report has benefited from the assistance of Therese Walsh and Florence Wojtasinski throughout the editorial process, and from that of Joseph Loux for the final publication process.

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Executive summary

Innovation is widely recognised as an important engine of growth. The underlying approach to innovation has been changing, shifting away from models largely focused on Research and Development (R&D) in knowledge-based globalised economies and giving more emphasis to other major sources of the innovation process. Understanding how organisations build up resources for innovation has thus become a crucial challenge to find new ways of supporting innovation in all areas of activity.

This report supports and contributes to this widened approach to innovation analysis and policy by showing the importance of work organisation, interactions within organisations, as well as individual and organisational learning and training for innovation. The analytical tools and empirical results it provides are designed to open the black box of what a *learning organisation* is, that is, a work organisation supporting innovation through the use of employee autonomy and discretion, supported by learning and training opportunities.

A learning organisation is an organisation that promotes management tools concerned with the improvement of individual and organisational learning.

This report begins with a survey of the literature on learning organisations in order to provide greater definitional clarity. Although the literature is highly disparate and there is nothing like a unified definition or concept of the learning organisation that has been developed and empirically tested in a cumulative manner, some common definitional ground has been identified. A key feature of the literature is that much of it is normative and concerned with the promotion of management tools that are designed to improve the learning capabilities of an organisation and its members.

Learning organisations are those with a capacity to adapt and compete through learning. First, most authors see the learning organisation as a multilevel concept involving interrelations between individual behaviours, team organisation, and organisational practices and structure. Secondly, there is an important emphasis in the literature on the role of learning cultures understood as beliefs, attitudes and values supportive of employee learning.

Further, an important strand in the literature identifies specific human resource management policies which are supportive or constitutive of learning cultures, such as further vocational training and performance assessment, payment for skill, transparent career paths, supportive management, and increased opportunities for informal learning.

Empirical analysis shows important variations in the spread of learning forms of work organisation across EU member nations, and in some nations, a slight downward trend in this form of jobs.

The multilevel nature of the concept as well as the emphasis on organisational culture poses a challenge for measurement and quantitative analysis. Drawing on the results of successive waves of the European Survey of Working Conditions carried out at the individual level, the report provides evidence on the spread of learning organisations within private sector establishments across the European Union and on the evolution of their characteristics over time. Learning organisations are then defined as organisations where high levels of autonomy in work are combined with high levels of learning, problem-solving and task complexity.

The results show firstly that while a large share of European workers have access to work settings that draw on their discretionary capacity for learning and problem-solving, there are important variations in the spread of learning forms of work organisation across EU member nations, with the percentage of salaried employees involved in 2005 ranging from a high of over 65% in Sweden to a low of about 20% in Spain and Bulgaria. Moreover, in the nations where work is organised to support high levels of employee discretion in solving complex problems, the evidence shows that firms tend to be more active in terms of innovations developed through their own in-house creative efforts. In countries where learning and problem-solving on the job are constrained, and little discretion is left to the employee, firms tend to engage in a supplier-dominated innovation strategy.

Secondly, the results show that in many European nations, and for the EU15 on average, there has been a slight downward trend over 1995-2005 in the percentage of employees having access to work settings characterised by high levels of learning, complexity and discretion. When structural factors are taken into account in a multilevel model involving an individual level and a country level, this decreasing trend in work complexity grows in size and significance. This result is surprising given the emphasis placed in the European Union on policies for constructing knowledge-based economies, and notably on those designed to increase the level of R&D expenditures, to augment the supply of persons in the labour market with tertiary science and

technology degrees, and to promote the wide diffusion of information and communication technology (ICT).

The analysis of these results point to the importance of learning and interactions within organisations. Learning work organisations are positively associated with in-house innovation.

Taken together these cross sectional and longitudinal results have some important implications for understanding the performance of national innovation systems.

Firstly, in line with the OECD emphasis on widening the concept of innovation, they imply a need to put the organisation of work more centrally in the analysis of innovation. Learning and interaction within organisations is at least as important for innovation as learning through interactions with external agents, and indicators for innovation need to capture how material and human resources are used and whether or not the work environment promotes the further development of the knowledge and skills of employees.

Secondly, policies designed to promote innovation, especially in countries that are trailing or behind, have tended to focus on the need for increased expenditures on Research and Development (R&D), on raising the percentage of the population with tertiary educational attainment and on furthering the diffusion of Information and Communication Technology. Considerable progress has been made with respect to the latter two indicators. The results presented here suggest that the bottleneck to improving the innovative capabilities of European firms might not be low levels of R&D expenditures, which are strongly determined by industry structures and consequently difficult to change, but the widespread presence of working environments that are unable to provide fertile grounds for innovation. If this is the case, then an important policy measure would be to encourage the adoption of "pro-innovation" organisational practices, particularly in countries with poor innovative performance. While the analysis draws on European data, the lessons may be extended to other OECD regions.

Institutional reforms also matter and may need to be reformed to stimulate pro-innovation organisational practices.

The analysis of institutional framework conditions for employee learning provides some guidance for the design of national policies. The results indicate that the way work is organised is closely connected to the structure of national labour markets and to the level of expenditures on labour market policies in the form of income maintenance for the unemployed and in the form of measures designed to move the unemployed into employment. There

are alternative ways to build systems of learning and innovation, and different systems tend to organise work and distribute security and protection differently among citizens.

While these conclusions are very preliminary and there is clearly a need for a more comprehensive analysis, they suggest that the institutional set-up determining the dynamic performance of national systems is much broader than normally assumed when applying the innovation system concept. They point to the need for a transversal approach to policy that can take into account the interconnections between learning, innovation and the different institutional sub-systems of the knowledge-based economy.

One main organisational design challenge lies in a central trade-off between routine (standardisation) and innovation (mutual adjustment).

From an employer point of view, some organisational design parameters are critical for the long term perspective of the organisation.

Employers appear to be confronted with a central trade-off between standardisation/routine and mutual adjustment/innovation when making decisions in these areas. Designing a stable organisational structure with some dynamic properties is a key issue behind this trade-off. The changes or innovations induced by "adaptive" or "learning" forms of organisations have to be sustainable. Changes or innovation have to be in a range that do not put the structure into question or that preserve inertia forces.

The initial organisational structure is a core decision for any entrepreneur or employer who sets foundations for a new organisation. By fixing how employees have access to the organisation's critical resources and knowledge, it sets the basis of a psychological contract between the employer and the employees. As the initial critical knowledge resource expands through collective learning by doing, human resource management practices become another key feature. The structuring of the information system is another important area of organisational design.

Some of the key design questions that must be addressed are: how are knowledge tasks divided between direct producers and specialised problem solvers? How does information and communication technology contribute to information processing and communication? How are social relationships articulated with production relationships?

Employee participation is the second main challenge: if not managed efficiently, can lead to conflicts between vested interests and constitute a strong barrier to innovation.

From the point of view of organisation, innovation strategies also meet a challenge in the human resources area: employers or managers willing to innovate have to deal with an employee participation constraint. If this participation constraint is not managed efficiently, conflicts between vested interests may arise and constitute a strong barrier to innovation.

In this context, human resources management practices are essential tools. Employer-provided continuing vocational training or multi-skilling policies contribute to alleviate skill obsolescence induced by innovation, formal systems of performance appraisals or evaluation interviews allow addressing issues connected with the balance between effort and reward which can be upset by change. Some of these tools can also open the path to some transparency in the organisational incentives policy, which is important to build in feelings of trust and fairness.

While the few available linked employer-employee surveys give some promising results on these issues, a linked employer-employee type of survey instrument covering more than one country with different institutional arrangements would be needed to better identify best practices.

Several countries use policy programmes to foster innovative workplaces.

How could policy makers foster innovative workplaces which are typically the realm of entrepreneurs and employers? Some promising policy programmes are used in some countries to this effect. Most of these programmes take two forms: workplace development projects and learning networks.

Workplace development projects focus on the performance and the quality of working life at workplaces. Improvement of the quality of working life may comprise, for instance, improvements in employees' opportunities for development and exerting an influence over their work, wellbeing at work, and co-operation and trust within the work community.

Learning networks consist in joint learning forums workplaces and research and development units (such as universities, research institutes, polytechnics or other educational institutions).

Within the European Union, the most ambitious programmes in terms of funding and outreach are located in Nordic countries that figure among the highest adopters of learning forms of work organisation.

Introduction

While innovation is widely recognised by OECD countries as an important engine of growth (OECD, 2010), the underlying approach to innovation has been changing, shifting away from models largely focused on R&D in knowledge-based globalised economies. Gaining a comprehensive understanding of how organisations build up resources for innovation has become a crucial challenge to finding new ways of supporting innovation in all areas of economic activity. In support of this widened approach to innovation analysis and policy, this report provides analytical tools and empirical results designed to open the black box of what is a learning organisation.

The literature on learning organisations is highly disparate and there is nothing like a unified definition of the "learning organisation" that has been developed by different authors in a cumulative manner. A key feature of the literature is that much of it is normative and concerned with the promotion of management tools that are designed to improve the learning capabilities of an organisation and its members.

A first objective in this report is to identify some common definitional ground in the case study and management literatures. Particular attention will be given to the way the literature treats the role of organisational culture in promoting employee learning and its relation to the use of specific HRM policies.

Another key feature of the management literature is that it is only weakly linked to an empirical research program designed to observe and measure the extent to which existing firms display the characteristics of learning organisations. While scholars such as Senge (1990) and Agyris and Schön (1978) have long maintained that organisational learning promotes creativity and innovation, there has been little effort to develop indicators of the learning organisation that could be measured with survey data and used to test different hypotheses about their behaviour. Drawing on a series of papers by Lorenz and his co-authors (Lorentz and Valeyre, 2005; Valeyre *et al*., 2007; Holms *et al*., 2009), a second aim of the report will be to present empirical evidence on the spread and characteristics of learning organisations at a national and EU-wide level. The discussion includes an assessment of the role of learning cultures in the development of learning organisations, an analysis of the relation between the frequency of learning organisations and national innovation performance, an analysis of the relation between learning organisations and the national institutional context, including the education and training system and the structure of labour markets, and a preliminary comparison of employee learning in public and private sector organisations.

Another important aspect is longitudinal. How are the characteristics of work and learning evolving over time? Greenan, Kalugina and Walkowiak (2007, 2010), using the common questions in three waves of the European Working Condition Survey (EWCS) (1995, 2000 and 2005) in a multilevel analysis find a decreasing pattern in the EU15 average evolution of work characteristics that are conducive to high learning opportunities (complex tasks, autonomy, problem solving and learning). They label it the "work complexity paradox": the increasing level of education, the growing experience of an ageing workforce, the shifts in sector and occupation shares and the diffusion of computers should drive the expansion of jobs with complex tasks, high discretion and learning, but this is not what is observed in the data. A *third objective* of this report is to uncover this work complexity paradox, searching in the literature for the reasons that may explain the negative trend in work complexity: growing standardisation, job polarisation, organisational change and skill mismatch are possible culprits.

In globalised advanced economies, growth and innovation should translate into increased work complexity, which is an important component of learning organisations. Thus, the connection between the learning activities of employees in their tasks, the dynamic capabilities of the organisations and the propensity to innovate needs to be investigated thoroughly. This will be a *fourth objective* of the report. We will try to address it by focusing first on the trade-offs that employers face when they decide to make new strategic decisions implying some changes in work methods, organisational structure, products or processes. We will then consider what happens on the employee side when employers innovate. We will carefully scrutinise empirical results based on innovation surveys and on linked employer/employee datasets. Is it possible to identify management practices that lead to higher innovation performance levels? What kind of work organisations fosters a culture of innovative behaviour and creativity? Do incentives to innovate matter? Empirical studies from the economic, the industrial relations and the psycho-sociology fields will be reviewed.

Finally, this report identifies metrics and survey methods that are most promising to capture differences in the capacities of organisations to adapt and compete through learning across countries.

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Chapter 1

Defining learning organisations and learning cultures[1]

This chapter reviews the research literature on learning organisations. After briefly recalling the historical link to the notion of organisational learning, it reviews the related management literature, showing that much of it is normative and concerned with the development of diagnostic tools that can be used by managers to assess and improve the learning capabilities of their organisations. It stresses the importance given to the notion of "learning culture", defined as a set of shared beliefs, values and attitudes favourable to learning. This management literature is only weakly linked to an empirical research program designed to observe and measure the extent to which existing firms display the characteristics of learning organisations.

Learning organisations can be defined as those with a capacity to adapt and compete through learning. But in the literature, no standard definition of the "learning organisation" has been developed yet. Different authors have tended to use the term in related but slightly different ways. A key feature of the management literature is that much of it is normative and concerned with the development of diagnostic tools that can be used by managers to assess and improve the learning capabilities of their organisations. This management literature is only weakly linked to an empirical research programme designed to observe and measure the extent to which existing firms display the characteristics of learning organisations. In particular, there has been little effort to develop indicators of the learning organisation that could be measured with survey data.

The notion of the learning organisation is closely linked to that of organisational learning. Therefore, before considering some of the principal ways in which learning organisations have been defined and analysed, it is useful to briefly consider the historical background of research on organisational learning. A seminal contribution was that of March and Simon (1958), and it is perhaps not an exaggeration to say that their conception dominated organisational learning theory until the 1990s along with a few other contributions such as those of Argyris and Schön (1978), March and Olson (1975), and Levitt and March (1988). March and Simon (1958) analysed organisational learning in terms of processes of search and the modification of routines which were identified as the basic building blocks of organisations. They identify a spectrum of behaviours going from those that are spontaneously invoked in response to repeated stimulus with little or no search activity, to those that depend on considerable search and the mediation of existing routines in response to more or less novel stimulus.

Argyris and Schön (1978) defined organisation learning as "the detection and correction of error" where learning can take place in three forms: single-loop, double-loop and deutero learning. Single-loop learning takes place when errors are detected and firms carry on with their ongoing policies and goals. As observed by Dodgson (1993), single-loop learning has also been referred to as lower-level learning (Fiol and Lyles, 1985), adaptive learning or coping (Senge, 1990) and non-strategic learning (Mason, 1993). In double-loop learning, in addition to detection and correction of errors, the organisation is involved in the questioning and modifications of existing norms, procedure, policies and objectives. As discussed by Dodgson (1993), double-loop learning involves changing the organisational knowledge base. Deutero learning occurs when the firm learns how to carry out single and double-loop learning, for example, by identifying the processes and structures that facilitate learning. Dodgson describes organisational learning as the way firms organise knowledge around their activities and within their cultures

and develop organisational efficiency by improving the use of the broad skills of their workforces whereas Senge (1990) defines it as generative learning or learning to expand organisations capabilities. Generative learning emphasises continuous, double-loop experimentation and feedback. Double-loop learning enhances the continual search for solutions while instilling behaviours and a culture where learning is embraced. Unlike adaptive learning, generative learning requires a new mindset and the capacity to create new visions for future realities. Fiol and Lyles (1985) defined higher-level learning as the process of improving actions through better knowledge and understanding, and Mason (1993) gave the name strategic learning to the type of learning behaviour in which organisations make sense of their environment in the ways that broaden the range of objectives that can be pursued or the range of resources and actions available for processing these objectives. So organisational learning is more than the sum parts of individual learning (Dodgeson, 1993; Fiol and Lyles, 1985).

From the late 1980s and early 1990s the notion of the "learning organisation" started gaining in popularity in the management literature. The term learning organisation was proposed by Pedler, Boydell and Bugoyne in 1989 and became more widely used following Senge's best seller, *The Fifth Discipline*, in 1990. Both the notions of organisational learning and the learning organisation have at their core the translation of information into business success through individual, team, organisational and wider learning processes. On the other hand, the learning organisation literature can be distinguished by its action orientation and the way it has been geared toward developing specific diagnostic and evaluative methodological tools which can help to identify, promote and evaluate the quality of learning processes inside organisations (Easterby-Smith, Araujo and Burgoyne, 1999; Tsang, 1997).

Senge (1990) provides a good example of the normative practitioner's orientation of much of the literature. Senge defines learning organisations as "organisations where people continually expand their capacity to create the results they truly desire, where new and expansive patterns of thinking are nurtured, where collective aspiration is set free, and where people are continuously learning to see the whole together" (p. 3). He defines five disciplines for the development of learning organisations: systems thinking, personal mastery, mental models, shared vision and team learning (Senge, 1990). Senge proposes that people put aside their old ways of thinking (mental models), learn to be open with others (personal mastery), understand how their company really works (systems thinking), form a plan everyone can agree on (shared vision), and then work together to achieve that vision (team learning). Much of his 1990 book develops, and illustrates with case study examples, these five disciplines or component technologies of learning organisations.

The number of books and articles that have been written in the spirit of providing management aids and diagnostic tools for developing or improving a company's learning capabilities is vast. Often cited contributions include Crossan *et al.* (1999); Deane *et al.* (1997); Garvin (1993); Gephart *et al.* (1996); Goh (1998); Levine (2001); Marquardt and Reynolds (1994); Mohanty and Deshmukh (1999); Pace (2002); Pedler *et al.* (1991); Redding (1997); Rothwell (2002); and Watkins and Marsick (1996, 2003).

Pedler *et al.* (1991) define the learning company as "an organisation that facilitates the learning of all its members and continuously transforms itself in order to meet its strategic goals". They identify eleven policy areas through which this occurs including internal exchange, reward flexibility, enabling structures, learning climate and self-learning for everyone. Garvin (1993, p. 80) defines a learning organisation as "an organisation skilled at creating, acquiring, and transferring knowledge, and at modifying its behaviour to reflect new knowledge and insights". He draws on case study evidence of the practices used by a number of companies to illustrate the use of strategic building blocks for constructing learning organisations. For example, he cites the training methods developed at Xerox as exemplary for promoting employee problem-solving capabilities. Redding (1997), in an article that bills itself as "a step-by-step guide to conducting an assessment to determine whether your company has the characteristics of a learning organisation", defines the learning organisation in terms of the degree to which the company "has purposely built its capacity to learn as a whole system and woven that capacity into all its aspects: vision and strategy, leadership and management, culture, structure, systems and processes". Deane, Clark *et al.* (1997) make an explicit link between learning organisations and performance in terms of whether project outcomes meet customer needs, explaining that a variety of gaps can exist between the two. The article presents a model that is designed to help managers assess and narrow these gaps and foster a continuous improvement cycle "typical of learning organisations". A similar focus on providing management aides can be found in Goh's (1998) discussion of "strategic building blocks for learning" in relation to overall company design and performance."

A few of these studies propose measurement instruments that can be used for quantitative assessments of a company's characteristics and the extent to which they correspond to a learning organisation. Most of the empirical research based on these instruments has been concerned with testing construct validity rather than to provide empirical evidence on the spread and performance of learning organisations using representative survey data. One of the most frequently cited is the Organisational Learning Profile (OLP) assessment tool described in Pace (2002). The instrument, which draws inspiration from the work of Huber (1991) and Levitt and

March (1988), consists of 34 items assessing the degree to which organisational learning is taking place. In the original Pace *et al.* (1997) study, factor analysis is used to identify four latent factors or dimensions of the learning organisation: *a)* information-sharing patterns, *b)* inquiry climate, *c)* learning practices, and *d)* achievement mindset. Information-sharing patterns include the ways and the extent to which organisational members share information. Inquiry climate includes the ways and extent to which organisation members inquire, challenge and experiment to improve organisational functioning. The learning practices factor focuses on the kinds of activities in which organisational members engage to learn. Finally, the achievement mindset factor has to do with the perspective that organisational members have regarding their desire to achieve in the organisation.

Another often cited assessment instrument is the Dimensions of the Learning Organisation Questionnaire (DLOQ) developed by Watkins and Marsick (1996, 2003).[2] The survey consists of 42 items concerning the kinds of beliefs and behaviours of organisational members related to seven dimensions of a learning organisation: *a)* creates continuous learning opportunities, *b)* promotes dialogue and inquiry, *c)* promotes collaboration and team learning, *d)* empowers people to evolve in a collective vision, *e)* establishes systems to capture and share learning, *f)* connects the organisation to its environment, and *g)* provides strategic leadership for learning. In Yang, Watkins and Marsick (2003) a further 12 items are added in order to assess the performance outcomes of learning organisations in the areas of knowledge accumulation and financial performance. Drawing on the results of interviews conducted with a sample of 836 subjects from multiple organisations, confirmatory factor analysis is used to assess construct validity, and structural equation modelling (SEM) is used to examine the hypothesised relations between the different dimensions and the measures of company performance. For the extended model the results showed that the 12-item measurement model for the constructs of financial performance and knowledge performance fitted the data moderately. The authors concluded that the learning organisation is a multidimensional construct involving a complex set of interrelations between individuals, teams and the organisation as a whole.

Despite the disparate nature of this literature and its largely normative focus, it is possible to identify some common definitional ground beyond, of course, the obvious point that learning organisations are those with a capacity to adapt and compete through learning.

First, most of the research sees the learning organisation as a multilevel concept and define the learning organisation in terms of the interrelations between individual behaviours, team organisation and organisational practices, and structure. The multilevel nature of the concept, for example, is explicit in the DLOQ measurement tool where the items are divided

between the individual, team or group and company levels. It is also explicit in Redding's (1997) step-by-step assessment guide where the interrelations between individual, team and organisation learning are emphasised. In a more general sense, the multilevel nature of learning organisation can be seen in the emphasis placed by both Crossan *et al.* (1999) and Rothwell (2002) in the relation of leadership style to individual employee learning dynamics.

Secondly, there is an emphasis in this literature on the importance of the beliefs, values and norms of employees for sustained learning. Although this aspect is discussed in a variety of ways and with differences in language, the emphasis on beliefs, values and attitudes raises the issue of the role of organisational culture in promoting and sustaining employee learning. The idea of organisational culture, of course, has been extensively developed in the field of organisational studies. While the term has been defined in a wide variety of ways (see Ott, 1989, for an overview) many authors identify company culture with the beliefs, attitudes and values shared by organisational members that contribute to co-ordinating their activities. For example, Schein (1985) defines organisational culture as "a pattern of shared basic assumptions that the group learned as it solved its problems of external adaptation and internal integration that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way you perceive, think and feel in relation to those problems". In a similar vein, Hill and Jones (2001) define organisational culture as "the specific collection of values and norms that are shared by people and groups in an organisation and that control the way they interact with each other and with stakeholders outside the organisation".

Understood in this way, organisational culture enters into most discussions of the learning organisation. It can be seen in the emphasis many authors place on the importance of developing beliefs and attitudes that support employee learning. For example, Senge's (1990) emphasis on the need to put aside established ways of thinking or mental models and to develop a shared vision can be seen as a call for organisational culture change. Similarly, Watkins and Marsick (2003) describe their DLOQ assessment tool as designed to "measure important shifts in an organisation's climate, culture, systems and structures that influence whether individuals learn". Examination of different items in their questionnaire reveals that many are designed to assess the extent to which employees hold the sorts of attitudes and values that are favourable to knowledge acquisition, exchange and learning. The same emphasis on values and beliefs supportive of learning can be seen in the discussion of Crossan *et al.* (1999) of the role of the organisational "environment" in supporting continuous learning by employees; in Rothwell's (2002) emphasis on the importance of a "learning

atmosphere" for sustaining employee learning; or in the way Gephart *et al.* (1996) define a learning culture in terms of values and beliefs that "promote enquiry, risk-taking and experimentation" as well as allowing "mistakes to be shared and viewed as opportunities for learning".

A learning culture, defined as set of shared beliefs, values and attitudes favourable to learning can be seen as an essential part of the organisational context within which specific organisational design principles and types of work organisation are successfully implemented. The connections between organisational culture and organisational design have been addressed explicitly in a recent article by Dimovski *et al.* (2007), who define an organisational learning culture as "a set of norms, values and underlying assumptions about the functioning of an organisation that support more systematic, in-depth approaches aimed to achieve deutero, strategic or generative learning…". They argue that a learning culture may be a crucial link between a business process orientation (BPO) and achieving high-level company performance. The key organisational design principles they identify are: cross-functional management and work organisation; decentralised decision-making, including autonomous team organisation; and tight links with customers and suppliers. The basic thesis is that, in the absence of a supportive learning culture, repeated changes in organisational design may amount to empty restructuring, since after the initial shock and adjustment behaviour will tend to drift back into its original form or possibly towards new and unintended perverse forms.

The idea of culture as a key factor impacting on the ability of firms to achieve higher rates of learning in turn raises the issue of personnel policies serving to foster and promote learning cultures. Johnston and Hawke (2002) take up this issue explicitly; they identify five types of human resource management (HRM) policies for fostering employee commitment which they see as the core of a learning culture. The five policy areas are: *a)* further vocational training and performance assessment, *b)* payment for skill, *c)* transparent career paths, *d)* supportive management, and *e)* increased opportunities for informal learning. A similar emphasis on supportive HRM policies can be found in other studies of the learning organisation even if the causal links we are drawing here between specific human resources policies and the development of learning cultures are not made so explicitly. For example, in his discussion of Xerox, GM Saturn and Boeing, Garvin (2003) points to the importance of supportive and open management, reward for risk-taking and making ample opportunities for informal learning and communication. Redding (1997) explicitly discusses the relation of culture to enterprise structure and advocates the use of performance management tools including those linking pay to learning performance measures. Gephart *et al.* (1996) argue that "cultures of learning" exist where "learning and

creativity are rewarded, supported and promoted through various performance systems from the top to bottom".

The multilevel nature of the concept of a learning organisation, as well as the importance of learning cultures understood as systems of beliefs and values supporting learning, poses a particular challenge for measurement and quantitative analysis, especially from an internationally comparative perspective. An ideal approach would be to use linked employer-employee data allowing for a rich characterisation and transnational comparison of enterprise structure and management practices in relation to individual learning dynamics. In the absence of such data, Chapters 2 and 3 draw on harmonised employee-level data for the EU15 and EU27 in order to explore the characteristics of learning organisations from both cross-sectional and time-series perspectives.

Notes

1. This chapter draws in part on a survey of the literature on learning organisations prepared by Rakhi Rashmi, GREDEG-CNRS, University of Nice.

2. See electronic version of the questionnaire at: *www.partnersforlearning.com/questions2.asp*.

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Chapter 2

Mapping learning organisations and their characteristics for the European Union

This chapter maps the importance of learning organisations at the national and EU levels. Learning organisations are defined as organisations where high levels of autonomy in work are combined with high levels of learning, problem-solving and task complexity. A series of policy relevant issues associated with the unequal spread of learning forms of work organisation across nations are then discussed: the relation of employee learning to national innovation style and performance; the link between the use of learning forms of work organisation and the national institutional context, including the development of systems of continuing vocational education and training; the structure of labour markets; and level of expenditure on different labour market policies. At the micro-level, the analysis attempts to shed light on the complex relation between employee learning, the use of different human resource management policies, and organisational culture, defined in terms of the beliefs and attitudes held by employees.

In this chapter we aim to provide a better empirical understanding of the spread and characteristics of learning organisations by drawing on a series of papers by Lorenz and his co-authors that focus on work organisation and employee learning dynamics in private sector establishments of EU member nations. The papers use a common methodology developed in Lorenz and Valeyre (2005), and they show how different styles of employee learning are linked to different ways of organising work. An attempt is made to connect the differences in forms of work organisation and learning to differences in organisational culture and HRM policies. Arundel *et al.* (2007) link national differences in work organisation and employee learning to innovation style and performance for the EU15. Holms *et al.* (2009) explore the relation between national differences in employee learning dynamics and the national institutional context for the EU27 and Norway. The focus is on the structure of the labour markets and national labour market polices.

The papers by Lorenz and his co-authors draw on the 2000 and 2005 waves of the European Working Conditions Survey (EWCS) carried out at the individual level by the European Foundation for the Improvement of Living and Working Conditions for the EU15 and EU27 respectively[1]. The papers use the survey results for employees working in establishments with at least 10 persons in both industry and services but excluding agriculture and fishing, public administration and social security, education, health and social work, and private domestic employees.

It is important to emphasise that the use of employee-level data captures the frequencies of different forms of work organisation and employee learning within private sector establishments but cannot be used to determine the prevalence of particular types of firms or company structures. The data thus can only provide an indirect measure of the diffusion of learning organisations, and the results allow for the obvious possibility that multiple forms of work organisation are in use within the same establishment. However, the absence of a harmonised employer-level EU survey on organisational dynamics precludes developing direct measures of types of enterprises based on employer-level data. The ideal approach would be a linked employer-employee dataset in order to examine more explicitly the relations between employee learning and organisational structure and design.

Mapping learning organisations for the EU

The basic methodology used to map the importance of different forms of work organisation and employee learning across EU member nations is set out in Lorenz and Valeyre (2005). Using 15 binary variables derived from the 2000 wave of the EWCS data, a combination of factor analysis and hierarchical classification is applied in order to assign employees to distinct categories or groups. The factor analysis method used is multiple correspondence analysis (MCA), which is suitable for the analysis of categorical variables.[2] The hierarchical cluster analysis is carried out on the factor scores of all 15 factors resulting from the multiple correspondence analysis.

The choice of variables for the analysis is based on the organisational taxonomy developed by Lam (2005), which extends the classic work of Mintzberg (1979). Lam contrasts two ideal organisational forms that support different styles of learning and innovation: the "operating adhocracy" and "J-form" or the Japanese form of organisation.[3] She observes that the operating adhocracy relies on the expertise of individual professionals and uses project structures to temporarily fuse the knowledge of these experts into creative project teams that carry out innovative projects typically on behalf of its clients. High levels of discretion in work provide scope for exploring new knowledge, and adhocracies tend to show a superior capacity for radical innovation. Compared to the operating adhocracy, the J-form is a relatively bureaucratic form that relies on formal team structures and rules of job rotation to embed knowledge within collective organisation. Stable job careers within internal labour markets provide incentives for members to commit themselves to the goals of continuous product and process improvement, and the J-form tends to excel at incremental learning and innovation.

Table 2.1 presents four basic systems of work organisation resulting from the hierarchical cluster analysis. The four clusters capture forms of work organisation that are characteristic of several of the main organisational forms discussed in the literature: "discretionary learning", which corresponds to work organisation in the notion of an adhocracy, "lean production" or the J-form organisation, the hierarchically structured Taylorist form, and the "traditional" organisation based on a simple management structure. Annex 2.A2 provides a graphical representation of the centres of gravity of the four work organisation clusters on the first two factors of the factor analysis.

Table 2.1. Work organisation clusters for the EU15 (2000)

Variable	Percentage of employees by work organisation cluster reporting each variable				
	Discretionary learning	Lean production	Taylorism	Traditional organisation	Average
Learning new things in work	93.9	81.7	42.0	29.7	71.4
Problem-solving activities	95.4	98.0	5.7	68.7	79.3
Complexity of tasks	79.8	64.7	23.8	19.2	56.7
Discretion in fixing work methods	89.1	51.8	17.7	46.5	61.7
Discretion in setting work rate	87.5	52.2	27.3	52.7	63.6
Horizontal constraints on work rate	43.6	80.3	66.1	27.8	53.1
Hierarchical constraints on work rate	19.6	64.4	66.5	26.7	38.9
Norm-based constraints on work rate	21.2	75.5	56.3	14.7	38.7
Automatic constraints on work rate	5.4	59.8	56.9	7.2	26.7
Team work	64.3	84.2	70.1	33.4	64.2
Job rotation	44.0	70.5	53.2	27.5	48.9
Quality norms	78.1	94.0	81.1	36.1	74.4
Responsibility for quality control	86.4	88.7	46.7	38.9	72.6
Monotony of tasks	19.5	65.8	65.6	43.9	42.4
Repetitiveness of tasks	12.8	41.9	37.1	19.2	24.9

Source: European Working Conditions Survey 2000, European Foundation for the Improvement of Living and Working Conditions, analysis and table from Lorenz and Valeyre (2005).

Table 2.2. Forms of work organisation by sector of activity (2000)

	Percentage of employees by sector in each organisational class				
	Discretionary learning	Lean production	Taylorism	Traditional organisation	Total
Mining and quarrying	42.4	41.5	3.4	12.7	100.0
Food processing	18.4	34.9	24.6	22.1	100.0
Textiles, garments, leather products	27.2	25.9	30.2	16.8	100.0
Wood and paper products	27.6	40.7	23.9	7.8	100.0
Publishing and printing	31.1	43.8	14.1	11.0	100.0
Chemicals and plastics	34.7	34.1	21.9	9.2	100.0
Metal products and mechanical engineering	31.8	35.7	19.8	12.7	100.0
Electrical engineering and electronics	41.5	38.5	8.6	11.4	100.0
Transport equipment	28.1	38.7	23.2	10.0	100.0
Other industrial production	50.9	22.1	18.4	8.5	100.0
Electricity, gas and water	58.5	19.4	6.2	15.8	100.0
Construction	40.9	31.4	10.6	17.1	100.0
Wholesale and retail trade	41.5	20.4	11.7	26.4	100.0
Hotels and restaurants	29.7	25.8	16.6	27.9	100.0
Land transport	26.3	24.0	10.2	39.5	100.0
Other transport	39.2	36.1	5.0	19.7	100.0
Post and telecommunications	38.1	27.1	7.7	27.1	100.0
Financial services	58.1	21.5	3.4	16.9	100.0
Business services	57.6	18.7	6.9	16.7	100.0
Personal services	39.7	18.9	7.6	33.8	100.0
Average	39.1	28.2	13.6	19.1	100.0

Source: European Working Conditions Survey 2000, European Foundation for the Improvement of Living and Working Conditions.

The first cluster, which accounts for 39% of the employees,[4] is distinctive for the way high levels of autonomy in work are combined with high levels of learning, problem-solving and task complexity. The variables measuring constraints on work pace, monotony and repetitiveness are under-represented. The use of team work is about at the average level for the population as a whole, while less than half of the employees in this cluster participate in job rotation which points to the importance of horizontal job specialisation. The forms of work organisation in this cluster correspond rather closely to those found in adhocracies and due to the combined importance of work discretion and learning we refer to this cluster as the discretionary learning form.

The second cluster accounts for 28% of the employees. Compared to the first cluster, work organisation in the second cluster is characterised by low levels of employee discretion in setting work pace and methods. The use of job rotation and team work, on the other hand, are much higher than in the first cluster, and work effort is more constrained by quantitative production norms and by the collective nature of work organisation. The use of quality norms is the highest of the four clusters and the use of employee responsibility for quality control is considerably above the average level for the population as a whole. Compared to operating adhocracies, these features point to a more structured or bureaucratic style of organisational learning that corresponds rather closely to the characteristics of the Japanese-inspired "lean production" model associated with the work of MacDuffie and Krafcik (1992) and Womack *et al.* (1990).

The third class, which groups 14% of the employees, corresponds in most respects to a classic characterisation of Taylorism. The work situation is in most respects the opposite of that found in the first cluster, with low discretion and low level of learning and problem-solving.

The fourth cluster groups 19% of the employees. All the variables are under-represented with the exception of monotony in work, which is close to the average. The frequency of the two variables measuring learning and task complexity is the lowest among the four types of work organisation, while at the same time there are few constraints on the work rate. This class presumably groups traditional forms of work organisation where methods are for the most part informal and non-codified.

As the figures in Table 2.2 show, the discretionary learning form of work organisation is especially prevalent in several service sectors, notably business services and banks and insurance, and in the gas, electricity and water utilities. As one would anticipate, the lean model of production is more developed in the manufacturing sector, notably in the production of transport equipment, electronics and electrical production, wood and paper

products, and printing and publishing. The Taylorist form is notably present in textiles, clothing and leather products, food processing, wood and paper products and transport equipment, while under-represented in the service sectors. The traditional organisational form is found principally in the services, notably land transport, personal services, hotels and restaurants, post and telecommunications, and wholesale and retail trade. Figure 2.1 summarizes this distribution.

Figure 2.1. Forms of work organisation by sector of activity (2000)

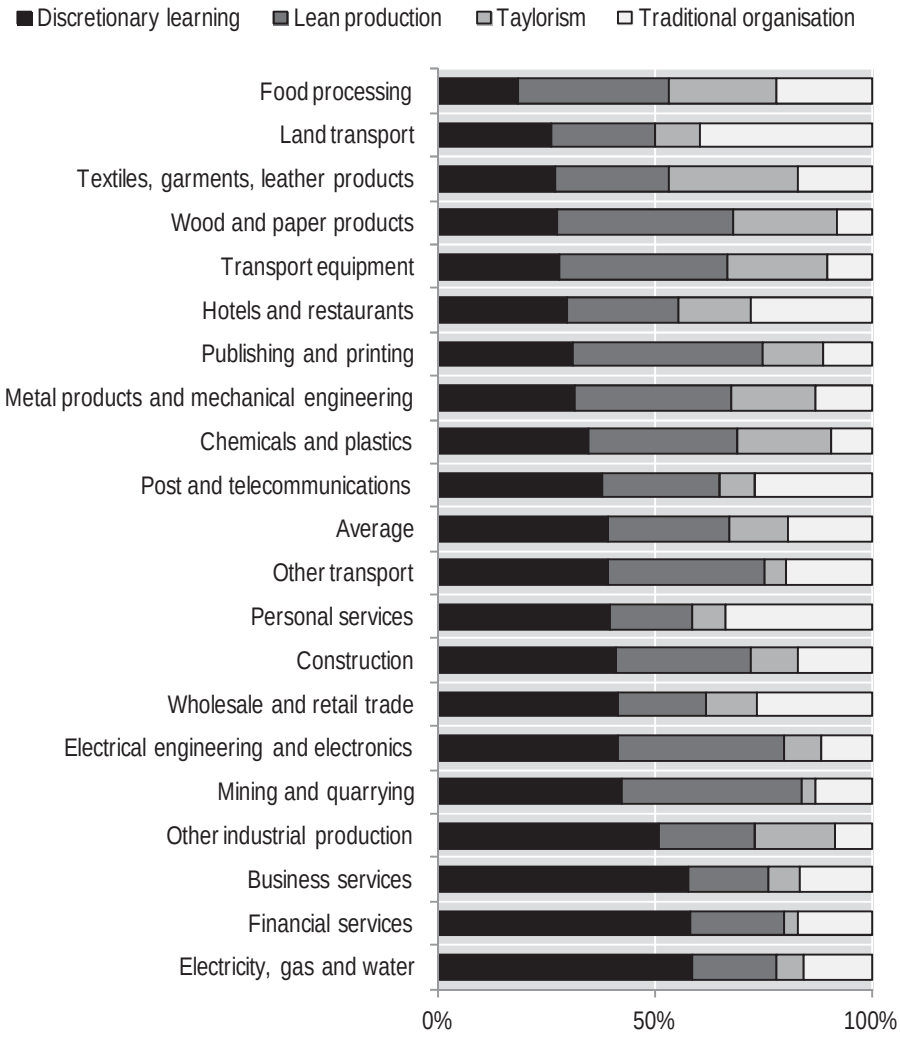


Table 2.3. National differences in forms of work organisation for the EU15 (2000)

	Percentage of employees by country in each organisational class				
	Discretionary learning	Lean production	Taylorist organisation	Traditional organisation	Total
Belgium	38.9	25.1	13.9	22.1	100.0
Denmark	60.0	21.9	6.8	11.3	100.0
Germany	44.3	19.6	14.3	21.9	100.0
Greece	18.7	25.6	28.0	27.7	100.0
Italy	30.0	23.6	20.9	25.4	100.0
Spain	20.1	38.8	18.5	22.5	100.0
France	38.0	33.3	11.1	17.7	100.0
Ireland	24.0	37.8	20.7	17.6	100.0
Luxembourg	42.8	25.4	11.9	20.0	100.0
Netherlands	64.0	17.2	5.3	13.5	100.0
Portugal	26.1	28.1	23.0	22.8	100.0
United Kingdom	34.8	40.6	10.9	13.7	100.0
Finland	47.8	27.6	12.5	12.1	100.0
Sweden	52.6	18.5	7.1	21.7	100.0
Austria	47.5	21.5	13.1	18.0	100.0
EU15	39.1	28.2	13.6	19.1	100.0

Source: European Working Conditions Survey 2000, European Foundation for the Improvement of Living and Working Conditions, analysis and table from Lorenz and Valeyre (2005).

Table 2.4. Logit estimates of national effects on organisational practice

	Logit estimates without structural controls				Logit estimates with structural controls			
	1	2	3	4	5	6	7	8
	Discretionary learning	Lean	Taylorist	Traditional	Discretionary learning	Lean	Taylorist	Traditional
Belgium	-0.22	0.32	-0.03	0.01	-0.23	0.42*	-0.11	-0.09
Denmark	0.63**	0.14	-0.82**	-0.79**	0.79**	0.29	-0.86**	-1.06**
Greece	-1.24**	0.35	0.85**	0.31	-1.33**	0.42	0.84**	0.12
Italy	-0.61**	0.24*	0.46**	0.20*	-0.51**	0.20	0.33**	0.16
Spain	-1.15**	0.96**	0.31*	0.04	-1.15**	1.08**	0.06	-0.17
France	-0.26**	0.72**	-0.29*	-0.27**	-0.32**	0.84**	-0.33**	-0.38**
Ireland	-0.92**	0.91**	0.45	-0.27	-1.11**	1.14**	0.47	-0.50
Luxembourg	-0.06	0.33	-0.21	-0.11	-0.17	0.42	0.00	-0.20
Netherlands	0.81**	-0.16	-1.10**	-0.59**	0.79**	0.02	-0.94**	-0.74**
Portugal	-0.81**	0.47**	0.58**	0.05	-0.78**	0.51**	0.44*	-0.01
United Kingdom	-0.40**	1.03**	-0.31**	-0.56**	-0.68**	1.32**	-0.24*	-0.72**
Finland	0.14	0.45*	-0.15	-0.71*	-0.01	0.63**	-0.07	-0.78*
Sweden	0.33*	-0.07	-0.77**	-0.01	0.22	0.06	-0.68*	0.00
Austria	0.13	0.12	-0.10	-0.24	0.33	0.14	-0.26	-0.43*

*Significant at 5%. **Significant at 1%. Reference country: Germany.

Source: European Working Conditions Survey 2000, European Foundation for the Improvement of Living and Working Conditions.

Table 2.3 shows that there are wide differences in the employee learning dynamics across European nations. The discretionary learning forms of work organisation are most widely diffused in the Netherlands, the Nordic countries and to a lesser extent Germany and Austria, while they are little diffused in Ireland and the southern European nations. The more bureaucratic lean model is most in evidence in the United Kingdom, Ireland, and Spain and to a lesser extent in France, while it is little developed in the Nordic countries or in Germany, Austria and the Netherlands. The low-learning Taylorist forms of work organisation show almost the reverse pattern compared to the discretionary learning forms, being most frequent in the southern European nations and in Ireland and Italy. Finally, the traditional forms of work organisation are most in evidence in Greece and Italy and to a lesser extent in Germany, Sweden, Belgium, Spain and Portugal.

Table 2.2 showed that each form of work organisation tends to be associated with particular industrial sectors. This raises the question of what part of the variation in the importance of these forms across EU nations can be accounted for by the nation's specific industrial structure. International differences in forms of work organisation might also reflect differences in a nation's occupational structure or in the size structure of its establishments. In order to test for this we use logit regression analysis to provide estimates of the impact of national effects on the relative likelihood of adopting the different types of work organisation with and without controls for sector, size and occupation (see Table 2.4). For each regression the dependent variable is a binary variable measuring whether or not the individual employee is subject to the particular form of work organisation. The independent variables are binary variables corresponding to the EU member nations that take on the value of 1 if the employee works in the particular nation and 0 otherwise. Germany, the most populous nation within the EU, is the reference case for the estimates of national effects. Thus column 1 gives the likelihood that employees are subject to the discretionary learning form of work organisation in each country relative to the German case.

Columns 1 through 4 present the logit regression results without controls for sector, size and occupation, and columns 5 through 8 present the results with these controls. Comparing the two sets of results shows that the national differences identified in columns 1 through 4 are for the most part robust to the various structural controls. After introducing the controls, the positive coefficient for the use of the "learning" forms in Sweden is no longer significant at the 0.05 level, and the positive coefficient for the use of Taylorist forms in Spain is no longer significant at the 0.05 level.

A number of important conclusions come out of the results presented in this chapter. They point to considerable diversity in how people work and learn across the member nations of the European Union. Not only are the traditional Taylorist forms of work organisation holding their own in certain nations, but also there is no evidence that a single model of high employee learning dominates the EU landscape. The evidence points to the existence of two models with strong learning dynamics: a relatively decentralised model associated with substantial employee autonomy in setting work methods and work pace (referred to as the discretionary learning model), and a more hierarchical model which places emphasis on regulating individual or group work pace by setting tight quantitative production norms and precise quality standards (referred to as the "lean" model).

The role of learning cultures

Drawing on the results of the 2005 wave of the EWCS, Holmes *et al.* (2009) extend the methodology developed by Lorenz and Valeyre (2005) to characterise the frequency of the four different forms of work organisation and employee learning for the 27 members of the EU and Norway. The 2005 wave of the EWCS includes a number of new questions pertaining to intrinsically motivating aspects of work organisation, and certain of these can be used in order to capture the presence of employee beliefs or attitudes that are characteristic of a learning culture. While the measures provide only a partial representation of what is understood by a learning culture, used in combination with indicators of human resource management (HRM) policies, they allow us to explore in a preliminary manner the links between employee learning dynamics and learning cultures for the 28 European nations.

As we noted above, Johnston and Hawke (2002) identify learning cultures with employee commitment, and they identify specific types of HRM policies that contribute to building such high-commitment cultures. They draw inspiration – at least implicitly – from the literature on HRM complementarities. A basic idea in this literature is that the forms of work organisation requiring considerable discretion and problem-solving activity on the part of employees are more likely to be effective if they are supported by particular policies around pay, training and manpower planning that serve to promote a culture of employee commitment. For example, as we stress in this report, work in learning organisations is characterised by a high degree of task complexity. Learning is continuous as employees are expected to take initiative and to exercise autonomy in resolving the production and service-related problems they confront. In the lean production model, while work requires problem-solving skills and involves learning, these dynamics are embedded in a more formal structure based on

codified protocols (*e.g.* team work and job rotation practices) often associated with tight quantitative production norms. Autonomy is relatively low compared to the discretionary learning model.

Nonetheless, since learning and problem-solving capabilities are central to both of these models, it can be expected, as Johnston and Hawke (2002) argue, that such organisations will have an interest in investing more in the training of their employees than more traditional Taylorist organisations, which are characterised by low task complexity and high task repetition.

For similar incentives reasons, it can be argued that firms relying on high levels of employee learning and problem solving will have an interest in adopting pay and promotion policies linking compensation and careers to individual, group or company performance. The quite plausible hypothesis is that employees will be more likely to commit themselves to the goal of improving the firm's capacity for learning and problem solving if they are promised a share of the quasi-rents which derive from their enhanced commitment and effort (Ichniowski *et al*., 1997; Freeman and Lazear, 1995; Levine and Tyson, 1990; Lorenz *et al.*, 2004, Osterman, 1994). Further, it has been argued that such complementary pay policies are more likely to be effective if they are embedded in some system of employee representation that assures employees that their interests will be represented in the design and operation of the pay and promotion system (Eaton and Voos, 1992; Freeman and Lazear, 1995; Levine and Tyson, 1990; Lorenz *et al.*, 2004).

Variable pay systems, however, may have different effects depending on whether they are collective or individual. Collective incentive schemes, such as profit-sharing and gain-sharing schemes that link pay to enterprise performance, are likely to out-perform individual schemes such as piece-rate systems or individual bonus payments in circumstances where a premium is placed on knowledge sharing amongst members and across different services. Individual incentive schemes are more prone to generating competitive behaviours, and they may motivate employees to hoard knowledge and ideas with the objective of achieving a superior performance relative to their colleagues.

Other personnel policies identified as supportive of learning cultures include encouragement from management and creating ample opportunities for knowledge exchange. These ideas are discussed extensively in the knowledge management literature and in the literature dealing with creativity at work. For example, the knowledge management literature dealing with "communities of practices" emphasises the importance of providing ample opportunities for interaction and exchange amongst employees in order to foster informal processes of learning and problem-solving (Brown and Duguid, 1991; Wenger, 1998). The literature on creativity at work emphasises

the importance of support and encouragement at the levels of management and the work group as well as fostering communication and knowledge exchange in order to promote diversity of ideas (Albrecht and Hall, 1991; Amabile *et al.*, 1996; Kimberly and Evanisko, 1981; Roffe, 1999).

In the literature on learning organisations there is no unified way of treating "culture" in relation to the sorts of HRM and personnel policies discussed above. Some authors (*e.g.* Gephart *et al.*, 1996) see HRM policies such as pay for knowledge as being part of what defines a culture of learning. Others (*e.g.* Johnston and Hawke, 2002) see HRM policies as serving to foster the employee attitudes and beliefs that are characteristic of learning cultures and, at least implicitly, treat culture understood as beliefs and attitudes as a variable mediating the relation between HRM policies and employee learning. Here we adopt the approach of Johnston and Hawke and distinguish between "culture", defined in terms of specific employee beliefs or attitudes, and HRM policies that are designed and put into effect by management. In order to explore the links between learning culture, HRM policies and employee learning, we adopt a two-stage strategy. In the first stage we use logit regression to examine the relation between specific HRM policies and the likelihood of different forms of work organisation and employee learning. In the second stage we introduce into the regressions our learning culture measures in order to determine to what extent the effects of HRM policies on employee learning are mediated by indicators of a learning culture.

Table 2.5 and Figure 2.2 present the frequency of the four forms of work organisation for the EU27 and Norway. As in the cluster analysis based on the 2000 wave of the European Working Conditions Survey (EWCS), the Nordic nations and the Netherlands stand out for their high use of the "discretionary learning" forms of work organisation and their low level of use of Taylorism. Amongst the EU15, the lean forms are most present in the United Kingdom and Portugal; and amongst the new EU member nations, they are most present in Latvia, Lithuania, Poland and Romania. The Taylorist forms are relatively developed in all of the southern nations amongst the EU15 and in a number of the new member nations, including the Czech Republic, Cyprus, Hungary, Bulgaria and Romania. The traditional or simple forms are relatively frequent in Spain, Greece and Ireland amongst the EU15; and in Hungary, Lithuania, Cyprus and the Czech Republic amongst the new member nations.

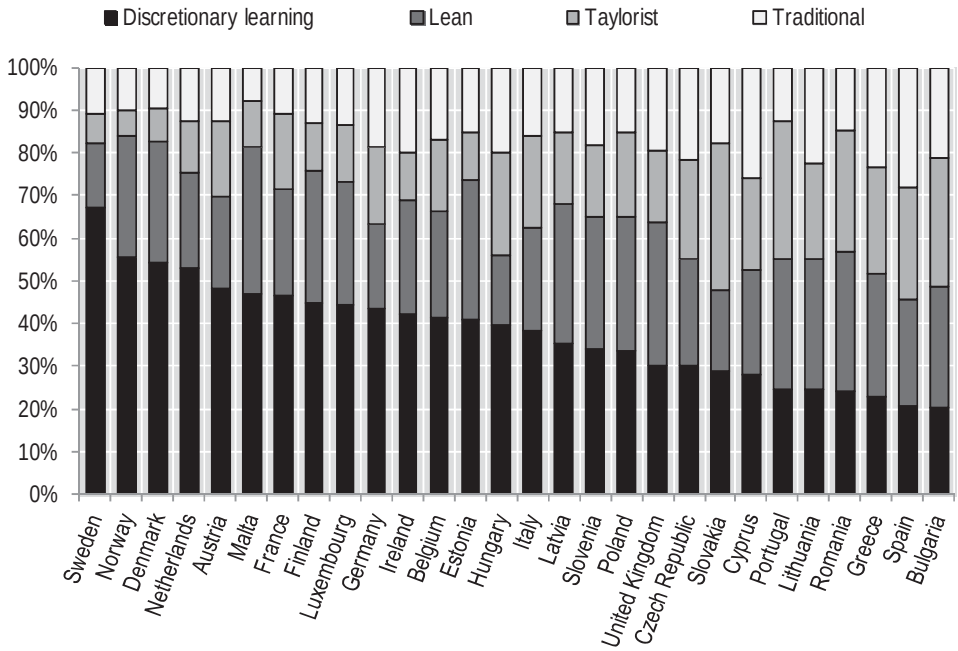
Table 2.5. Forms of work organisation for the EU27 and Norway (2005)

Weighted percentage of employees by organisational class

	Classes of work organisation			
	Discretionary learning	Lean production	Taylorist	Traditional or simple
Belgium	41.2	25.2	16.8	16.9
Czech Republic	30.2	25.1	22.8	21.9
Denmark	54.1	28.4	7.9	9.6
Germany	43.3	19.8	18.3	18.6
Estonia	40.8	32.7	11.4	15.1
Greece	22.9	28.9	24.5	23.6
Spain	20.6	24.9	26.3	28.2
France	46.7	24.8	17.6	10.9
Ireland	42.3	26.8	10.9	20.1
Italy	38.2	24.4	21.4	16.0
Cyprus	27.9	24.7	21.6	25.8
Latvia	35.2	32.6	17.1	15.1
Lithuania	24.5	30.8	22.0	22.7
Luxembourg	44.2	29.0	13.1	13.7
Hungary	39.6	16.4	23.9	20.1
Malta	47.0	34.3	10.6	8.1
Netherlands	52.8	22.7	11.9	12.6
Austria	48.1	21.4	17.9	12.6
Poland	33.5	31.3	20.0	15.2
Portugal	24.8	30.3	32.1	12.9
Slovenia	34.0	31.0	16.9	18.1
Slovakia	28.9	19.0	34.3	17.8
Finland	44.9	30.9	11.3	12.9
Sweden	67.2	14.9	7.1	10.8
United Kingdom	30.3	33.3	16.7	19.7
Bulgaria	20.3	28.1	30.2	21.3
Romania	24.3	32.5	28.2	15.0
Norway	55.6	28.2	6.0	10.2
All	38.2	25.7	19.0	17.1

Source: European Working Conditions Survey 2005, European Foundation for the Improvement of Living and Working Conditions, analysis and table from Holms *et al.* (2009).

Figure 2.2. Forms of work organisation for the EU27 and Norway (2005)



The European Working Conditions survey, of course, was not designed to measure the beliefs and attitudes of employees that are characteristic of a learning culture. Nonetheless, the 2005 wave of the survey included a number of new questions designed to capture intrinsically motivating aspects of work. By drawing on these questions we are able to provide measures of the extent to which employees hold certain types of beliefs and attitudes that are characteristic of employees working in organisations with strong learning cultures. These include a question asking how often the employee applies his or her own ideas in work; a question asking how often the employee finds his or her job intellectually demanding; and a question asking how strongly the employee agrees that he or she has opportunities to learn and grow at work. Of course, the three questions only capture in a partial way the beliefs and attitudes characteristic of learning cultures, and they notably have little to say about the role of trust or the extent to which employees see their organisation as being open to exploration and risk-taking. Nonetheless they provide a basis for a preliminary analysis of the role of culture in relation to employee learning.

Table 2.6 presents the frequency with which these beliefs or attitudes are held by employees according to the form of work organisation. The frequencies for the three beliefs or attitudes are consistently higher for the

discretionary learning than for the lean forms. Further, both the discretionary learning and lean forms stand out for the higher frequency of the three measures compared to the Taylorist or simple forms.

Table 2.6. Frequency of learning culture measures according to form of work organisation

Percentage of active persons in each class, weighted data

	Discretionary learning	Lean	Taylorist	Simple
Almost always or often applies one's own ideas in work	67	58	22	36
Almost always or often finds one's job intellectually demanding	60	58	23	36
Strongly agrees or agrees that has opportunities to learn and grow at work	65	59	28	33

Source: European Working Conditions Survey 2005, European Foundation for the Improvement of Living and Working Conditions.

The EWCS survey includes a limited number of measures of the kinds of HRM polices that employees are subject to. We draw on these questions in order to identify the use of HRM policies in four of the areas that are identified in the learning organisation literature as being supportive of, or an element of, a learning culture. The four policy areas are: *a)* further vocational training, *b)* pay for performance, *c)* consultation and assessment, and *d)* assistance to employees. The training measure is a binary indicator of whether or not the employee received training provided by the employer over the last 12 months. The pay system measures distinguish between piece rate or individual bonus payments, pay based on group performance, and pay based on the performance of the enterprise. Assessment is captured by a question asking whether or not the employee has had a frank discussion with his or her boss about work performance, and by a question asking whether or not the employee has been subject to regular formal assessment of his or her work performance. Consultation is measured by a question asking whether or not the employee has been consulted over changes in work organisation or working conditions. Assistance is measured by two questions, one asking whether the employee can almost always or often get assistance from his or her boss or superior when it is asked for, and a second asking whether the employee can almost always or often get external assistance when it is asked for.

Table 2.7. Forms of work organisation, HRM policies and learning culture

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
	Discretionary learning	Lean	Taylorist	Simple	Discretionary learning	Lean	Taylorist	Simple
Further training	.34***	.10*	-.35***	-.55***	.27***	.04	-.25***	-.44***
Payment system								
Piece rate	-.35***	.37***	.28***	-.64***	-.28***	.42***	.21***	-.50***
Pay based on group performance	-.22**	.38***	-.17	-.37**	-.29***	.31***	-.09	-.09
Pay based on enterprise performance	.37***	.02	-.54***	-.45***	.29***	-.01	-.42***	-.20*
Consultation and assessment								
Frank discussions with employer over performance	.09*	.13**	-.06	-.22***	.06	.11**	-.00	-.18***
Consultation over changes in working conditions	.23***	.30***	-.36***	-.46***	.15***	.25***	-.21***	-.27***
Regular formal performance assessment	-.13***	.44***	.06	-.57***	-.17***	.42***	.11*	-.46***
Assistance								
Assistance from employer	.22***	.07	-.19**	-.17***	.09*	-.01	.00	-.03
External assistance	.16***	.22***	-.63***	-.13*	.03	.15***	-.39***	-.11
Learning culture measures								
Apply one's own ideas in work					.64***	.12**	-.99***	-.36***
Intellectually demanding job					.25***	.49***	-.53***	-.55***
Opportunities to learn and grow at work					.28***	.21***	-.36***	-.53***

*Significant at 10%. **Significant at 5%. ***Significant at 1%. The regressions control for sector, occupational category and gender.

Source: European Working Conditions Survey 2005, European Foundation for the Improvement of Living and Working Conditions.

Table 2.7 presents the results of the logit regression analysis. The first four columns show the relation between the likelihood of the different forms of work organisation and the various HRM policies. Considering first the predictors of the discretionary learning forms, the results for the most part conform to our expectations. There are positive and significant coefficients on the indicators for further training, the two indicators of assistance, the indicators of pay linked to enterprise performance and the indicators of consultation and discussion with one's employer over work performance. The negative coefficient on individual piece rate or productivity bonus may be explained by the fact that work activity in the discretionary learning forms is largely non-repetitive and unsupervised which reduces the scope for linking pay to a well-defined measure of individual output. The negative coefficients on group-based pay and on regular formal assessment are somewhat surprising. For the former indicator, the explanation may be the same as that for individual performance pay. If teamwork is non-repetitive and complex in nature, then the scope for linking pay to a well-defined measure of group performance may be reduced. Pay linked to measures of enterprise performance does not face the same technical difficulty.

A related possible reason pertains to the relation between intrinsic and extrinsic motivation as discussed by Amabile *et al.* (1996) in their research on creativity at work. As they observe, in much of the literature on intrinsic motivation it is assumed that extrinsic motivators in the form of compensation for performance will undermine the positive effect of such intrinsic motivators as curiosity and a sense of personal accomplishment and fulfilment. On their account, however, pay and rewards can combine synergistically with intrinsic motivation in so far as they are perceived by the employee as designed to give recognition for accomplishment and not as management tools for controlling one's effort. If group-based pay combined with regular formal assessment is perceived by the members of a team as a tool designed to control their collective effort then they may prove incompatible with relying on intrinsic motivators for promoting knowledge exploration and learning in the discretionary learning forms.

When we compare the relatively regulated and pace constrained lean forms with the discretionary learning forms, it is interesting to note that the coefficients on pay linked to individual and group performance and on being subject to regular formal assessment take the opposite sign and are positive and significant. These differences may be understood in terms of the different nature of learning in the lean forms. Since work and learning activity is less autonomous in the lean forms, with above average levels of repetitiveness and with work pace being sharply constrained by hierarchical and norm-based constraints, there is greater scope for linking pay directly to well-defined measures of individual or group output. Such measures of individual

or group output in turn provide a basis for subjecting employees to regular formal performance assessment. While this emphasis on extrinsic motivators may act to undermine the effects of intrinsic motivators, this may be less of a problem for management in the lean forms, given the scope for regulating work pace through norm-based and hierarchical constraints.

Columns 5 through 8 in Table 2.7 present the regression estimates including the learning culture measures. Examining these variables first, the coefficients are all positive and significant for the discretionary learning and learn forms, while they are negative and significant for the Taylorist and simple forms. The main differences between the discretionary learning and lean forms concerns the much larger positive coefficient on the indicator for applying one's own ideas in work in the case of the discretionary learning forms, whereas the positive coefficient on finding the job intellectually demanding is somewhat smaller than it is for the lean forms. These differences are consistent with the fact that whereas the learning and complexity are equally high in the two models, the level of autonomy and hence scope for creative use of one's own ideas is much higher in the discretionary learning forms.

Examining next the effects of introducing the learning culture variables on the coefficients for the HRM variable, we find support for the idea that culture understood as beliefs and attitudes mediates the impact of HRM practices on the likelihood of employee learning. The size of the positive coefficients on the HRM variables for the model estimating the likelihood of the discretionary learning forms is reduced in all cases, and in the case of the two variables measuring assistance to employees, the coefficients are no longer statistically significant or are of borderline statistical significance. This shows that by introducing the learning culture variables we have fully or in part "explained" the positive relation between specific HRM polices and the likelihood of the discretionary learning forms. In the case of the lean forms, we can see the same tendency, with decreases in the size of most of the positive coefficients on the HRM variables. The downward shifts in the size of the positive coefficients are relatively small, however, and this tends to reinforce the view that learning cultures play a less important role in promoting employee learning in the relative regulated and work pace constrained lean forms of work organisation.

In Arundel *et al.* (2007) the analysis of forms of work organisation based on the 2000 wave of the EWCS is extended in order to explore the relation between employee learning and problem-solving on the one hand, and innovation style and performance on the other. The data used for this exercise come from two independent surveys, one carried out at the individual level (EWCS 2000) and one carried out at the enterprise level (the 3rd Community Innovation Survey) Although the data used for this analysis

are aggregated at the national level and can only show correlations rather than causality, the results support the view that the way work is organised co-evolves with a highly nation-specific distribution of different modes of innovation.

Some of the early contributions to the innovation literature evaluated the effect of organisational structures on the success of innovation. The Sappho study pointed to the importance of interactions between different divisions of the same firm (Rothwell, 1972). Indirectly, Kline and Rosenberg's (1986) chain-link model of innovation points to the importance of feed-back loops and interactions between agents within the same organisation, but operating at different stages of the innovation process. Freeman's (1987) analysis of the Japanese innovation system partly explained the success of Japanese innovation performance by the specific organisational characteristics of Japanese firms. More recently, there have been several systematic attempts to evaluate the effect of specific modes of work organisation on national innovation performance (Lundvall, 2002; Lam, 2005; Lam and Lundvall, 2006; Lorenz and Valeyre, 2005).

Work organisation could influence innovation performance through two main mechanisms. First, forms of work organisation that stimulate interaction among agents with a diverse set of experiences and competences could be more creative, leading to the development of original ideas for new products and processes. Second, work organisation forms that delegate responsibility for problem solving to a wide range of employees could be more successful both in upgrading the competences of workers and in transforming ideas into new products and processes.

Economists and business scholars frequently measure innovation by R&D expenditures or by the number of patents applied for or granted. The weaknesses of these measures are well known. R&D doesn't necessarily result in the development of new products or processes and many innovative firms do not perform R&D. A large fraction of innovations are not patented and the importance of patenting varies according to sector. Furthermore, R&D and patents entirely fail to capture innovation that occurs through diffusion processes, such as when a firm purchases innovative production equipment or product components from other firms.

The Community Innovation Surveys (CIS) were in part designed to respond to these limitations by providing survey-based estimates of the percentage of manufacturing firms and selected service sector firms that have developed or introduced a new product or process over a three-year time period. However, the CIS estimates of the percentage of innovative firms are based on a very broad definition of innovation ranging from intensive in-house R&D that results in new-to-market products or processes

to minimal effort to introduce manufacturing equipment purchased from a supplier. Consequently, a broad all-encompassing definition where a distinction is made between 'innovative firms' and 'non-innovative firms' is both misleading in international comparisons and fails to provide a clear picture of the structure of innovation capabilities within individual countries.

In order to overcome these limitations, Arundel and Hollanders (2005), in collaboration with Paul Crowley of Eurostat, developed a taxonomy classifying all innovative CIS respondent firms into three mutually exclusive innovation modes that capture different methods of innovating, plus a fourth group for non-innovators.[5] The classification method uses two main criteria: the level of novelty of the firm's innovations, and the creative effort that the firm expends on in-house innovative activities. The three innovation modes are as follows:

Lead innovators. For these firms, creative in-house innovative activities form an important part of the firm's strategy. All firms have introduced at least one product or process innovation developed at least partly in-house, perform R&D at least on an occasional basis, and have introduced a new-to-market innovation. These firms are also likely sources of innovations that are later adopted or imitated by other firms.

Technology modifiers. These firms primarily innovate through modifying technology developed by other firms or institutions. None of them perform R&D on either an occasional or continuous basis. Many firms that are essentially process innovators that innovate through in-house production engineering will fall within this group.

Technology adopters. These firms do not develop innovations in-house, with all innovations acquired from external sources. An example is the purchase of new production machinery.

Table 2.8 presents the distribution of firms according to innovation mode for 14 EU nations for which the necessary data are available and also includes the percentage of firms that did not innovate. The results are weighted to reflect the distribution of all firms within the industry and service sectors covered by CIS-3. The results show that Finland, Germany, Luxembourg, and Sweden have the highest percentage of firms in the lead category of innovators, while Germany, Luxembourg and Austria have the highest percentages of firms that are technology modifiers. In Greece, Spain and the United Kingdom over 80% of firms are either adopters or non-innovators.

Table 2.8. Distribution of innovation modes in 14 EU member nations, 1998-2000 (%)

	Leaders	Modifiers	Adopters	Non-innovators	Total
Belgium	20	16	14	50	100
Denmark	19	11	14	56	100
Germany	25	25	11	39	100
Greece	13	5	10	72	100
Italy	18	15	4	64	100
Spain	8	5	19	67	100
France	20	10	11	59	100
Luxembourg	24	20	4	52	100
Netherlands	22	16	8	55	100
Portugal	18	16	13	54	100
United Kingdom	11	5	16	68	100
Finland	29	10	3	55	100
Sweden	25	14	8	53	100
Austria	20	20	9	51	100

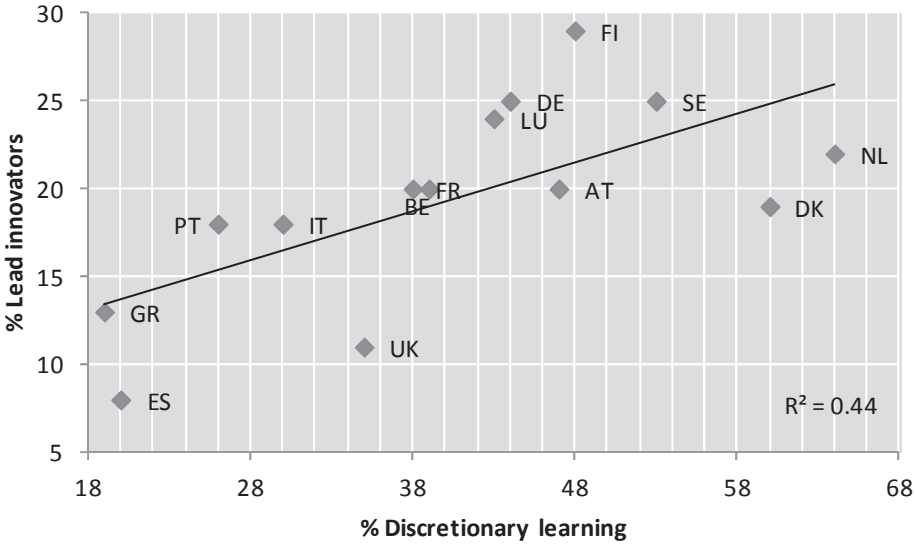
Source: Third Community Innovation Survey, Eurostat, Analysis and table from Arundel *et al.* (2007).

The relation between organisational learning and innovation is explored at the aggregate level by means of correlations between the frequencies of different forms of work organisation and modes of innovation. Figure 2.3 presents the results of this exercise for the discretionary learning form of work organisation. The main result is that there is a positive correlation between discretionary learning and the frequency of the two innovation modes for which the levels of novelty and creative in-house effort are the highest, the lead innovators and modifiers, while there is a negative correlation between discretionary learning and the frequency of non-innovators. Furthermore, the strongest positive correlation is between lead innovators and discretionary learning, with an R^2 of 0.44.[6]

Figure 2.4 presents the same analysis using the frequency of the lean form of work organisation. The results tend to go in the opposite direction of those for discretionary learning. Thus they show a negative correlation between the frequency of the lean form and the frequency of the two innovation modes which depend on in-house creative effort for innovation, and a positive correlation with the frequency of adopters and non-innovators.[7]

Figure 2.3. Correlations between innovation modes and discretionary learning, all sectors, 2000

2.3a. Lead innovators and discretionary learning



2.3b. Modifiers and discretionary learning

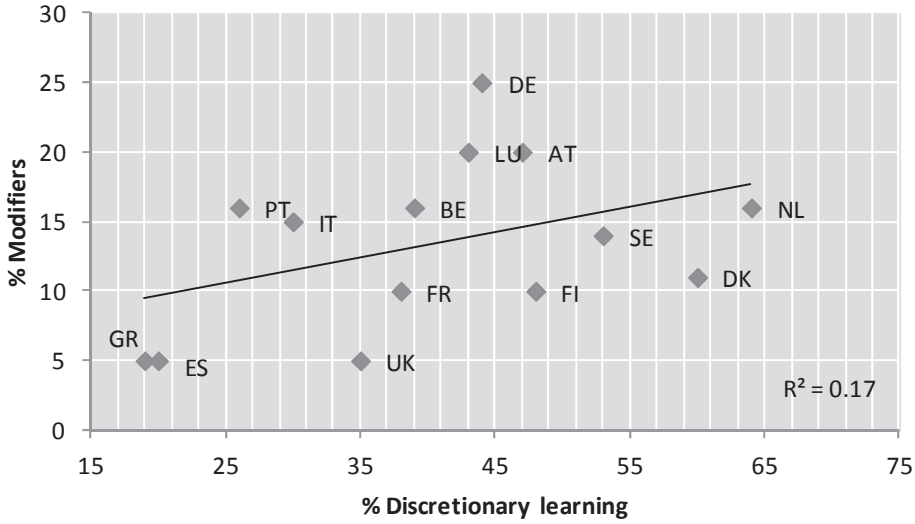
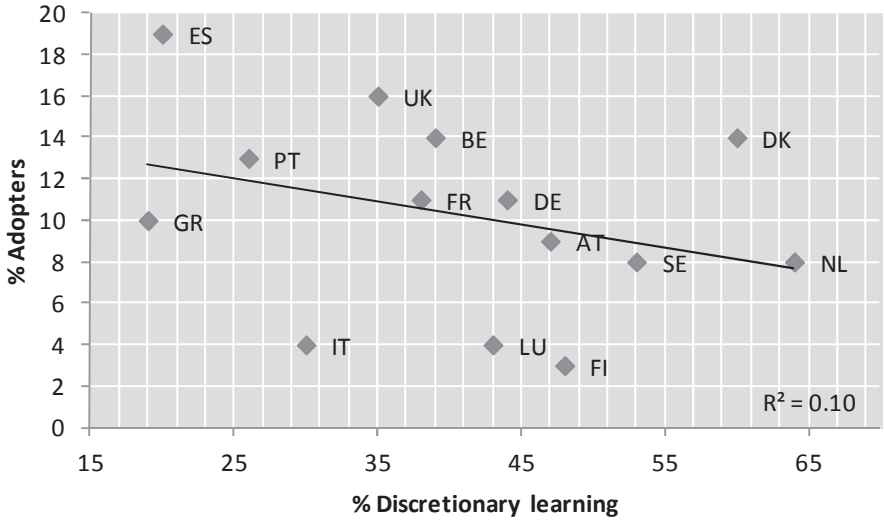
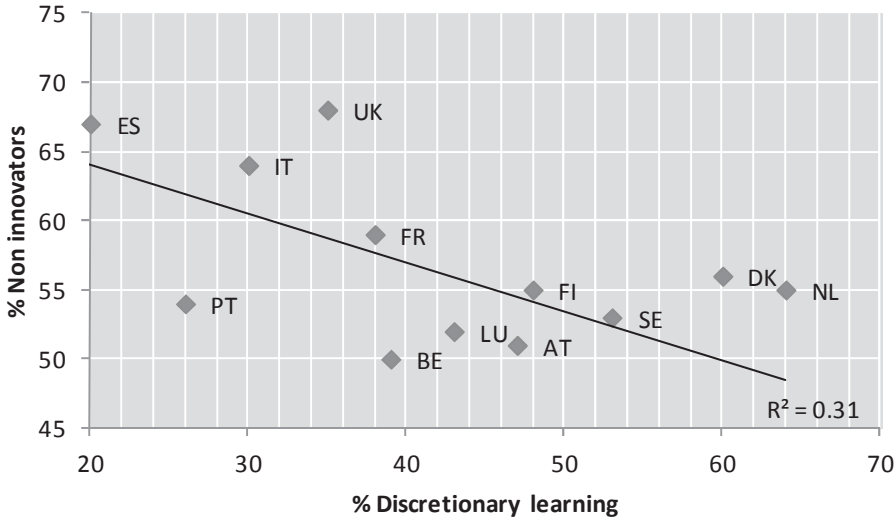


Figure 2.3. Correlations between innovation modes and discretionary learning, all sectors, 2000

2.3c. Adopters and discretionary learning



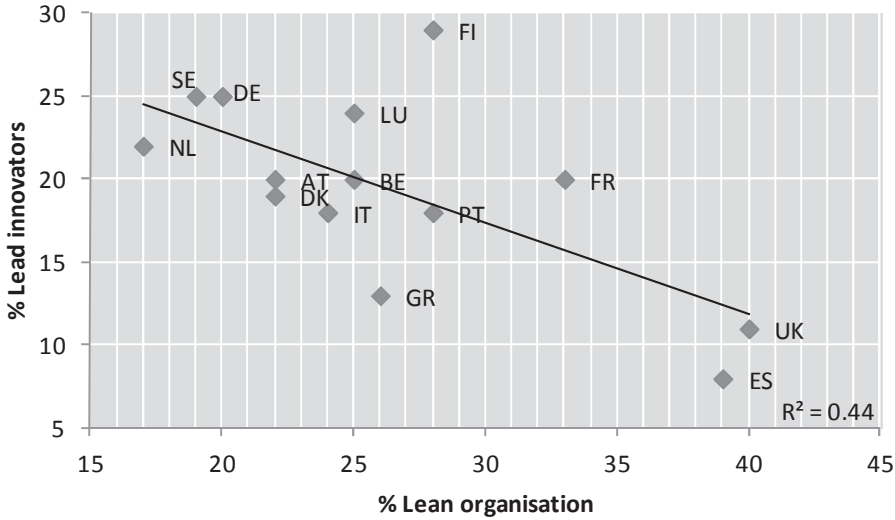
2.3d. Non-innovators and discretionary learning



Source: Third Community Innovation Survey, Eurostat and European Working Conditions Survey 2000, European Foundation for the Improvement of Living and Working Conditions, analysis and figures from Arundel *et al.* (2007).

Figure 2.4. Correlations between innovation modes and lean organisation, all sectors, 2000

2.4a. Lead innovators and lean organisation



2.4b. Modifiers and lean organisation

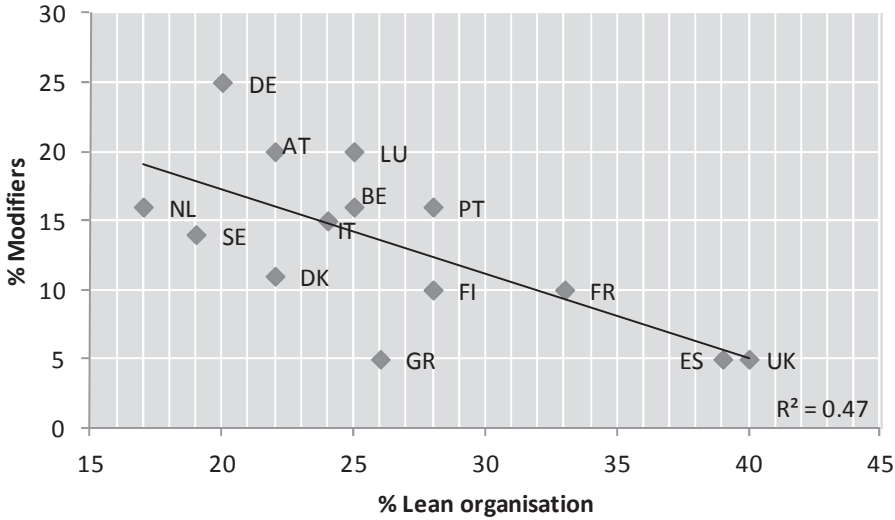
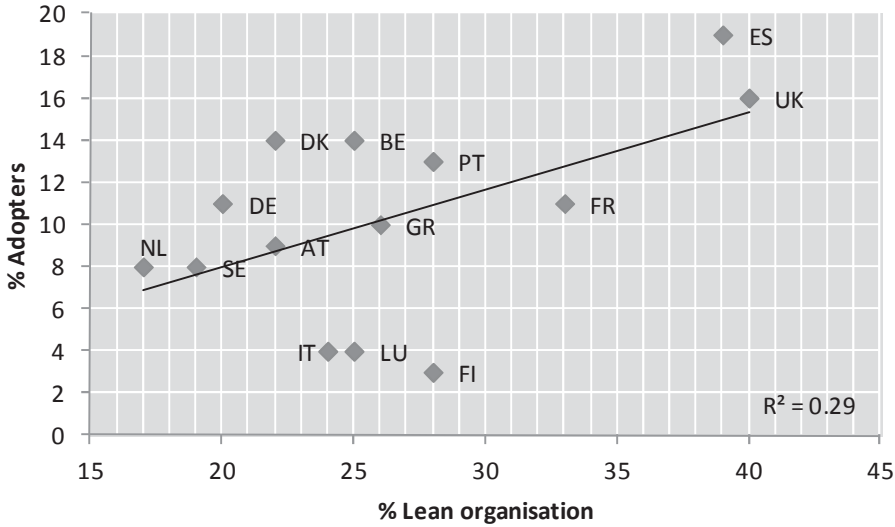
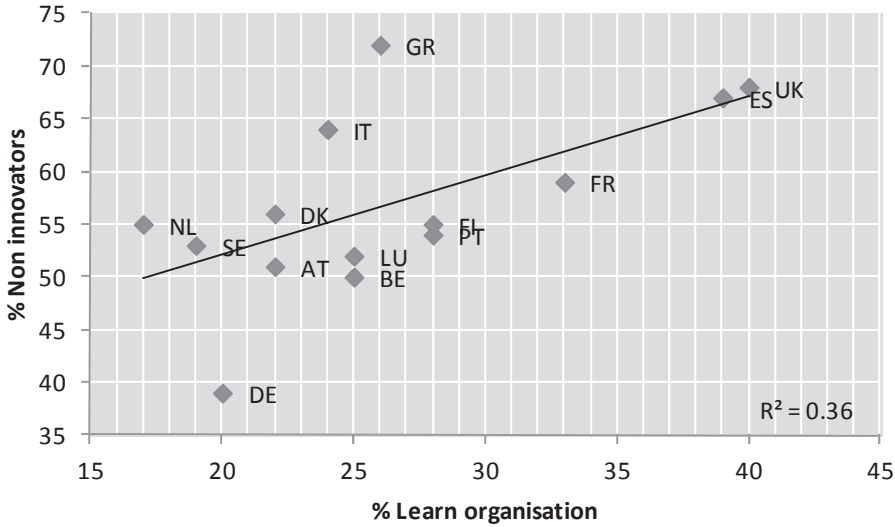


Figure 2.4. Correlations between innovation modes and lean organisation, all sectors, 2000

2.4c. Adopters and lean organisation



2.4d. Non-innovators and lean organisation



Source: Third Community Innovation Survey, Eurostat and European Working Conditions Survey 2000, European Foundation for the Improvement of Living and Working Conditions, analysis and figures from Arundel *et al.* (2007).

While the negative correlations shown in Figure 2.4 between the lean forms of work organisation and the frequency of the lead innovators are consistent with our reading of the organisational design literature, the negative correlation with the frequency of modifiers is not. Based on the Japanese experience, we expected the frequency of the lean forms to be positively correlated with the prevalence of technology modifiers, which are dominated by innovation based on minor incremental improvements. The lack of a positive correlation between the lean form of work organisation and the prevalence of modifiers could be due to limitations with the data, but an alternative possibility is that the lean model could have been adopted by European firms as a more efficient alternative to Taylorism, without adopting the Japanese emphasis on the delegation of decision-making responsibility to shop-floor employees. Under these conditions, the problem solving and learning tasks reported by employees subject to lean organisation could be severely limited by the high prevalence of reported constraints (see Table 2.1), limiting opportunities to suggest or implement incremental improvements.[8] This interpretation finds support in the fact that monotonous and repetitive work is as frequent or even more frequent in the lean production category than it is in Taylorist work form. If true, such restrictions on lean organisational forms could explain part of an innovation performance gap between Europe and Japan.

The analysis suggests a number of noteworthy results.

First, in nations where work is organised to support high levels of discretion in solving complex problems, the results show that firms tend to be more active in terms of innovations developed through their own in-house creative efforts. In countries where learning and problem-solving on the job are constrained, and little discretion is left to the employee, firms tend to engage in a supplier-dominated innovation strategy. Their technological renewal depends more on the absorption of innovations developed elsewhere.

Second, the results indicate that learning and interaction within organisations and at workplaces are at least as important for innovation performance as learning through interactions with external agents. Therefore, in order to understand national systems of innovation it is necessary to bring the organisation of work and employee learning into the analysis. Early conceptions of national innovation systems were built upon an analysis of interactive learning between producers and users. Now the analysis needs to be founded also on an understanding of learning organisations and the way people interact and learn at the workplace in different national economies.

A third implication is that indicators for innovation need to do more than capture material inputs such as R&D expenditures and human capital inputs such as the quality of the available pool of skills based on the number of years of education. Indicators also need to capture how these material and human resources are used and whether or not the work environment promotes the further development of the knowledge and skills of employees.

The data supporting the above analysis date from around 2000. It would be important to replicate the analysis with more recent data to check for its robustness. Unfortunately this could not be done for the present report as the taxonomy of innovators developed by Arundel and Hollanders (2005) on the basis of CIS-3 data has not been produced for the latest waves of the Community Innovation Survey. In order to bring more recent evidence to bear on the issue, we explore the relation between the different forms of work organisation based on the 2005 wave of the EWCS and more conventional indicators of innovation style and performance based on CIS-5, which concerns the innovative activity of firms during the period 2004-2006. In order to compare populations of firms with different capacities for innovation, we distinguish between the following three categories: enterprises that have introduced products that are new-to-the market; enterprises with any innovative activity (either new-to-the market or new-to-the firm); and non-innovators. An important distinction in the Arundel and Hollanders (2005) taxonomy that is not captured at all in this three-way categorisation is between enterprises that innovate by modifying technologies developed by other firms and those that simply adopt new products or process developed by other firms or organisations. Table 2.9 presents the frequencies for these three categories for 26 EU countries.

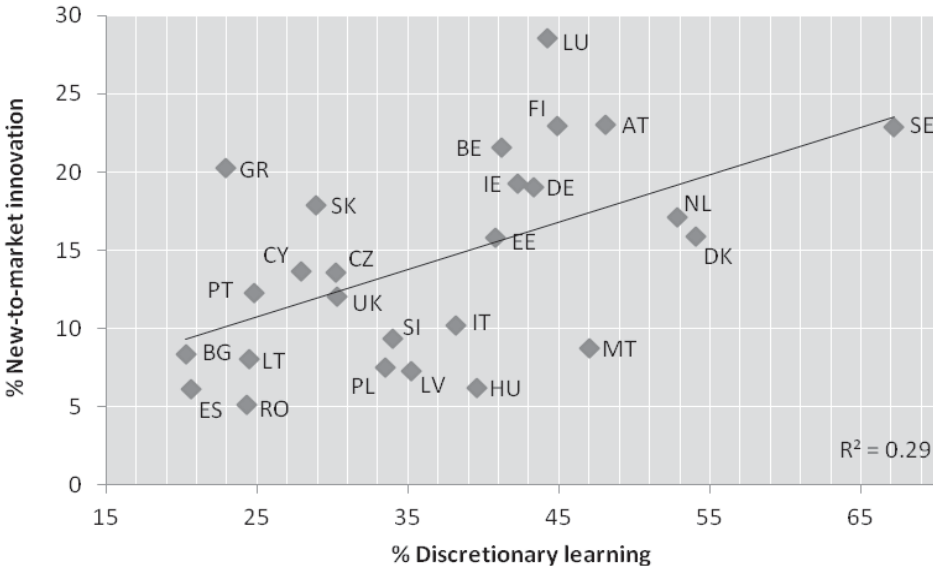
Table 2.9. Distribution of firms by innovation category in 26 EU member countries, 2004-2006 (%)

	New-to-market innovation	Any innovation	Non innovators
Austria	23.0	50.6	49.4
Belgium	21.6	52.2	47.8
Bulgaria	8.3	20.2	79.8
Cyprus	13.6	39.5	60.5
Czech Republic	13.6	35.0	65.0
Denmark	15.8	46.9	53.1
Estonia	15.8	48.2	51.8
Finland	23.0	51.4	48.5
Germany	19.0	62.6	37.4
Greece	20.2	40.9	59.1
Hungary	6.2	20.1	79.9
Ireland	19.3	47.2	52.8
Italy	10.2	34.6	65.4
Latvia	7.2	16.2	83.8
Lithuania	8.0	22.3	77.7
Luxembourg	28.5	48.5	51.6
Malta	8.8	28.0	72.0
Netherlands	17.1	35.5	64.5
Poland	7.5	23.0	77.0
Portugal	12.3	41.3	58.7
Romania	5.1	20.7	79.3
Slovak republic	17.9	35.1	64.9
Slovenia	9.4	24.9	75.1
Spain	6.1	33.6	66.4
Sweden	22.8	44.6	55.4
United Kingdom	12.0	38.1	61.9

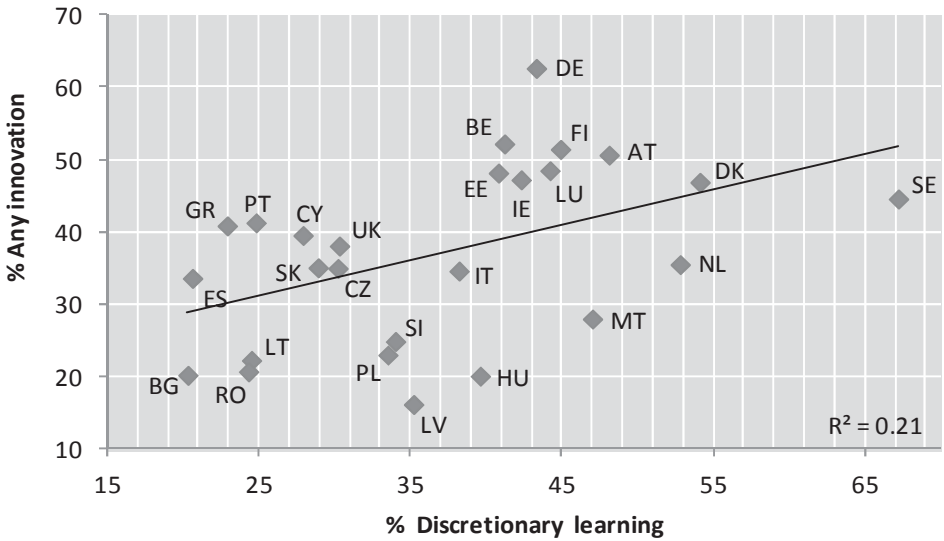
Source: Fifth Community Innovation Survey, Eurostat. Data are not available for France.

Figure 2.5. Correlations between innovation modes and some organisation forms, all sectors, 2005

2.5a. Discretionary learning and new-to-market innovation



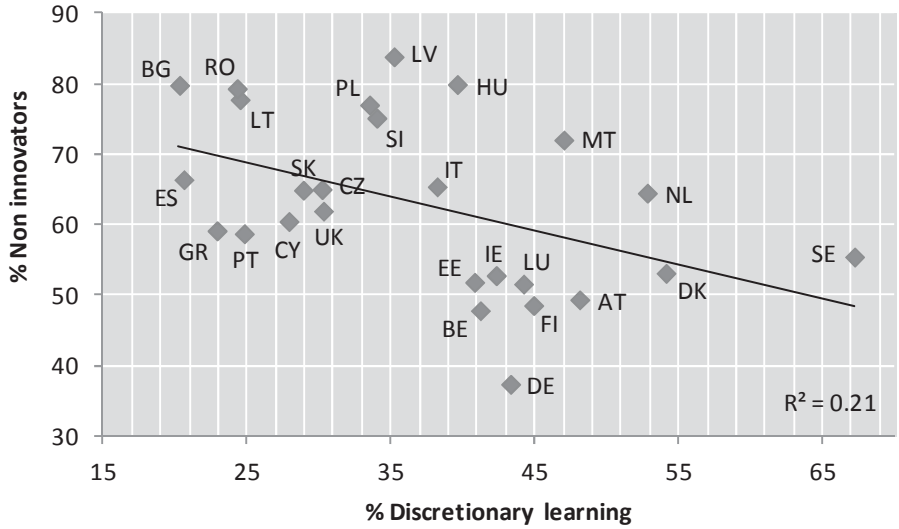
2.5b. Discretionary learning and any innovation



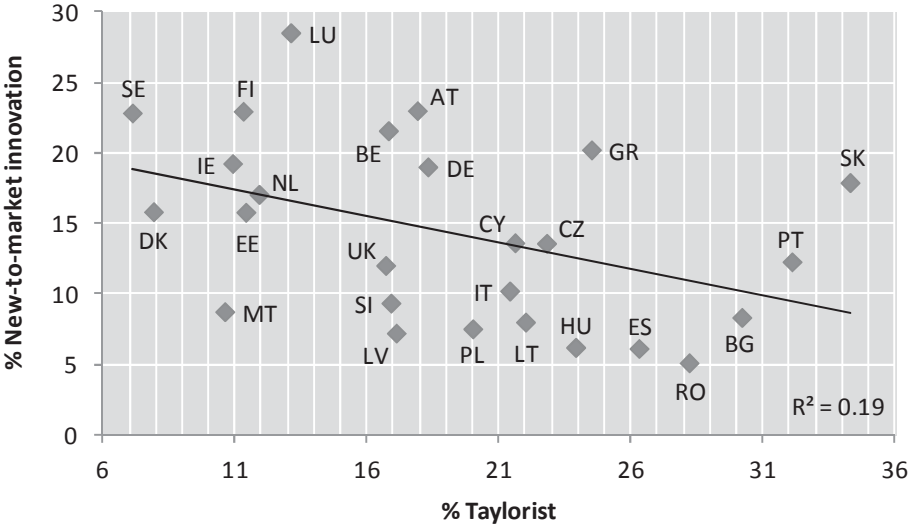
Data Source: Fifth Community Innovation Survey, Eurostat and European Working Conditions Survey 2005, European Foundation for the Improvement of Living and Working Conditions.

Figure 2.5. Correlations between innovation modes and some organisation forms, all sectors, 2005

2.5c. Discretionary learning and non innovators



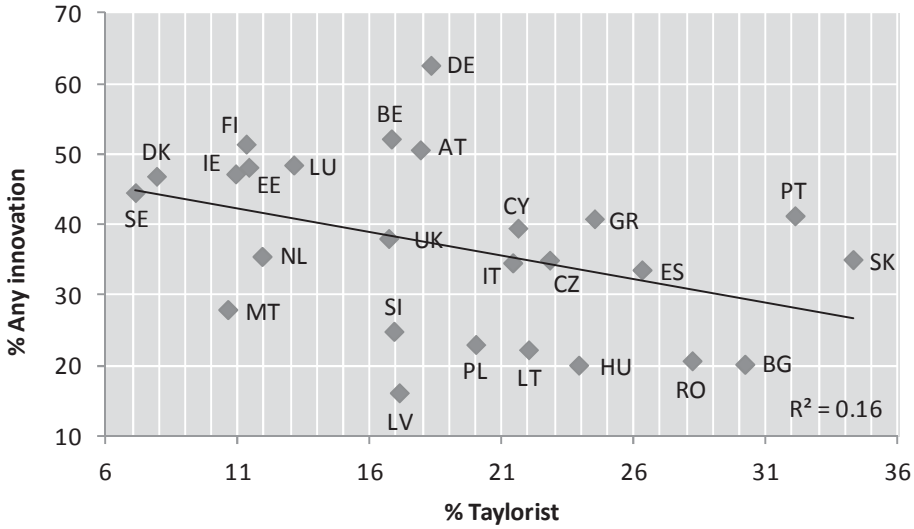
2.5d. Taylorist organisation and new-to-market innovation



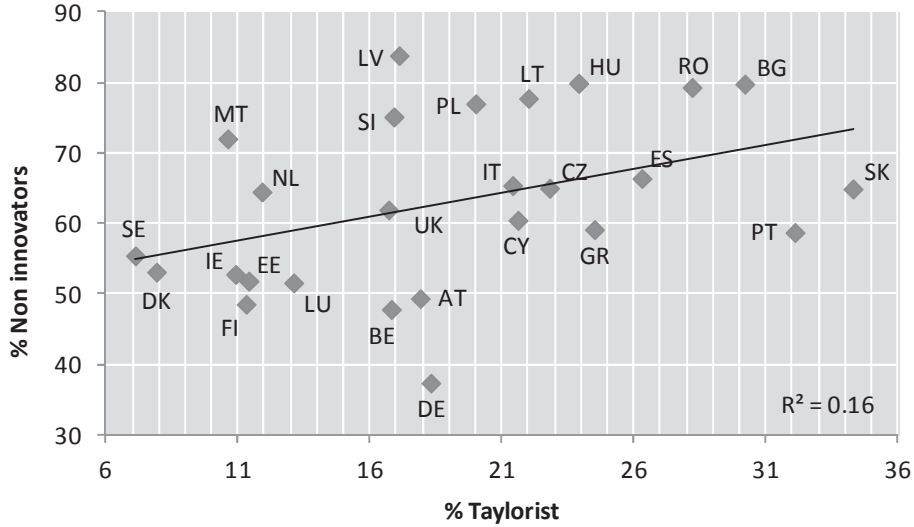
Data Source: Fifth Community Innovation Survey, Eurostat and European Working Conditions Survey 2005, European Foundation for the Improvement of Living and Working Conditions.

Figure 2.5. Correlations between innovation modes and some organisation forms, all sectors, 2005

2.5e. Taylorist organisation and any innovation



2.5f. Taylorist organisation and non innovators



Data Source: Fifth Community Innovation Survey, Eurostat and European Working Conditions Survey 2005, European Foundation for the Improvement of Living and Working Conditions.

A calculation of correlations between the frequencies of the forms of work organisation as measured in 2005 (Table 2.5) and the distribution of firms across the frequencies of the two innovation modes and non-innovators yields results that support the basic proposition that in nation where a large fraction of employees are engaged in discretionary learning enterprises are more active in the more radical forms of innovation. As Table 2.10 shows, there are positive and significant relations between the frequency of discretionary learning and the frequency of the two innovation modes. The correlation is slightly stronger in the case of the frequency of enterprises having introduced new-to-the market products. There is a negative correlation between the frequency of discretionary learning and the frequency of non-innovators. The results move in the opposite direction in the case of the Taylorist mode of work organisation. There are negative correlations between the frequency of Taylorism and the frequency of the two innovation modes, and there is a positive correlation between Taylorism and the frequency of non-innovators. In the case of the lean and traditional forms of work organisation, although there are negative correlations with the frequency of the two innovation modes and a positive correlation with the frequency of non-innovators, the relations are not statistically significant and for this reason they are not presented in the form of scatter plots (Figure 2.5). Assessing the reasons for this difference with the analysis based on CIS-3 and the second wave of the EWCS would require a more extended analysis.

Table 2.10. Correlations between shares of firms by innovation category in 26 EU member countries, 2004-2006 (%)

	Classes of work organisation			
	Discretionary learning	Lean production	Taylorist	Traditional or simple
New-to-market innovation	0.54*	-0.31	-0.43*	-0.28
Any innovation	0.46*	-0.27	-0.41*	-0.18
Non innovators	-0.46*	0.27	0.41*	0.18

*Statistically significant at 5%.

One step toward more adequately addressing the relation between organisation and innovation is to gather and analyse complementary firm-level data on both innovation modes and organisational forms. One option is to develop better indicators of organisational innovation and practices in future CIS surveys, as proposed by the third revision of the *Oslo Manual* in 2005. Another option is to develop new linked employer-employee survey instruments providing the basis for a rich multi-level characterisation of the innovative behaviours and practices of both organisations and their employees. As we

discuss in Chapter 3, an advantage of this approach is that it allows an assessment of the impact of different organisational arrangements and designs on employee outcomes and thus a better appreciation of the conditions favouring a sustained interest on the part of employees for learning and change.[9]

Linking learning organisations to institutional context

In this part we consider the links between national institutional context and the use of forms of work organisation characterised by high levels of employee learning and autonomy. Using first the results from the 2000 wave of the EWCS we present correlations at the aggregate level between the frequency of the discretionary learning forms of work organisation and various indicators of the development of formal and continuing vocational education and training. We then turn to the results of the 2005 wave of the EWCS and use multilevel analysis to explore the relationship between employee learning dynamics and aggregate indicators of national labour market policies and mobility.

Education and training systems

Since the discretionary learning forms of work organisation depend on the capacity of employees to undertake complex problem-solving tasks in relatively unconstrained or 'organic' work settings, it can be expected that nations with a high frequency of these forms will have made substantial investments in the development of the knowledge and skills of their labour forces. Investments in education and training take various forms and in what follows the analysis focuses on tertiary or tertiary education and on the continuing vocational training provided by enterprises both through external and internal courses. Tertiary education develops both general problem-solving skills and formal and transferable technical and scientific skills. A major goal of most EU nations over the last two to three decades has been both to increase the percentage of their populations with tertiary education, and more specifically to increase the number of graduates qualified in science and engineering. Both the percentage of the population with tertiary education and the percentage of new graduates with science and engineering qualifications figure prominently in innovation benchmarking exercises such as INNO-policy Trendchart.

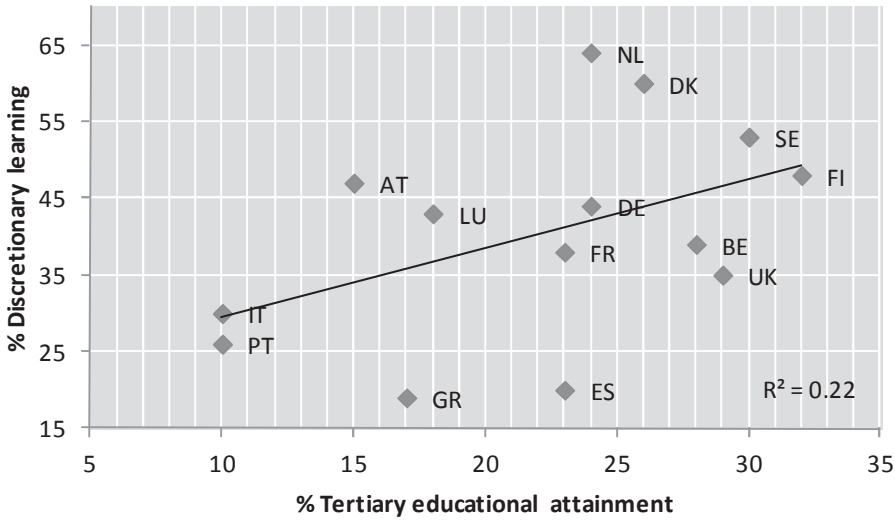
While most of the qualifications acquired through tertiary education will be quite general and hence transferable on the labour market, the qualifications an employee acquires through continuing vocational training will be more firm-specific. Some of this training will be designed to renew employees' technical skills and knowledge in order to respond to the requirement of ongoing product and process innovation in particular technological domains or areas. Other parts of continuing vocational training, notably that provided in-house, will be more organisationally focused and designed to develop employee competence in the firm-specific routines and operating procedures required for daily production activities. This latter kind of vocational training will be highly complementary to the more informal forms of learning that occur on-the-job, as employees seek solutions to the problems they confront in their daily work.

Figures 2.6a and 2.6b show the correlations between the frequency of the discretionary learning forms and two of the four measures of human resources for innovation used in the Trendchart innovation benchmarking exercise: the proportion of the population with tertiary education and the number of science and engineering graduate since 1993 as a percentage of the 20-29 aged cohort of the population in 2000. The results show a modest positive correlation (R-squared = .22) between the percentage of the populaion with tertiary education and no discernible correlation between the discretionary learning forms and the measure of the importance of new science and engineering graduates.

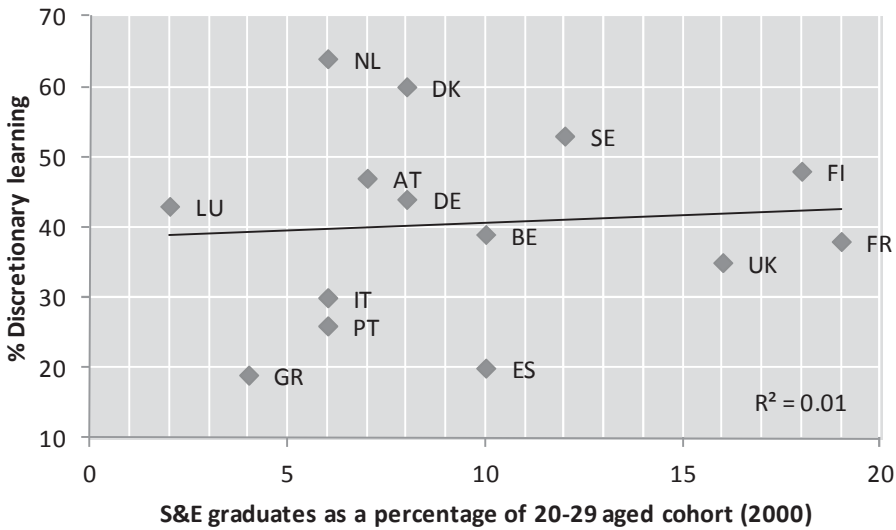
Figures 2.6c and 2.6d show that there are fairly strong positive correlations (R-squared = .84 and .52 respectively) between the frequency of the discretionary learning forms and two measures of firms' investments in continuing vocational training: the percentage of private sector firms offering such training, and the participants in vocational training as a percentage of employees in all enterprises. The results suggest that these forms of firm-specific training are key complementary resources in the development of the firms' capacity for knowledge exploration and innovation. The figure also points to a possible north/south divide within Europe. The four less technologically developed southern nations are characterised by both low levels of enterprise continuing vocational training and low use of discretionary learning, while the more developed northern and central European nations are characterised by relatively high levels of enterprise training and by high level use of the discretionary learning forms.

Figure 2.6. Correlations between forms of work organisation and education and training, 2000

2.6a. Discretionary learning and tertiary education



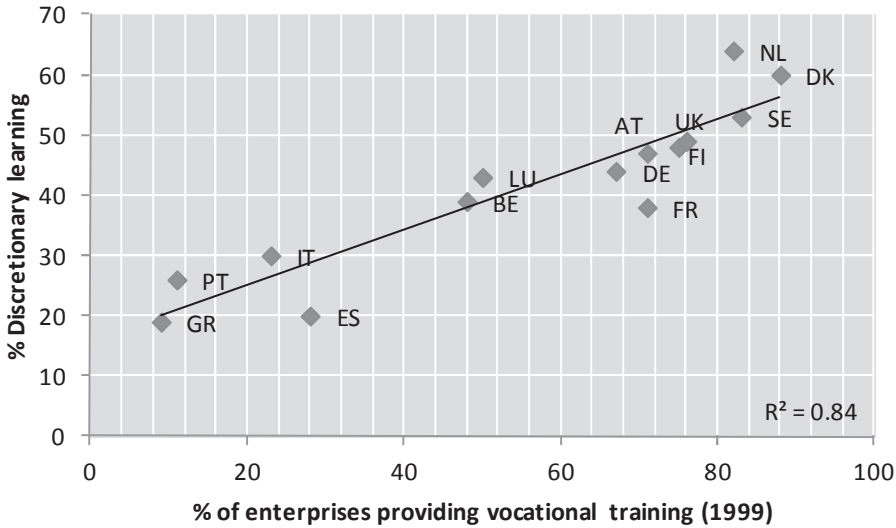
2.6b. Discretionary learning and new science and engineering graduates



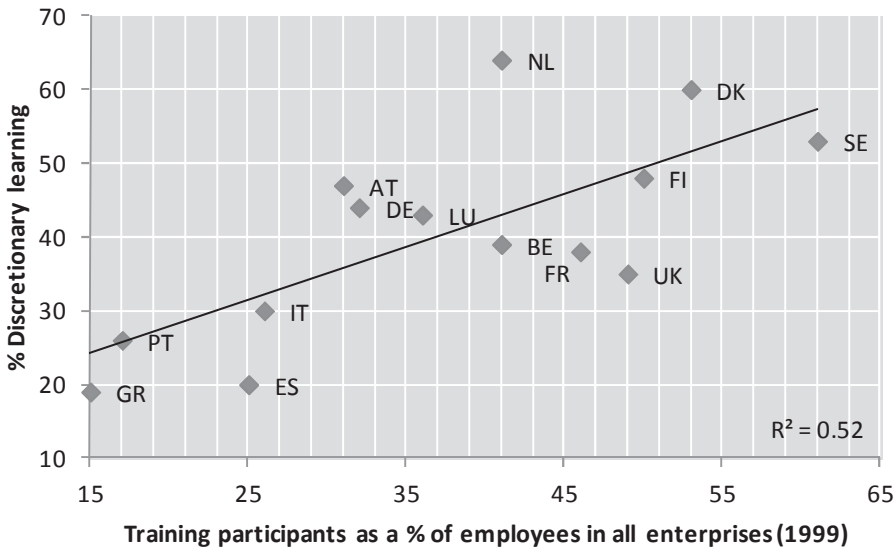
Source: European Working Conditions Survey 2000, European Foundation for the Improvement of Living and Working Conditions; Education Statistics, 2000; and Continuing Vocational Education Survey, 1999, Eurostat.

Figure 2.6. Correlations between forms of work organisation and education and training, 2000

2.6c. Discretionary learning and firm vocational training



2.6d. Discretionary learning and employee vocational training



Source: European Working Conditions Survey 2000, European Foundation for the Improvement of Living and Working Conditions; Education Statistics, 2000; and Continuing Vocational Education Survey, 1999, Eurostat.

In bringing to the fore these differences between indicators of tertiary education and indicators of continuing vocational training the point is not to argue that formal tertiary education does not play a critical role in developing innovative capacity. Rather, the point is that within Europe, and from the point of view of constructing learning organisations, the bottleneck would appear to be at the level of firm-specific vocational training and not at the level of formal tertiary education. It is worth emphasising that Italy, Greece, Portugal and Spain, which have all made important strides in increasing the number of science and engineering graduates, stand out for their low levels of investment in continuing vocational training and they rank the lowest on the discretionary learning scale.

Labour market policies and mobility

Recent works on national systems of innovation (Amable, 2003; Hall and Soskice, 2001; Lorenz and Lundvall, 2006; Whitley, 2006) have argued that there are systematic relations between the structure of labour markets and systems of unemployment protection on the one hand, and the dynamics of knowledge accumulation and learning at the workplace on the other. National systems combining high levels of labour market mobility with relatively high levels of unemployment protection and expenditure on 'active' labour market policies may have an advantage in terms of the adoption of the forms of work organisation and knowledge exploration at the firm level that can promote innovation. This is related to the fact that organisations which compete on the basis of strategies of continuous knowledge exploration tend to have relatively porous organisational boundaries so as to permit the insertion of new knowledge and ideas from the outside. Job tenures tend to be short as careers are often structured around a series of discrete projects rather than advancing within an intra-firm hierarchy (Lam and Lundvall, 2006).

Well-developed systems of unemployment protection in association with active labour market polices may contribute to the development of such fluid labour markets for two complementary reasons. Firstly, in terms of incentives, the security such systems provide in terms of income maintenance can encourage individuals to commit themselves to what would otherwise be perceived as unacceptably risky forms of employment and career paths. Second, active labour market policies, including expenditures on further vocational training education and other forms of life-long learning, contribute to the flexibility of labour markets by supporting the continuous reconfiguration of the workforce's skills and competences.

Holms *et al.* (2009) address these issues in a paper focusing on the EU27 and Norway. Using data on labour market mobility and on expenditure on labour market policies available from Eurostat's electronic data set,

the authors use multilevel logistic analysis to analyse the relation between the likelihood of the different forms of work organisation and differences in institutional context.[10] A principal components analysis for the 28 nations is conducted on the aggregate data identifying three factors or components.

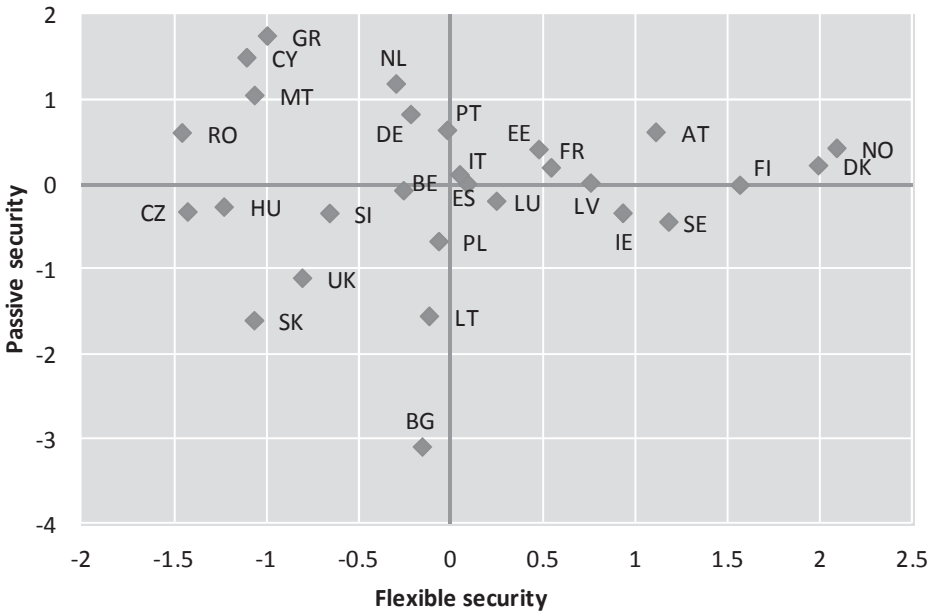
The first, FLXSCR, which accounts for 24% of the total variance, can be interpreted as a measure of *flexicurity* or alternatively as a measure of precarious rigidity. Countries scoring high on this factor combine high levels of labour market flexicurity with high level expenditures on both active and passive labour market policies. They have a particular emphasis on training designed to promote the movement of the unemployed into employment. These are classic characteristics of policies for flexible security and correspond closely to the notion of a "golden triangle of flexicurity" based on the combination of flexible labour markets, high levels of unemployment protection and labour market policies designed to move the unemployed into employment through up-grading skills.

The second factor, PASVSCR, accounts for 23% of the variance. This factor measures the balance in a nation between an emphasis on *passive security* in the form of income support for the unemployed or the part-time employed versus an emphasis on active measures in the form of subsidies for start-ups and self-employment and direct job creation of community or social benefit.

The third, EMPPTC, accounting for 18% of the variance, measures the importance of *subsidies* for maintaining existing job or moving the unemployed into jobs of social or community value, versus expenditures services for job search.

Figure 2.7 plots the position of the 28 European countries on the flexicurity (FLXSCR) and passive security (PASVSCR) scales. The figure shows that the Nordic countries (Denmark, Finland, Norway and Sweden) all score high on the flexible security scale, that the continental European nations score near to or above average, and that the eastern European nations, with the exception of Bulgaria, score low. The southern nations are at average levels, with the exception of Greece that scores low, and the Baltic nations are at average or above average levels. The United Kingdom scores low on the flexible security scale while Ireland scores relatively high. Figure 2.7 also shows that the continental nations with the exception of Belgium stand out for their emphasis on passive security in the form of income transfers, while Bulgaria, Lithuania, Slovakia and the United Kingdom stand out for giving a relative priority to start-up incentives or job creation measures.

Figure 2.7. Labour market policies and mobility EU28



Source: Eurostat, analysis and figure from Holms *et al.* (2009).

The aggregate labour market measures are used for a multilevel logistic analysis built-up from a rather simple single-level model explaining the likelihood of the different forms of work organisation as a function of level of formal education, years of working experience, occupation, sector and gender. The two-level model with random intercepts and coefficients is presented in Annex 2.A2.

The individual-level variables for the analysis are defined as follows. There are two dummy variables for education.[11] *Medu* indicates that the employee has upper secondary education or post secondary but not tertiary education. *Hedu* indicates that the employee has education of the tertiary level. The reference category is thus lower secondary or less education (*Ledu*). There are also two dummy variables for experience. *Mexp* indicates that the employee has more than five but no more than 15 years of work experience. *Hexp* indicates that the employee has more than 15 years of work experience. The reference category is thus employees with at most five years of work experience (*Lexp*).

Table 2.11. Multilevel model of work organisation with random intercepts and slope and contextual effects: EU27 and Norway

	Dependent variable			
	Discretionary learning	Lean	Taylorist	Simple
Individual level				
Intercept	-2.31***	-0.97***	0.21*	-1.58***
Medu	0.35***	0.16**	-0.40***	-0.24**
Hedu	0.87***	0.08	-1.23***	-0.65***
Mexp	0.22**	0.00	-0.53***	0.25**
Hexp	0.43***	-0.03	-0.69***	0.12
Occu1	1.48***	0.20***	-1.51***	-1.04***
Occu2	1.00***	-0.05	-1.23***	0.02
Occu3	0.69***	0.50***	-0.26***	-1.19***
Female	-.15***	-0.30***	0.52***	0.13**
Sect2	0.23***	0.02	- 0.41***	0.24**
Sect3	0.43***	-0.45***	-0.58***	0.71***
Sect4	0.56***	-0.53***	-0.61***	0.55***
Sect5	0.58***	-0.38***	-1.34***	0.89***
Country level				
FlexScr	0.27***	0.03	-0.25***	-0.27***
PasvScr	0.13	0.00	-0.01	-0.14*
EmpPrtc	0.02	-0.09*	-0.01	0.01
Random effects				
Intercept	0.14 (.057)	0.04 (0.023)	0.11 (0.053)	0.05 (0.03)
Medu	0.09 (.039)	0.01 (0.016)	0.08 (0.045)	0.10 (0.047)
Hedu.	0.06 (0.048)	0.05 (0.039)	0.19 (0.13)	0.31 (0.144)
Mexp	0.02 (0.019)	0.05 (0.027)	0.07 (0.049)	0.03 (0.034)
Hexp	0.01 (0.015)	0.00 (0.012)	0.01 (0.020)	0.02 (0.026)
n workers	9649	9649	9649	9649
n countries	28	28	28	28

Source: European Working Conditions Survey 2005, European Foundation for the Improvement of Living and Working Conditions, analysis and table from Holms *et al.* (2009).

Four occupational categories are distinguished. *Occu1* refers to managers, professionals and technicians; *Occu2* refers to clerks and sales; *Occu3* refers to skilled workers; and *Occu4* refers to unskilled workers. The reference category is unskilled workers (*Occu4*). For gender, the reference category is male and the variable *female* is coded 1 if the employee is a woman. Five industrial sectors are distinguished: *Sect2* is construction and utilities (NACE groups E and F). *Sect3* is Retail, wholesale, hotels & restaurants and other services (NACE groups G, H and I). *Sect4* is business and financial services (NACE groups J and K). *Sect5* is community, personal and social services (NACE group O). The reference category is mining and manufacturing (*Sect1*, NACE groups C and D).

The basic results of the multi-level regression analysis are presented in Table 2.11. The dependent variables for the regressions are binary variables equal to 1 if the employee is subject to the particular form of work organisation. The coefficient results are divided between those for individual-level variables, country-level variables and random components. The coefficients for the individual level variables should be read like those for any single level logistic regression model. Thus, focussing on column 1, the results show for the EU-27 and Norway that that there is a positive effect of the level of formal education and of years of experience on the likelihood of an employee being subject to the discretionary learning forms of work organisation. Unskilled workers are less likely than the other occupational categories to be involved in the discretionary learning forms, and the difference is most marked relative to managers, professionals and technicians. Women are significantly less likely than men to be subject to the discretionary leaning forms of work organisation, and employees in mining and manufacturing are less likely than those working in the other sectors to be involved in the discretionary learning forms.

The coefficients for the country level variables show how differences in national labour market conditions impact on the likelihood that an employee is subject to the different form of work organisation. The most noteworthy result here is that there is a positive and significant impact of the aggregate measure of flexible security on the likelihood of the discretionary learning forms of work organisation. This supports the initial hypothesis that the combination of a mobile workforce and labour market policies emphasising expenditures on further training are associated with greater use of forms of work organisation that involve high levels of learning and discretion. The results also identify for the Taylorist forms of work organisation model a negative coefficient on the flexicurity scale. This may be explained by the fact that of the four forms of work organisation the levels of learning, problem-solving and complexity are the lowest in the Taylorist forms, and active labour market policies would not be likely to play a major role in moving the unemployed into active employment in simple or traditional work settings.

The coefficients for the random effects provide estimates of how much variance there is across nations in the effect of the individual-level variables measuring education and experience on the likelihood of the different forms of work organisation.[12] Focussing on the model for discretionary learning, the results show that that there is moderate trans-national variance in the positive effect of secondary and tertiary education, whereas there is little transnational variance in the effect of year of experience.

The discussion of Arundel *et al.* (2007) above pointed to evidence showing that in nations where work is organised to support high levels of discretion in solving complex problems firms tend to be more active in terms of innovations developed through their own in-house creative efforts. In countries where learning and problem-solving on the job are constrained, and little discretion is left to the employee, firms tend to engage in a supplier-dominated innovation strategies. Their technological renewal depends more on the absorption of innovations developed elsewhere. Holms *et al.* (2009) extends on these results by exploring the relation between individual level outcomes and national systems of labour market flexibility and regulation. These still preliminary results provide support for the view that the way work is organised across EU nations varies in a systemic way with the degree of labour market mobility and with the way labour markets are regulated. The implications of these results are that the institutional set-up determining the dynamic performance of national systems is much broader than normally assumed when applying the innovation system concept. Policies affecting employment security including income maintenance policies for the unemployed are of fundamental importance for how firms learn and innovate. There are alternative ways to systems of innovation and competency-building and different systems tend to organise work and distribute security and protection differently among citizens.

Employee learning in public sector establishments

The drivers for organisational change in the public sector are different from those in the private sector, emanating as they do in part from the political system. It can be anticipated that forms of work organisation in the public sector will be distinctive for this reason as well as for reasons to do with the specific nature of the activities undertaken in different sub-sectors: public administration and social security, education, and health and social work. At the same time, there has been a growing interest in the reform of the public sector including the possible impact of the spread to public sector organisations of practices and accounting methods developed initially in private sector firms. A key issue raised in this context is the capacity of public sector organisations to adapt to changes in technology and in the demands of citizens, clients and customer. This raises the issue of the extent

of employee learning in public sector organisations and its relation to organisational change and innovation.

Table 2.12 and Figure 2.8 provide a comparison for the private and public sectors of the frequencies for the 15 work organisation variables used as basis for clustering private sector employees in the different analyses presented above. The results show that on average public sector organisations are characterised by higher levels of learning, problem-solving and task complexity, by higher levels of autonomy in work, by less repetitiveness and monotony, and by lower levels of constraint on the pace of work. As is not surprising, this is especially true for automatic constraints on work pace which concern less than 8% of employees in the public sector as compared with about 26% in the private sector.

Figure 2.8. Forms of work organisation in the public and private sectors for the EU28 in 2005

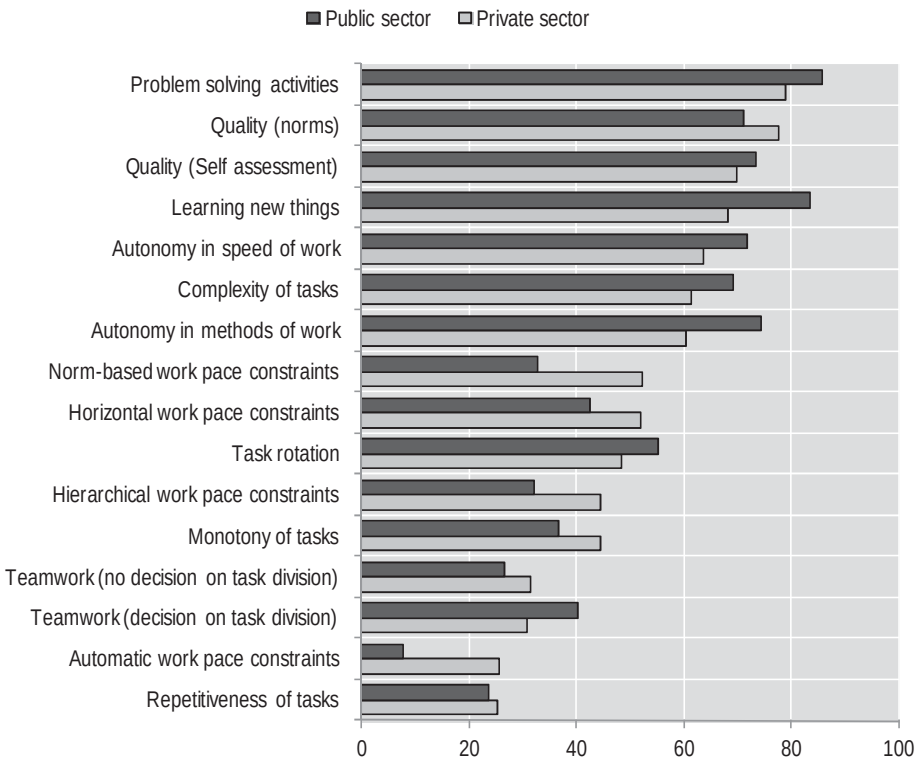


Table 2.12. Forms of work organisation in the public and private sectors for the EU28 in 2005

		Private sector			Public sector			
		Manufacturing construction and utilities	Services	Total	Public administration	Education	Health and social work	Total
Autonomy in work	Methods of work	56.4	64.3	60.6	68.1	85.8	68.1	74.3
	Speed or rate of work	59.9	67.0	63.6	70.5	78.7	65.5	71.9
Cognitive dimensions of work	Learning new things	69.2	67.5	68.3	80.7	86.5	83.8	83.7
	Problem-solving activities	75.6	81.8	78.9	84.7	86.6	86.5	85.9
	Complexity of tasks	64.5	58.6	61.4	71.7	65.2	70.9	69.2
Quality	Self assessment	73.1	67.1	69.9	65.5	78.9	74.8	73.4
	Quality norms	84.6	71.7	77.7	65.9	69.6	78.7	71.1
Task rotation		49.2	47.9	48.5	56.6	45.4	65.5	55.3
Team work	with decision on task division	29.4	32.4	31.0	32.9	39.9	46.1	40.3
	w/o decision on task division	34.8	28.5	31.4	36.1	17.3	27.1	26.8
Monotony of tasks		48.9	40.6	44.5	41.1	30.8	38.8	36.8
Repetitiveness of tasks		28.0	22.8	25.3	20.0	14.8	25.5	23.8
Workplace constraints	Automatic	36.6	15.3	25.8	11.1	3.5	8.9	7.8
	Norm-based	62.8	42.8	52.2	31.8	35.1	31.4	32.8
	Hierarchical	49.1	40.7	44.6	39.3	27.6	29.0	32.1
	Horizontal	57.1	47.6	52.0	46.9	31.1	51.4	42.6

Source: European Survey on Working Conditions, 2005, European Foundation for the Improvement of Living and Working Conditions.

The table also points to considerable differences across different subdivisions of the public sector, with the education sector standing out for its very high levels of learning and autonomy in work. There is little difference in the frequency of problem-solving activity across different public sectors while reported task complexity is lower in the education sector than it is in public administration and in health and social work. Monotony and repetitiveness are lower in the education sector than in public administration and in health and social work, and the frequency of the four indicators of work pace constraints are also lower in the education sector with the exception of norm-based constraints involving numerical or performance production targets. The public administration sector stands out for the relatively high level of hierarchical constraints on work pace, while health and social work stand out for the high frequency of use of quality norms and horizontal constraints on the work pace.

These preliminary results suggest that the learning forms of work organisation are more widely adopted in the public than in the private sector and that they are especially characteristic of the education sector. The results point to the need for more detailed empirical research on public sector organisations, possibly involving the development and testing of indicators of ongoing public sector reform involving, for instance, the move towards market-oriented management systems, increased use of performance measurements, but also innovation.

Summary

In conclusion, this chapter has drawn on and extended a series of papers by Lorenz and his co-authors firstly in order to better map the importance of learning organisations at the national and EU levels. The discussion has taken up a series of policy relevant issues associated with the unequal spread of learning forms of work organisation across nations. These include the relation of employee learning to national innovation style and performance, and the link between the use of learning forms of work organisation and the national institutional context, including the development of systems of continuing vocational education and training; the structure of labour markets; and level of expenditure on different labour market policies. At the micro-level, the analysis attempts to shed light on the complex relation between employee learning, the use of different HRM policies, and organisational culture defined in terms of the beliefs and attitudes held by employees.

Notes

1. The survey design and the initial findings of the 2005 survey are presented in a European Foundation report by Parent-Thirion *et al*. (2007).

2. Unlike principal components analysis where the total variance is decomposed along the principal factors or components, in multiple correspondence analysis the total variation of the data matrix is measured by the usual chi-squared statistic for row-column independence, and it is the chi-squared statistic which is decomposed along the principal factors. It is common to refer to the percentage of the 'inertia' accounted for by a factor. Inertia is defined as the value of the chi-squared statistic of the original data matrix divided by the grand total of the number of observations. See Greenacre (1993, pp. 24-31).

3. The term J-form is used because its archetypical practices and forms of work organisation are best illustrated by the "Japanese-type" organisation discussed extensively in the research on Japanese automobile and electronics firms in the 1970s and 1980s. Some authors refer specifically to the diffusion of the "lean production" model associated with Toyota (Womack, John and Roos, 1990; MacDuffie and Pil, 1997).

4. The percentages are weighted.

5. Data are available for all EU member nations in 2000 with the exception of Ireland. The original Arundel, Hollanders, and Crowley classification makes a further distinction between lead innovators that make continuous use of R&D and are active on national or international markets and lead innovators that make only occasional use of R&D and/or are only active on local or regional markets. Since our interest is the relation between forms of work organisation and the capacity for creative in-house development of novel products or processes regardless of R&D expenditures or the scope of markets, we have merged these two categories into a single 'lead innovator' group. For full details on the methodology for innovation modes, see Annex B of the Trend Chart document EXIS: An Exploratory Approach to Innovation Scoreboards: *http://trendchart.cordis.lu/scoreboards/scoreboard2004/pdf/EXIS.pdf*.

6. The correlations between the frequency of discretionary learning and the frequencies of lead innovators and non-innovators are significant at the .05 level.

7. All these correlations are significant at the .05 level or better with the exception of the positive correlation between lean and the frequency of adopters which is significant at the .10 level.

8. The vast literature on the transfer of Japanese management practices by Japanese multinationals to their affiliates located in Europe and the United States during the 1980s and 1990s provides evidence relevant to this issue. Most of this literature argues that Japanese management practices are modified in the process of transfer resulting in hybrid organisational forms combining elements of work organisation and HRM practices characteristic of the host country. See Kenney and Florida, 1993; Liker *et al*. 1992; and Oliver and Wilkinson, 1992. For evidence on the limited delegation of decision-making

authority to shop floor personnel in Japanese transplants located in the United Kingdom, see Doeringer *et al.*, 2003.

9. For a further discussion of this approach see the EU MEADOW project designed to develop guidelines for undertaking linked employer-employee surveys of organisational change and it economic and social impacts. www.meadow-project.eu/

10. The data on labour market mobility is taken from "Eurostat Data in Focus, Population and Social Conditions, no. 1/2007". The labour market policy expenditure figures are taken from Eurostat's Labour Market Policy data base. The figures are for 2005 for all countries except for Denmark (2004), Malta (2006) and Cyprus (2006). See: *http://epp.eurostat.ec.europa.eu/portal/page?_pageid=1090,30070682,1090_30298591&_dad=portal&_schema=PORTAL*

11. A "dummy variable" is a variable that can take only two values.

12. Observe that the dummies for occupation and sector are individual-level variables.

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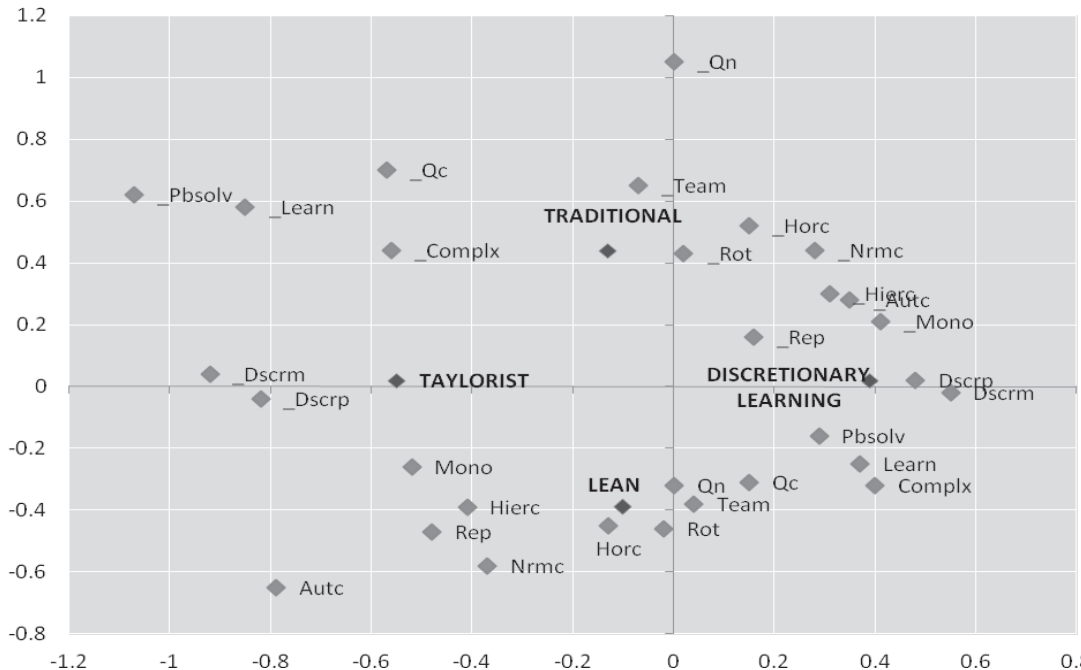
Annex 2.A1

Graphical representation of factor analysis in the European Working Conditions Survey (EWCS) 2000: 15 organisational variables

Figure 2.A1.1. Forms of work organisation



Note: See Table 2.A1.1 for codes.

Table 2.A1.1. Codes for Figure 2.A1.1

Xxx = presence of feature; _Xxx = absence of feature	
Team work	**Team**
Job rotation	**Rot**
Responsibility for quality control	**Qc**
Quality norms	**Qn**
Problem-solving activities	**Pbsolv**
Learning new things in work	**Learn**
Complexity of tasks	**Complx**
Discretion in fixing work methods	**Dscrm**
Discretion in setting work pace	**Dscrp**
Horizontal constraints on work pace	**Horc**
Hierarchical constraints on work pace	**Hierc**
Norm-based constraints on work pace	**Nrmc**
Automatic constraints on work pace	**Autc**
Monotony of tasks	**Mono**
Repetitiveness of tasks	**Rep**

Figure 2.A1.1 presents graphically the first two axes or factors of the multiple correspondence analysis (MCA). The first factor or axis, accounting for 18% of the inertia or chi-squared statistic, distinguishes between Taylorist and "post-Taylorist" organisational forms. Thus on one side of the axis we find the variables measuring autonomy, learning, problem-solving and task complexity and to a lesser degree quality management, while on the other side we find the variables measuring monotony and the various factors constraining work pace, notably those linked to the automatic speed of equipment or flow of products, and to the use of quantitative production norms. The second factor or axis, accounting for 15% of the chi-squared statistic, is structured by two groups of variables characteristic of the lean production model: first, the use of teams and job rotation which are associated with the importance of horizontal constraints on work pace; and secondly those variables measuring the use of quality management techniques which are associated with what we have called 'automatic' and 'norm-based' constraints. The third factor, which accounts for 8% of the chi-squared statistic, is also structured by these two groups of variables. However, it brings

into relief the distinction between on the one hand those organisational settings characterised by team work, job rotation and horizontal interdependence in work, and on the other hand those organisational settings where the use of quality norms, automatic and quantitative norm-based constraints on work pace are important. The second and third axes of the analysis demonstrate that the simple dichotomy between Taylorist and lean organisational methods is not sufficient for capturing the organisational variety that exists across European nations.

The projection of the centre of gravity of the four organisational clusters coming out of the hierarchical classification analysis (see Table 2.1) onto the graphic representation of the first two factors of the MCA shows that the four clusters correspond to the quite different working conditions. The discretionary learning cluster is located to the east of the graph, the lean cluster to the south, the Taylorist cluster to the west and the traditional cluster to the north.

Annex 2.A2

Multilevel logistic model used in Chapter 2

The multilevel logistic analysis is built-up from a rather simple single-level model explaining the likelihood of the different forms of work organisation as a function of individual level variables measuring formal education, years of working experience, occupation, sector and gender as defined in the main text of Chapter 2.

Equation (1) on the following page illustrates the two-level structure (I employees in J countries) of the model.

$$
\begin{aligned}
&\text{Level1:}\\
&Logit_{ij} = \beta_{0j} + \beta_{1j}Medu_{ij} + \beta_{2j}Hedu_{ij} + \beta_{3j}Mexp_{ij} + \beta_{4j}Hexp_{ij}\\
&\qquad \beta_{5j}Occu1_{ij} + \beta_{6j}Occu2_{ij} + \beta_{7j}Occu3_{ij} + \beta_{8j}Female_{ij}\\
&\qquad \beta_{9j}Sect2_{ij} + \beta_{10j}Sect3_{ij} + \beta_{11j}Sect4_{ij} + \beta_{12j}Sect5_{ij}\\
&\text{Level2:}\\
&\beta_{0j} = \gamma_{00} + \gamma_{01}ActFlex + \gamma_{02}UempPtc + \gamma_{03}JobPtc + u_{0j}\\
&\beta_{1j} = \gamma_{10} + u_{1j}\\
&\beta_{2j} = \gamma_{20} + u_{2j}\\
&\beta_{3j} = \gamma_{30} + u_{3j}\\
&\beta_{4j} = \gamma_{40} + u_{4j}\\
&\beta_{5j} = \gamma_{50}\\
&\beta_{6j} = \gamma_{60}\\
&\beta_{7j} = \gamma_{70}\\
&\beta_{8j} = \gamma_{80}\\
&\beta_{9j} = \gamma_{90}\\
&\beta_{10j} = \gamma_{100}\\
&\beta_{11j} = \gamma_{110}\\
&\beta_{12j} = \gamma_{120}
\end{aligned}
\tag{1}
$$

The level 1 model of equation (1) is similar to any other binary logistic model. The dependent variable is the logit-transformation of the conditional probability of success for the ith worker in the jth country:

$$
\begin{aligned}
&\mathrm{E}(y_{ij} = 1 \mid \beta_j) = \pi_{ij}\\
&\ln\left(\frac{\pi_{ij}}{1-\pi_{ij}}\right) = Logit_{ij}
\end{aligned}
\tag{2}
$$

The important difference between equation (2) and the traditional logistic model is the subscript j on the vector of estimators, $\boldsymbol{\beta}$, signalling that the model will provide country specific intercept and slope estimates.

Chapter 3

Measuring trends: the work complexity paradox

This chapter assesses the trends of work characteristics associated with learning organisations over 1995, 2000 and 2005 for EU15 countries. Finding an average decreasing trend in EU15, driven by results in Germany, Great Britain, Italy and Spain, it then tries to uncover this work complexity paradox by taking into account structural factors influencing work complexity at the individual and country level. Four possible culprits that are not measured in the available databases are discussed: standardisation, job polarisation, organisational change and self-reported overqualification. The first two explanations make the assumption that the decreasing trend in work complexity is an objective phenomenon; the two others explore how it could be related to subjective assessments of persons in employment.

Chapter 3 mapped the spread of learning organisations across Europe using the European Working Conditions Survey (EWCS). Relying on the different waves on the same data source, this chapter is dedicated to assessing the trends of work characteristics associated with learning organisations over 1995, 2000 and 2005 for EU15 countries. It will give a detailed account of results found in Greenan *et al.* (2010).

Data and measurement frame

The European Foundation for the Improvement of Living and Working Conditions has carried out four surveys on the working conditions in Europe (in 1990-91, 1995-96, 2000 and 2005), and also surveyed the acceding and candidate countries in 2001-02[1]. Greenan, Kalugina and Walkowiak (2007 and 2010) have analysed trends for EU15 over 1995-2005 and for EU27 over 2000-05. They did not use the first waves of the survey because the formulation of the core set of questions for describing work organisation has strongly evolved between the first and second waves of the survey. They report on trends in three different dimensions of work experience in Europe: quality of working conditions, work intensity and work complexity.

In this chapter, we focus on the results found about trends in work complexity in EU15 over a 10-year period, between 1995 and 2005. Data coverage is different from the one retained in Chapter 1 as the sample used is representative of persons in employment, defined in the Labour Force Surveys as including "those who did any work for pay or profit during the reference week (the reference week varied from country to country) or those who were temporarily absent from their jobs". Thus, in addition to the sample used in the work presented in the first part of Chapter 1 (8 081 salaried employees in 2000 and 9 986 salaried employees in 2005), we include the self-employed, salaried employees in establishments with fewer than 10 employees and salaried employees in agriculture and fishing, public administration and social security, education, health and social work and private domestic employees. As the sample is restricted to EU15, we exclude new member states (Bulgaria, Czech Republic, Cyprus, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia and Slovenia) and Norway. The total sample used includes 15 986 persons in 1995, 21 703 persons in 2000 and 14 952 persons in 2005.

In order to characterise work organisation in Europe, the authors select a set of 12 primary variables capturing the experience of persons in employment about how their work is organised and co-ordinated. These questions are formulated in a simple and objective way, using a yes/no scale. This contributes to the international comparability of answers by lowering country differences in the way questions are understood and answered. However, this does not wear away heterogeneity in legal and cultural norms across country that could still generate country patterns or effects.

Work organisation is a latent multidimensional variable which is not directly observable. Each of the 12 primary variables that are selected contributes to the construction of an overall picture of work organisation, but none of them alone is sufficient to describe it effectively. Multiple correspondence analysis (MCA) is a useful technique as it aims at producing a simplified low-dimensional representation of the information in a large frequency table (Greenacre and Blasius, 2006). First, each item response of the twelve qualitative work organisation variables are coded as a dummy. The Multiple Correspondence Analysis generates quantitative scores, called dimensions, which maximise the average correlation among these dummy-coded qualitative variables. These dimensions are linear combinations of the dummy variables that play an active role in the analysis. They can be considered as synthetic indicators whose interpretations rely on the variables that take a prominent part in their construction. The survey weights are used in the analysis in order to draw an overall picture of work organisation in Europe, taking into account the differences in sampling frames across countries. An interesting result from this Multiple Correspondence Analysis, which we will discuss further below, is that the first key dimension arising from the analysis summarises how individual and organisational knowledge is involved in the work process. This is why it is interpreted as work complexity.

The longitudinal dimension of the data is limited, consisting of three cross sections in 1995, 2000 and 2005. Greenan, Kalugina and Walkowiak (2010) measure trends in the synthetic indicator of work complexity applying the method proposed by Greenan and Mairesse (2006). They run a Multiple Correspondence Analysis for the starting year of the time period, 1995 and retain the first dimension. The linear combination of variables underlying this dimension is then applied to the distribution of individual characteristics measured in 2000 and 2005 to build up indicators that are comparable across time. A core assumption in this method is that it is meaningful to apply the structural relationships observed in 1995 to 2000 and 2005.

A decreasing trend in work complexity

The 12 primary variables of the work organisation analysis provides some detailed information on the characteristics of tasks (are they monotonous? are they complex?), on how they are performed (with precise quality standards? with self-assessment of quality? with discretion for changing the order of tasks? with discretion for changing the methods of work?), on how they are co-ordinated (with task rotation involving colleagues? with assistance from colleagues? with freedom to take breaks? with freedom to take days off or holidays?) and on the associated learning process (learning new things at work? solving unforeseen problems on your own?).

In Table 3.1, column 1 gives the exact formulation of the corresponding question in the European Working Conditions Survey (EWCS). The first factor of the work organisation Multiple Correspondence Analysis for 1995, accounting for 22% of total inertia[2], results from a linear combination whose coefficients are given in column 2. The bold coefficients indicate that the item response has a high contribution to the inertia of the dimension. The dimension measures an opposition between complex jobs involving opportunities of learning and routine jobs: on one side jobs involving complex tasks also entail discretion on how the work is carried out and learning new things, while on the opposite persons in employment declare that their work is not complex, that they are not able to change or choose their methods of work and order of task, that they do not solve unforeseen problems or assess themselves the quality of their work, that they are not free to take breaks or days off when they wish to and that they do not feel that they learn new things. As mentioned in the previous chapter, the fact that complexity, discretion and learning goes hand in hand with one another supports the idea of the existence of a learning model of organisation. This interaction has already been identified in work based on an employee level survey at a national level and connected with economic performance issues at the employer level (Greenan and Guellec, 1998). However, in this analysis, complexity, discretion and learning make up a dimension of their own, weakly connected with other features of work organisation like quality standards, task monotony, job rotation, or support from colleagues. This result echoes findings of Lorenz and Valeyre (2005), based on the previous wave of the EWCS and presented in Chapter 2, where the discretionary learning model is only weakly connected to the use of teams, job rotation and quality norms. We label this synthetic indicator *work complexity*, knowing that high work complexity is conducive to high learning opportunities.

Table 3.1. Indicators of work complexity in EU15

Questions in EWCS	Synthetic indicators	EU15 1995 (%)	EU15 2000 (%)	EU15 2005 (%)
(1)	(2)*	(3)	(4)	(5)
Intercept	-0.411			
Does your main paid job involve…?				
…meeting precise quality standards				
Yes	0.066	71.07	68.23	73.52
No	-0.066	28.93	31.77	26.48
…assessing yourself the quality of your own work				
Yes	0.089	75.58	74.04	71.44
No	**-0.089**	24.42	25.96	28.56
…solving unforeseen problems on your own				
Yes	0.145	83.77	81.97	80.93
No	**-0.145**	16.23	18.03	19.07
…monotonous tasks				
Yes	-0.019	43.72	38.78	41.39
No	0.019	56.28	61.22	58.61
…complex tasks				
Yes	**0.101**	58.55	55.51	58.18
No	**-0.101**	41.45	44.49	41.82
…learning new things				
Yes	**0.122**	75.79	70.41	69.56
No	**-0.122**	24.21	29.59	30.44
…rotating tasks between yourself and colleagues				
Yes	0.049	54.68	43.23	42.87
No	-0.049	45.32	56.77	57.13
Are you able, or not, to choose or change…?				
…your order of tasks				
Yes	**0.123**	65.7	64.17	63.44
No	**-0.123**	34.3	35.83	36.56
…your methods of work				
Yes	**0.128**	72.09	70.4	67.71
No	**-0.128**	27.91	29.6	32.29
Can you get assistance from colleagues if you ask for it?				
Yes	0.039	83.48	82.45	81.63
No	-0.039	16.52	17.55	18.37
Can you take your break when you wish?				
Yes	0.081	63.12	60.46	63.34
No	**-0.081**	36.88	39.54	36.66
Are you are free to decide when to take holidays or a day off?				
Yes	0.072	56.97	55.35	66.91
No	**-0.072**	43.03	44.65	33.09

Note: The coefficients in column 2 are computed so that their sum over item responses of each variable equals to zero. A coefficient in bold indicates a high contribution of the variable to the inertia of the synthetic indicator. *The underlying multiple correspondence analysis has been computed using the 1995 wave of the survey*. Sample coverage: salaried and self-employed individuals from EU15 in private and public sectors. Descriptive statistics are weighted. *Source:* European Working Conditions Survey 1995, 2000 and 2005, European Foundation for the Improvement of Living and Working Conditions, analysis and table from Greenan *et al*. (2010).

In Table 3.2, columns 1, 2 and 3 give the rank of each EU15 country in term of the average level of work complexity in 1995, 2000 and 2005. Generally speaking, it is in Scandinavian countries (Denmark, Sweden and Finland) that workers frequently perform complex tasks, but other countries also offer high learning opportunities and complex tasks. Indeed, the Netherlands is ranked in the third position in 1995 and 2005. Routine jobs are more frequent in Mediterranean countries, but they are also frequent in the British Isles (ranking 10th for United Kingdom and 9th for Ireland) and in Germany (ranking 13th in 2005). These results are in line with the distribution of the discretionary learning form of work organisation presented in Chapter 2.

In Table 3.1, columns 3, 4 and 5 give the weighted distributions of the 12 primary variables in 1995, 2000 and 2005 for EU15. These descriptive statistics are somewhat surprising: most of the variables under scrutiny show a slight downward trend over the ten years time period. For example, the percentage of EU15 persons in employment declaring that their jobs involved learning new things decreased from 76% in 1995 to 70% in 2005, for task rotation, the percentage decreased from 55% to 43% and for discretion in the choice of methods of work the percentage decreased from 72% to 68%. There are only two exceptions to this general picture: a small increase in quality standards (71% in 1995, 74% in 2005) and a large increase in freedom to take holidays or days off (57% in 1995, 67% in 2005).

How do these trends translate in the work complexity indicator? In Table 3.2, trends in the work complexity indicator are computed in two different ways. Columns V1 (variation 1) give the sign of the variation of the EU15 or country average work complexity indicator over 1995-2000 (column 4), 2000-05 (column 6) and 1995-2005 (column 8). In EU15, average work complexity has first decreased significantly over 1995-2000, and then it has increased over 2000-05 without compensating the initial decrease so that a significant overall decrease is measured over the ten years period. However, work complexity has significantly decreased over 1995-2005 in three countries only, Great Britain, Spain and Germany which have a strong weight in EU15 average trend. On the opposite, it has significantly increased over the ten years in Austria, Belgium, Denmark, Greece, Ireland and Luxembourg.

Table 3.2. Change in work complexity between 1995 and 2005

	1995	2000	2005	Variation, 2000-1995		Variation, 2005-2000		Variation, 2005-1995	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Rank 1995	Rank 2000	Rank 2005	V1	V2	V1	V2	V1	V2
EU15 average				-***		+***		-***	
Nordic countries									
Denmark	2	1	1	-	+**	+***	+	+***	+***
Finland	5	4	4	-***	-**	+***	+***	+	+
Sweden	1	3	2	-***	-***	+***	+***	+	+
British Isles									
Ireland	11	9	9	-	+	+***	+	+***	+**
Great Britain	4	5	10	-***	-***	-***	-***	-***	-***
Western Europe									
Austria	10	6	5	+***	+***	+**	-	+***	+***
Belgium	7	8	7	-	+	+***	+	+**	+
Germany	9	10	13	-**	+	-	-***	-***	-***
France	6	7	8	-*	+	+**	-	+	+
Luxembourg	12	12	6	-	+	+***	+*	+***	+***
Netherlands	3	2	3	-	+**	+*	-	+	+
Mediterranean countries									
Greece	15	15	14	-***	-	+***	+***	+***	+**
Italy	8	11	11	-***	-*	+***	-	-	-**
Portugal	13	14	12	-***	-***	+***	+***	-	+
Spain	14	13	15	-**	+	-	-***	-***	-***

*Significant at 10%. **Significant at 5%. ***Significant at 1%. Sample coverage: salaried and self-employed individuals from EU15 in private and public sectors. *Source:* European Working Conditions Survey 1995, 2000 and 2005, European Foundation for the Improvement of Living and Working Conditions, analysis and table from Greenan, Kalugina, Walkowiak (2010).

Columns V2 (variation 2) give the sign of the variation once they have been purged of the structural effect of sectors and occupations. More precisely, the authors run regression at the individual level where work complexity is explained by occupation, sector and year dummies. Then, they retrieve the residuals which provide the value of each indicator when the occupation and the sector are controlled for and they test the significance of its average variation over 1995-2000 (column 5), 2000-05 (column 7) and 1995-2005 (column 9). Column V1 results appear robust to the inclusion of occupation and sector structures. Belgium and Italy are the only countries for which a change in the significance of the variation is observed. In Belgium the increase in work complexity is no longer significant, which indicates that the proportion of sectors or/and occupations implying more complex jobs increased but that the degree of work complexity within jobs did not change. In Italy, shifts in occupations and sector structures were hiding a general decreasing trend in job complexity.

To understand how organisations adopt new ideas and behavioural patterns, and how workers absorb and exploit knowledge to innovate, the evolutionary economic literature (Cohen and Levinthal, 1990; Winter and Zollo, 2002) analyses the micro-dynamics of routines, capabilities and learning. It is now largely admitted that the way co-ordination takes place at workplaces has some important consequences in terms of learning processes. We also know that patterns of work co-ordination differ substantially across employers, sectors and countries. A widespread idea is that to adapt the fordist and the Taylorist models of production, where co-ordination rests on standardisation of products and processes, to more rapid changes in the environment of firms there is a movement towards a model where co-ordination rests on mutual adjustments, allowing for a learning process that is more prevalent, less concentrated on a small fraction of the work force.

If this is true, the negative average work complexity trend in EU15 is puzzling. It is unexpected as the knowledge base of the core of the European economy is most of the time described as expanding. How can an increased dependency of the economy on the generation of new knowledge fit with an average decreasing trend of work complexity experienced by EU15 workers? It is also at odds with the groupings of countries from the literature on the variety of capitalism or welfare regimes. Strong decreasing trends in work complexity are observed in countries from different institutional and cultural backgrounds: Germany, Italy, Spain and United Kingdom. If Scandinavian countries appear to be preserved over 1995-2005, it is because the initial and significant decreasing trends they registered over the 1995-2000 period was counterbalanced by a subsequent significant growth in 2000-05. Greenan *et al.* (2010) try to uncover this work complexity paradox by taking into account structural factors influencing work complexity in a multilevel model.

Taking into account structural factors in a multilevel model

Greenan *et al.* (2010) use multilevel analysis to identify the role of structural factors, at the individual level (level 1) as well as at the country level (level 2) in the decreasing trend of work complexity. The multilevel analysis is a relevant econometric approach if the answers of persons in employment of a same country are correlated. In that case, the variance in answers can be decomposed into a within-country variance and a between-country variance. This decomposition requires estimating a basic two-level regression model called the intercept-only model, which contains no explanatory variables. This decomposition of variance will serve as a benchmark with which other, more complicated models are compared (see Annex 3.A).

Table 3.3 reports the results of the weighted intercept-only model for work complexity in 1995, 2000 and 2005. The intra-country correlation is non negligible indicating that it is worth while analysing a country effect in work complexity. This result supports the application of a multilevel model on the pooled data from the different waves of the European Working Conditions survey to identify the influence of structural factors in the decreasing work complexity trend.

Table 3.3. Heterogeneity in work complexity across EU15 over 1995-2005

Degree in complexity in work	1995	2000	2005
Intercept	-0.01	-0.049*	0.012
Random part			
Variance of the country level residual errors	0.015***	0.017***	0.017***
Variance of the individual level residual errors	0.206***	0.217***	0.220***
Intra country correlation in percentage	7.0%	7.1%	7.1%

Significant at 10%. **Significant at 5%. ***Significant at 1%. Sample coverage: salaried and self-employed individuals from EU15 in private and public sectors.

Source: European Working Conditions Survey 1995, 2000 and 2005, European Foundation for the Improvement of Living and Working Conditions, analysis and table from Greenan, Kalugina, Walkowiak (2010).

Four different models are estimated (Annex 3.A), going from the simplest to the most elaborated one. The first model is the intercept only model. As the regressions are ran on the pooled data from the three survey waves, results are different from the ones displayed in Table 3.3. Model 2 includes year 2000 and 2005 dummies. As 1995 is the reference date, the coefficient associated with year 2000 gives the 1995-2000 trend, while the one associated with 2005 gives the 1995-2005 trend. A central objective in

the modelling is to identify the sensitivity of these coefficients to the inclusion of individual level and country level variables. Thus model 3 includes year dummies and individual level variables. Model 4 is the complete model, including country level variables in addition to time dummies and individual level variables. What are the structural factors that enter the model at the individual and country levels?

At the individual level, the need for variables that are consistently measured over the three waves of the European Working Conditions survey imposes strong constraints on the information. Hence, we are able to measure demographic information (gender and age), occupation (nine categories), employment status (contract duration, self-employed or salaried employee), sector of the workplace (five categories), use of a computer and management position. Indeed, all these characteristics have a potential influence on work complexity.

We would have liked to have explicitly taken into account educational attainment and work experience as proxies for skills, in reference to human capital theory, but this information is not available over the three waves of the survey. However, a broader conception of skills is now widely acknowledged where skills' accumulation also takes place in work experience, through learning by doing and on the job training. This broader conception highlights the relevance of the occupational dimension in the measurement of human capital. Furthermore, age, management position and computer use complement occupation in the indirect assessment of skills.

When individual variables are introduced in model 3 the meaning of the intercept changes. In model 2, the intercept gives the average EU15 level work complexity in 1995. In model 3, it becomes the average EU15 level of work complexity for a reference individual with the following characteristics: he is a young (between 15 and 24) plant and machine operator working in the manufacturing sector on an unlimited contract, using no computer and with no supervisory role. In 1995, this reference employee experiences a low degree of work complexity

The availability of time series for EU15 also imposes strong constraints on what can be measured at the country level. OECD and Eurostat databases are privileged as they provide high quality time series for EU15. Eight major country level variables which are potentially related to work complexity are retained. A first variable, which is consistently measured over time, is real annual GDP growth which gives an indication of the position in the business cycle. International trade in goods and services as a percentage of GDP is an indicator of globalisation. The development of the knowledge base of economic activity is another important country level dimension which is captured. The (log) number of patent applications to the European Patent Office (EPO) is a first indicator. According to the *Canberra Manual* (OECD

and Eurostat, 1995) persons having graduated at the tertiary level of education are part of the human resources in science and technology. Education levels are not available at the individual level in the EWCS, but they are at the country level. The share of persons between 25 and 64 years old with tertiary attainment is the retained indicator of education. In an ageing Europe where labour force is becoming more opened to women, gender and age perspectives are needed and taken into account through the gender and age composition of the workforce. Finally, two variables characterise the state of the labour market: the unemployment rate and the part-time employment rate in total employment. In model 4, country level variables are centred on the European average. Thus the interpretation of the intercept does not vary much when country level variables enter the model: it gives the average level of each indicator for our reference employee in an 'average' EU15 country, which is a country where macroeconomic variables take the EU15 average. Parts of these country level variables are highly correlated with one another. In order to mitigate multi-collinearity problems in the regressions, we have identified two different bundles of predictors which limiting redundancy and leading to estimations (4) and (4').

Results of the five models are reported in Table 3.4. The estimation of model 1 shows that there is a significant country effect in work complexity, but that the variance is considerably higher among individuals. The estimated intra-country correlation is 6.55%. In model 2, 3 and 4 dummy variables for years 2000 and 2005, individual controls for workers characteristics and country controls for macroeconomic factors are successively and respectively introduced. The impacts of these controls on the different components of variance are first analysed. In model 2 statistically significant negative coefficients for both years are found but the coefficient for year 2005 is smaller in absolute value compared to that for year 2000 (-0.055 and -0.038). This finding supports and confirms the descriptive statistics on trends over the two sub-periods of time displayed in Table 3.2 and discussed earlier. When individual characteristics only are introduced (model 3), the years' dummies remain significant with the same relation between 1995 and 2000 and 1995 and 2005 pointing out that structural factors measured at the individual level do not account for observed average EU 15 changes in work complexity. Compared to the intercept-only-model the addition of individual variables explains 25%[3] of the individual variance of work complexity. In model 4, country level indicators centred on the European average are introduced in addition to the year dummies, which remain significant but their absolute level increases and in model 4, the year 2005 dummy is greater in absolute value than the year 2000 dummy (-0.062 *versus* -0.051).

Table 3.4. Degree of work complexity in EU15 over 1995-2005: multilevel analysis

	Model 1	Model 2	Model 3	Model 4	Model 4'
Intercept	0.017	0.016	-0.425***	-0.415	-0.395***
Trend analysis					
Year 1995	*Reference*				
Year 2000		-0.055***	-0.048***	-0.051***	-0.089***
Year 2005		-0.038***	-0.038***	-0.062***	-0.079***
Individual level (n = 52248)					
Individual is female			-0.066***	-0.066***	-0.066***
Individual's age is between 15 and 24	*Reference*				
Individual's age is between 25 and 34			0.101***	0.101***	0.100***
Individual's age is between 35 and 44			0.102***	0.102***	0.103***
Individual's age is between 45 and 54			0.082***	0.082***	0.082***
Individual's age is between 55 and +			0.058***	0.059***	0.059***
Individual is self-employed			0.171***	0.171***	0.171***
Individual is on a fixed term contract			-0.060***	-0.060***	-0.059***
Individual's main job involves working with computers			0.216***	0.216***	0.215***
Individual has people under his/her supervision			0.174***	0.174***	0.174***
Agriculture			0.027*	0.026*	0.026**
Manufacturing	*Reference*				
Services			0.018***	0.018***	0.018***
Construction			0.064***	0.064***	0.064***
Public sector			0.058***	0.058***	0.058***
Legislators (and senior officials) and managers			0.256***	0.256***	0.257***
Professionals			0.311***	0.311***	0.312***
Technicians (and associate professionals)			0.301***	0.301***	0.301***
Clerks			0.159***	0.159***	0.160***
Service workers and (shop and market) sales workers			0.143***	0.143***	0.143***
(Skilled) agricultural and fishery workers			0.206***	0.206***	0.209***
Craft and related trades workers			0.228***	0.228***	0.229***

Table 3.4. Degree of work complexity in EU15 over 1995-2005: multilevel analysis *(continued)*

	Model 1	Model 2	Model 3	Model 4	Model 4'
Plant and machine operators	*Reference*				
Elementary occupations			0.003	0.003	0.002
Country level (n = 45)					
Real annual GDP growth				-0.005	-0.000
% trade in goods and services in GDP				0.001	0.002***
Ln of number of patent applications to the EPO per million inhabitants					0.046***
% tertiary attainment for age group 24-64				0.006***	
% aged 50 and more in economically active population				-0.004**	
Unemployment rate				0.003*	
% part-time employment in total employment					-0.008***
% females in economically active population					0.012**
Random components					
Variance of the country level residual errors	0.015***	0.015***	0.011***	0.011**	0.010**
Variance of the individual level residual errors	0.216***	0.216***	0.162****	0.162***	0.162***
Intra-country correlation in percentage	**6.55%**	**6.55%**	**6.52%**	**6.37%**	**5.94%**

*Significant at 10%. **Significant at 5%. ***Significant at 1%. Coverage: salaried and self employed individuals from EU15 private and public sectors.

Source: European working conditions survey 1995, 2000 and 2005, European Foundation for the Improvement of Living and Working Conditions, country level variables are from OECD and Eurostat data bases, analysis and table from Greenan *et al*. (2010).

What does the complete model (model 4) indicate? First of all, work complexity reacts very strongly to the individual characteristics of workers. At the individual level, the typical worker having the most routine job is a young woman (15 to 24 years old), working as a salaried employee with a temporary contract. She does not work with a computer and does not have any management position. She is a plant or machine operator (or in elementary occupation) in the manufacturing sector. It is interesting to look more closely at the occupation and sector coefficients in the regressions. They are quite stable when model 3 is compared with models 4 and 4'. Occupations with the highest degree of work complexity are first professionals, second

technicians and associate professionals and third legislators, senior officials and managers. These occupations are considered as high skills. The medium skills occupations with the highest degree of work complexity are craft and related trade workers and skilled agricultural and fishery workers. Finally, the degree of work complexity is the lowest in low skills occupations and in particular for plant and machine operators. In terms of sectors, construction appears as the sector with the highest degree of work complexity, followed by the public sector, agriculture, services and last manufacturing.

The inclusion of country level variables in model 4 explains about 10% of the country level variance remaining when individual factors are taken into account. As expected, in models 4 and 4', variables that are positively linked to the development of the knowledge base of the economy are positively correlated with the degree of work complexity: tertiary attainments in model 4, log number of patents in model 4'. In both models, the percentage of international trade in GDP is positively linked, to the degree of work complexity, but only significant in model 4'. Countries that are more opened to international trade seem to specialise in activities that entail more complex work. An ageing economically active population implies a lower degree of work complexity, whereas on the opposite, female participation in the labour market is positively linked with it. Countries with higher unemployment rates have a higher degree of work complexity. This could reflect the fact that less complex jobs are the first to be destroyed in economic downturns, when unemployment rates become higher. Conversely, when the activity expands again, the degree of work complexity should fall because less complex jobs are being created, the negative (but non-significant) relationship with economic growth could echo such a mechanism. Lastly, countries where work complexity is high have a smaller share of part-time workers in total employment.

Overall, this multilevel analysis makes the work complexity paradox even deeper. When potential structural factors are taken into account at the individual and country levels, the residual decrease in work complexity becomes larger. This is because many structural forces should drive an increase in work complexity. At the individual level, occupations with higher educational attainments, age as a proxy of accumulated work experience, computer use are associated with higher levels of work complexity. At the country level the development of international trade and of the knowledge base of the economy, as well as the expansion of third level education and an increased female participation favour work complexity. Thus, taking into account these structural factors, we should have observed an increase in work complexity when we observe a slight decrease in simple descriptive statistics. If econometric modelling allows identifying a clear negative residual trend in the average EU15 degree of work complexity once structural factors are taken into account, it does not allow going any deeper into the analysis

because of a lack of data. The next section explores alternative possible explanations of this "work complexity paradox".

Uncovering the work complexity paradox

First, looking more closely at the results of the model some possible structural drivers of a decrease in work complexity can be identified connected with gender, part time, limited contracts, and aging.

There is a vast body of literature, theoretical and empirical, stretching back over more than two decades, on gender and work and the ways in which patterns of segregation are reinforced or challenged. Some positive assumption about changes in work organisation as regards to women are made, such as the idea that new career profiles offer more opportunities for women to follow a successful professional trajectory. Traditional forms of organisation, particularly bureaucracy, where learning opportunities are weaker, would have strictly defined gender roles, while new forms of organisation, would favour more porous gender roles. However, the empirical research often contradicts this assumption (Greenan and Walkowiak, 2005, Liff and Ward, 2001). Results in Table 3.4 show that, all things being equal, women perform more routine jobs. One reason could be that more female-type jobs have moved from the non-market to the market sector and they are often organised in a traditional way with a low level of employee discretion. But this negative result is however mitigated by our positive country level result on female participation.

Countries with a greater percentage of part-time employment are characterised by a lower degree of work complexity. This indicator could reflect the degree of flexibility of the labour market and the quality of jobs, but it is also positively correlated with the percentage of females in economically active population. Like part-time work at the macro level, fixed term contracts at the micro level are associated with lower levels of work complexity. Precarious employment relationship does not favour work complexity but routine jobs with less learning opportunities and competence developments. This result is in line with the one obtained in Table 3.3 for year 2005. Using employee level data from an Italian nationwide survey on skills, Leoni and Gaj (2008) find negative impacts of gender, temporary contracts and part-time contracts on employee level indicators of competences measured through a job requirement approach and in particular problem solving skills. They show that these negative impacts reflect three lacks: lack of experience accumulation at the workplace for the temporary contract effect, lack of continuing vocational training for the part-time effect and lack of access to jobs with innovative organisational characteristics for the gender effect.

Finally, models 3 to 4' show an inverted U-shape profile for work complexity related with age. The younger workers experience the more routine jobs. Then work complexity increases between 24 and 44 and decreases slightly afterwards, remaining at a higher level after 55 than for younger workers. This effect finds a country level counterpart in the negative effect of the share of aged 50 and more in the economically active population. However, as the regression results show it, these factors taken together do not exhaust the decrease in work complexity. Other forces are at play, which are not captured in our measurement frame.

Searching in the literature for alternative explanations, we identified four other possible culprits: growing standardisation, job polarisation, organisational change and skill mismatch. The first two explanations rely on the idea that there is an objective and concrete decreasing trend in work complexity, whereas the third and fourth explanations discuss the fact that this trend is measured through a subjective assessment.

Growing standardisation

In his classic work on the structure of organisations, Mintzberg (1979) identifies two modes of co-ordination involving some standardisation in how work is performed: the standardisation of work processes when the content of tasks can be specified and programmed by means of rules and procedures to secure acceptable outcomes and the standardisation of output when tasks options are uncertain and when expected results can be clearly identified. These two types of co-ordination are associated to bureaucratic forms of organisation. Over the past two decades, much emphasis in the literature has been put on other forms of organisations than the bureaucratic one as responses to the increased complexity and uncertainty in business environment and to the growing importance of knowledge in economic activity. These forms of organisation are more organic and decentralised and involve less standardisation than bureaucratic types of organisation. For example, according to Mintzberg (1979), the archetype of the innovative organisation is the adhocracy, a typical learning organisation where workers are organised in multidisciplinary project teams, with liaison devices to encourage mutual adjustment as the central co-ordination mechanism. Theoretically, as the adhocracy tries to break out from established patterns to innovate, it does not rely on standards.

However, since the mid-1990s, as a response to globalisation and backed up by the availability of ICT that transformed communication costs and drastically reduced the cost of distant co-ordination, many organisations opened up their external boundaries, resulting in a restructuring of value chains. Drawing on material from four case studies on outsourcing practices in the United Kingdom, Grugulis, Vincent and Hebson (2003) come to the conclusion that "in every instance, the process of contracting meant that tasks were more strictly defined and monitored and employees were able to exercise less discretion". Relying on fifty-six organisational case studies of restructuring processes across Europe conducted in the EC funded WORKS project, Greenan, Kocoglu *et al.* (2008) point out that the main change in work organisation associated with ICT diffusion is a higher standardisation of work and an increase in work control through electronic devices. When organisations decide to outsource or offshore some of their activities, they face a problem of loss of control that they partially master through the use of ICT like Enterprise Resource Planning Software, workflow management technologies or supply chain management technologies which allow a quasi integration of business partners. A prerequisite of ICT use is then a standardisation process which generates routine tasks and specified products and services that can be easily outsourced or offshored. ICT then plays a role at two levels in the inter-organisation relationship: they embed standards and they structure the flow of information about the outsourced activity between business partners. If ICT involves codification of knowledge and standards, many new management concepts also contribute to the generation of standards: quality certification (like the International Organisation for Standardisation certification), traceability tools, Service Level Agreements, performance tracking systems, etc.

Moreover, as pointed by Ellström (2001), the links between formalisation of work processes through the use of standards and organisational learning needs further investigation. Formalisation appears to be a double-edged sword. By reducing variations in task performance and inducing a focus on solutions that fit established procedures, standards are likely to cut some learning opportunities. However, standards save time and attention that may be reallocated to more creative tasks and by codifying previously tacit knowledge and best practices and creating more transparency they may contribute to organisational learning. Thus there is indeterminacy and employers need to strike the right balance between standardisation and mutual adjustment which are two different modes of co-ordination.

There could also well be a specific time frame in developments of work complexity in a given workplace or industry: cycles between more complexity and less complexity could alternate with the development of technical progress. Innovation is favoured by the higher work complexity that characterise learning organisations, but once it has taken place, new knowledge and

practices are codified and embedded into new standards and routines that contribute to lowering the degree of work complexity. The decrease in work complexity over 1995-2005 would then reflect a cycle of standardisation following a learning phase connected to the massive diffusion of ICT.

A last point worth noting is that moving up the value chain does not necessarily imply greater work complexity. In other words, the relationship between the complexity of the product and the complexity of work is not necessarily positive and linear. According to the available technology, segments of the value chain can become easy to standardise and thus outsource and these segments can be situated at the top as well as at the bottom of the value chain. For example, in the automobile industry, the key business processes that have been standardised are product design, product planning, inventory and logistic control and various stages of the production (Sturgeon, 2008). Unfortunately, the lack of data on business practices and work organisation does not allow assessing and analysing the trend towards growing standardisation connected to the diffusion of specific ICT.

Job polarisation

The decrease in work complexity appears to be strongest in the United Kingdom, Germany, Spain and Italy and this result holds once industrial structures have been accounted for. It is interesting to note that in the United Kingdom and Germany, a case for growing job polarisation linked with ICT diffusion has been made (Goos and Manning, 2007; Spitz-Oener, 2006).

To understand the interplay between computerisation and job skill demands, Autor, Levy and Murnane (2003) built up measures of tasks performed in particular jobs and their change over time between 1960 and 1998 based on the Dictionary of Occupational Titles and applied to the census occupation codes. Five different types of tasks are identified within jobs: non-routine analytic, non-routine interactive, routine cognitive, routine manual and non-routine manual. In the case of the United States, the documented task shift towards non-routine cognitive tasks, pervasive in gender, education and occupation groups, is positively associated with the adoption of computer technology. Decreasing trends in both routine cognitive and routine manual tasks are the other side of the coin. Autor, Levy and Murnane also argue that technology cannot replace human labour in non-routine manual tasks requiring the flexible use of the brain, eye, hands and legs.

Goos and Manning (2007) revisit this finding for the United States, showing that jobs requiring non-routine tasks tend to be at the top and at the bottom of the wage distribution, while the jobs that require routine tasks tend to be in the middle, leading to a job polarisation pattern which they also

find in the United Kingdom between 1975 and 1999. Thus middling jobs, that are mainly clerical jobs, like book keepers or bank employees and skilled manual jobs have become less numerous. Spitz-Oener (2006) replicates Autor, Levy and Murname's research using West Germany data and also observes a hollowing out of middle class occupations between 1979 and 1999. We may also note that Polavieja (2005) mentions a polarisation process in Spain over the 1987-1997 period, but he connects it with labour market reforms rather than with technology. Using the harmonised European Union Labour Force Survey, Goos *et al.* (2009) map occupational changes in 16 European countries over the period 1993-2006 show that on average, the low and high paying occupations increase their employment shares by six and two percentage points respectively, whereas the middling occupations decrease their employment share by 8%. This polarisation trend is particularly strong in the UK, Germany and close to the EU average in Spain.

The positive correlation we find in Table 3.4 between computer use and work complexity at the worker level is in line with the positive correlation between computer use and non-routine cognitive tasks. The tasks performed by computer users are complex and they involve discretion, learning and problem solving abilities. The negative trend in work complexity could however reflect the displacement of workers from middling jobs to non-routine manual jobs. According to Spitz-Oener, examples of such occupations are waiters, domestic staff, blacksmiths, or transport equipment operatives. Moreover, standardisation and polarisation could well be connected and indirectly linked to technological progress. ICT contributes to the global restructuring of value chain. In this process, outsourced or offshored tasks and work processes are standardised. If these tasks were previously performed by occupations with intermediate skills, global value chain restructuring would induce both polarisation and decreased work complexity. This would reflect a "power biased" use of ICT in value chain restructuring, in line with the increased intensity of work effort, which has been empirically documented by Green (2005) in the United Kingdom and with the theoretical model proposed by Guy and Skott (2007) where the use of ICT allows firms to monitor low skill workers more closely and may drive a simultaneous occurrence of lower wages, higher unemployment and higher work effort for the lower skills.

This thesis would require further assessment both theoretically and empirically. In particular, it would be important to understand why some countries face higher decrease in work complexity than others. If the explanation has something to do with technical progress, we need to identify some heterogeneity in the way it is embodied in work processes at the national level. Chapter 2 has made a step in this direction by showing a spread across Europe of different forms of work organisation. If the lean production model implies more standardisation than mutual adjustment, then this could explain the sharp decrease in work complexity in the United Kingdom where it is prevalent. In Spain and Italy, traditional and Taylorist forms of organisation are more frequent, with some implications probably on the way ICT enter the work process. The German case is more difficult to analyse in the light of the work organisation typology as it is a country where the discretionary model is rather frequent.

Organisational change and feeling of overqualification

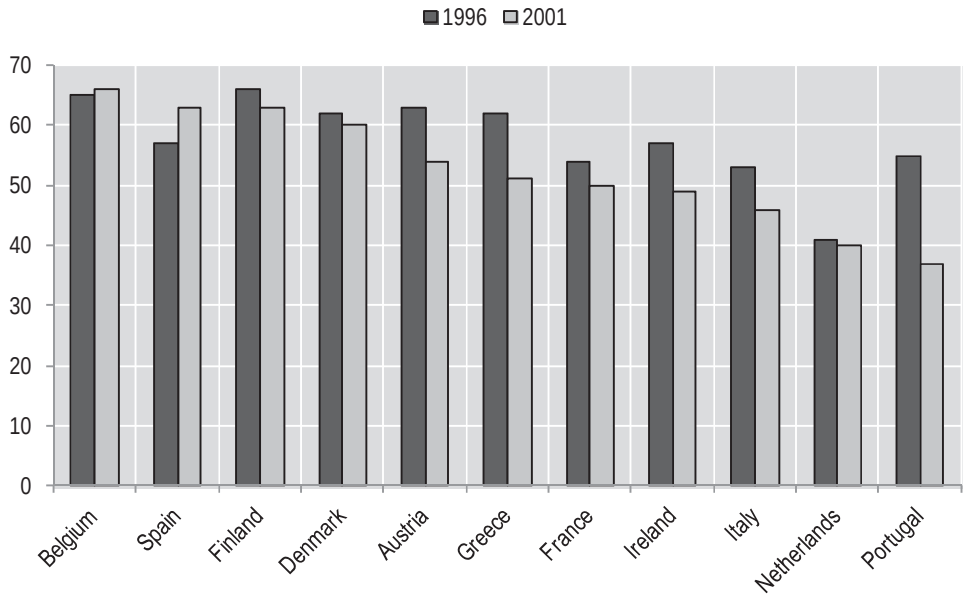
Up to now, we have considered that the decreased work complexity reflected a hard fact. However, in trying to explain the work complexity paradox, we need to consider the fact that even though questions in the European Working Conditions Survey are formulated in a simple and objective way, work assessments provided in employee declarations remain subjective in nature. Thus the average European workers could feel that his job is becoming less complex over time, even though, objectively, it is difficult to observe a decrease in skill content. Two main causes could generate such a feeling: organisational change and overqualification.

Case study evidence shows that organisational changes put into question the way employees view and assess the content of their jobs. If organisational changes have some deep consequences on task content, they can be viewed as deskilling, even when new skills are involved. The past trajectories of workers have an influence on how they value the content of their work. If some positively valued dimensions of work disappear, the new dimensions may be negatively considered, even when they incorporate new skills. For example, Dahlman (2007) describes the restructuring of an IT help desk in a British local government involving an IT workflow management system. More interpersonal skills are required from the staff transferred to this help desk. However, IT staff with experience of the previous work organisation have a technical background. They feel that they have less discretion because the new IT system requires logging every work-related task and scheduling work to be carried out when before work tended to be carried out on an *ad hoc* basis. Even if some training has been provided to update their skills and develop inter-personal skills, IT staff report that they do not feel they have learned more or developed new skills. Moreover, skill obsolescence

may arise from repeated change, driving a feeling of loss and of work becoming less enriching.

Overqualification is a last culprit for the decrease in work complexity. The feeling of overqualification is quite widespread across Europe (Brunello *et al.*, 2007; Brynin and Longhi, 2009). The European Community Household panel provides a self-reported measure through the question "do you feel to have skills or qualifications to do a more demanding job than the current one?". In 2001, the proportion of workers who feel overqualified varies from 40% in the Netherlands to 66% in Belgium. It reached 46% in Italy and 63% in Spain (Figure 3.1). Unfortunately this measure is not available for the United Kingdom and Germany.

Figure 3.1. Percentage of workers who feel overqualified



Source: European Household Community Panel, 1996 and 2001.

Overqualification is a puzzle for human capital theory, and it does not fit well with the skill bias technological change evidence. Machin and McNally (2007) rule out the explanation in terms of over-supply of tertiary-educated graduates. Other possible causes can be related to specific employment practices such as flexible employment, to the fact that employers cannot discriminate easily between different skill levels (Brynin and Longhi, 2009), to design problems in the educational system making it difficult to provide the skills needed by the market and to the interplay between institutions,

educational choices and the labour market in matching the supply and demand of skills (Brunello *et al.*, 2007). Like for organisational change, overqualification could drive a relative negative assessment of work content: the worker compares his situation, not to a past one like for organisational change, but to a virtual one corresponding to his alleged level skill. A discrepancy between the two assessments could drive an underestimation of the level of work complexity.

Summary

This chapter has reviewed results obtained by Greenan, Kalugina and Walkowiak (2010) about trends in work organisation over 1995-2005 using the European Working Conditions survey. They measure a synthetic indicator of the degree of work complexity that is comparable over time, using Multiple Correspondence Analysis and find an average decreasing trend in EU15, driven by results in Germany, Great Britain, Italy and Spain. They then try to uncover this work complexity paradox by taking into account structural factors influencing work complexity at the individual and country level using a multilevel modelling approach. Once structural factors are taken into account, the work complexity paradox becomes deeper: they estimate a negative residual trend that is even stronger than what is measured in descriptive statistics. This is because, many structural factors should have contributed to an increase in work complexity and in particular, the development of the knowledge base of the economy shifts in industrial structures and ICT diffusion. However, the model identifies five variables that are negatively connected with work complexity: at the individual level, women appear to have lower access than men to jobs with innovative work characteristics; there is an inverted U-shape profile for work complexity in relation with age and limited contracts are associated to less work complexity, at the country level, the share of part-timers and the ageing of the workforce drive a decrease in work complexity. Then four possible culprits that are not measured in the available databases are discussed: standardisation, job polarisation, organisational change and overqualification. The first two explanations make the assumption that the decreasing trend in work complexity is an objective phenomena, the two other ones explore how it could be related to subjective assessments of persons in employment.

Notes

1. The full descriptive report of the Fourth European Working Conditions Survey is available on the European Foundation website: *http://eurofound.europa.eu/ewco/surveys/EWCS2005/index.htm*.

2. Inertia in multiple correspondence analysis is an indicator of heterogeneity, analogous to variance in factor analysis.

3. More precisely, by comparing variance of the individual level residual errors in models 1 and 3, we have (0.216-0.162)/0.216 = 0.25.

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Annex 3.A

Multilevel model used in Chapter 3

A benchmark regression to identify within-country and between-country variance

Respondents in the EWCS are persons in employment from each EU country. Thus the dataset is hierarchical, with a level 1 (the individual, indexed by *i*) nested in a level 2 (the country, indexed by *j*). Multilevel modelling is adequate for that type of data structure, and in particular when there is a "level 2 effect", that is when the answers given by individuals at level 1 are correlated. In our case, the "level 2 effect" is a country effect.

The first step in multilevel modelling is to identify within-country and between-country variance through a benchmark regression: the intercept only model. If there are no explanatory variables at level 1, the model equation can be formulated as follows:

$$Y_{ij} = \beta_{0j} + r_{ij}, \quad \text{where } r_{ij} \sim N\left(0, \sigma^2\right) \tag{1}$$

In traditional models, β_{0j} is an intercept and r_{ij} a random term. In the presence of a country effect, there is a correlation between observations within countries, resulting in differences in country intercepts, which may be expressed as follows:

$$\beta_{0j} = \gamma_{00} + u_{0j}, \quad \text{where } u_{0j} \sim N\left(0, \tau_{00}\right) \tag{2}$$

The full model is specified by substituting (2) in (1):

$$Y_{ij} = \gamma_{00} + u_{0j} + r_{ij} \quad \text{where } u_{0j} \sim N\left(0, \tau_{00}\right) \text{and} \quad r_{ij} \sim N\left(0, \sigma^2\right) \tag{3}$$

This model allows decomposing the total variance into two independent components: the variance of individual-level errors (r_{ij}) and the variance of the country-level errors (β_{0j}). The intra-country correlation can be expressed as:

$$\hat{\rho} = \frac{\hat{\tau}_{00}}{\hat{\tau}_{00} + \hat{\sigma}^2}$$

It indicates the proportion of the variance explained by the grouping structure in the sample. It can also be interpreted as the expected correlation between two randomly chosen units that are in the same country. In other words, this intra-country correlation measures the share of the total variance that occurs between countries. In Table 3.3, the EU15 intra-country correlation of the degree of work complexity is computed for each of the three waves of the EWCS (1995, 2000 and 2005).

Four models

In the following modelling steps in Chapter 3, the three waves of the EWCS are pooled. The intercept only model on the pooled data set (model 1) is computed first. Then the model is enriched with year 2000 and year 2005 dummies (model 2). As year 1995 is the reference year, the coefficient associated with each time dummy gives the EU15 average trends in the degree of work complexity between 1995 and 2000 and 1995 and 2005. An aim in this modelling is to check the sensitivity of computed trends to the inclusion of individual level and country level structural variables. In model 3, there are time dummies and individual level variables. Finally, model 4 is the complete model, with time dummies, individual level variables and country-level variables. Two versions of model 4 (4 and 4') are estimated, using two different sets of country level variables.

Model 1. Intercept-only model

$$Y_{ij} = \beta_{0j} + r_{ij} \text{ where } r_{ij} \sim N(0, \sigma^2)$$
$$\beta_{0j} = \gamma_{00} + u_{0j} \text{ where } u_{0j} \sim N(0, \tau_{00})$$
$$Y_{ij} = \gamma_{00} + u_{0j} + r_{ij} \text{ where } u_{0j} \sim N(0, \tau_{00}) \text{ and } r_{ij} \sim N(0, \sigma^2)$$

Model 2. Inclusion of time dummy

$$Y_{ij} = \beta_{0j} + T_1 Year2000 + T_2 Year2005 + r_{ij} \text{ where } r_{ij} \sim N(0, \sigma^2)$$
$$\beta_{0j} = \gamma_{00} + u_{0j} \text{ where } u_{0j} \sim N(0, \tau_{00})$$

$Y_{ij} = \gamma_{00} + T_1 Year2000 + T_2 Year2005 + u_{0j} + r_{ij}$ where $u_{0j} \sim N(0, \tau_{00})$ and $r_{ij} \sim N(0, \sigma^2)$

Model 3. Inclusion of only individual variables

$Y_{ij} = \beta_{0j} + T_1 Year2000 + T_2 Year2005 + \beta_{ij} Ind_{ij} + r_{ij}$ where $r_{ij} \sim N(0, \sigma^2)$

$\beta_{0j} = \gamma_{00} + u_{0j}$ where $u_{0j} \sim N(0, \tau_{00})$

$Y_{ij} = \gamma_{00} + T_1 Year2000 + T_2 Year2005 + \beta_{ij} Ind_{ij} + u_{0j} + r_{ij}$ where $u_{0j} \sim N(0, \tau_{00})$ and $r_{ij} \sim N(0, \sigma^2)$

Model 4. Full model with individual and macroeconomic determinants

$Y_{ij} = \beta_{0j} + T_1 Year2000 + T_2 Year2005 + \beta_{ij} Ind_{ij} + r_{ij}$ where $r_{ij} \sim N(0, \sigma^2)$

$\beta_{0j} = \gamma_{00} + \gamma_{0j} Macro_j + u_{0j}$ where $u_{0j} \sim N(0, \tau_{00})$

$Y_{ij} = \gamma_{00} + \gamma_{0j} Macro_j + T_1 Year2000 + T_2 Year2005 + \beta_{ij} Ind_{ij} + u_{0j} + r_{ij}$ where $u_{0j} \sim N(0, \tau_{00})$ and $r_{ij} \sim N(0, \sigma^2)$

Chapter 4

Behind innovation: employer and employee trade-offs

This chapter focuses on the issues faced by organisations that are willing to encourage innovative work behaviours and organisational learning processes. The trade-offs that employers face when they decide to make new strategic decisions implying some changes in work methods, organisational structure, products or processes are first described. Then what happens on the employee side is considered.

Chapter 1 provided a definition of a learning organisation. Using the European Working Conditions survey, Chapter 2 assessed the spread of the learning model of work organisation across Europe, its relation to learning culture and HRM practices, and its links with innovation and with labour market institutions. Chapter 3 has identified a trend of decreasing work complexity between 1995 and 2005 and proposed alternative explanations. This empirical analysis has pointed to the existence of a significant heterogeneity across European nations in the way learning and knowledge enter production processes. It thus seems necessary to revisit the relationships between the diffusion of ICT, organisational models and innovation and to identify the trade-offs that employers and employees face in these relationships. This will allow to better understand why organisations opt for different types of arrangements, sometimes translated into national models according to institutional settings at the national level.

The learning organisation literature highlights that innovation is not only produced by structures and people doing scientific and technological work. In this chapter, we focus on the issues faced by organisations that are willing to encourage innovative work behaviours and organisational learning processes. We will first focus on the trade-offs that employers face when they decide to make new strategic decisions implying some changes in work methods, organisational structure, products or processes. We will then consider what happens on the employee side.

Designing adaptive or learning organisational structures

A new business generally starts with a new idea, new equipment, a new management concept or the identification of a non satisfied customer need. This critical resource is made out of knowledge, and it is the source of the entrepreneurial rent. Thus, the entrepreneur is facing a main problem which is how to enlist the co-operation of workers who will contribute to creating value out of this critical resource, without ceding to them too much of the surplus that the new activity will generate (Rajan and Zingales, 2001). Organisational design and more precisely, the design of the structure of the organisation and of some core HRM practices is a response to this problem.

Rajan and Zingales (2001) propose a simple model to explore the implications of this founder primary trade-off. They explore two possible organisational structures, vertical and horizontal hierarchies and formalise three mechanisms that may tie workers to the firm's critical re*Source:* access which is the ability to use or work with it, specialisation which is the acquisition of knowledge about the resource and learning about how to work with their superior (firm specific assets) or ownership of the resource. In the vertical hierarchy, the entrepreneur controls access to the critical resource so

as to favour specialisation and then uses specialised employees to control the action of new employees, who have a position of subordinate; in the horizontal hierarchy, where all employees are directly connected to the entrepreneur, access to the resource is limited and incentives to specialisation are given on the ground that ownership may be granted in a subsequent period (tactic of divide and conquer). They show that, because in human capital intensive industry it is easier to get hold of an entrepreneur's critical resource, flat organisational structures, like in law or consulting firms, will be more prevalent, with up or out promotion systems. By contrast, in physical capital intensive industries where property rights are more easily protected from expropriation, large and steep hierarchy with seniority based promotion will be more frequent, where promotion is simply a way of filling sensitive position with employees that proved loyal.

As the firm grows, the initial critical resource expands through learning by doing. Managers and employees develop informal communication channels for talking about the tasks that are performed, the precise equipment and production arrangements used and sharing tacit knowledge. Informal work routines, technical jargon and specific vocabulary patterns are developed which progressively build up into the firm's own language as new projects are undertaken and valuable experience is gained. Chowdhry and Garmaise (2003) argue that the richness of a firm's language, measured by the breadth of the set of tasks covered by its communication channels, is the essential component of its organisational capital. They show that HRM practices will have a crucial influence on the evolution of organisational capital. In particular employee retention and insider managerial succession are two important features for the accumulation of organisational capital.

Garicano (2000) provides another model of communication in organisations. His starting point is that production requires physical resources and knowledge about how to combine them. If communication is available, workers do not need to acquire all the knowledge involved in production activities. When matching problems with those who know how to solve them is costly, knowledge tasks can be divided between production workers and specialised problem solvers. Production workers acquire knowledge about the most common or easiest problems they are bound to face in their every day work and specialised problem solvers deal with more complex problems. They derive optimal knowledge hierarchies characterised by a number of layers, the problem solving ability of workers, reflecting the discretion they have and the proportion of problem solvers assigned to each layer. The key trade-off for the organisation occurs between communication and knowledge acquisition costs. Garicano (2000) then suggests that the different waves of ICT had different cost implications. First, expert systems and codification allowed by computers have cut the cost of acquiring

knowledge, leading to flattened hierarchies and empowerment of production workers. Second, email and network technology has reduced the cost of transmitting knowledge, and this could also result in flatter hierarchies but with a smaller range of expertise or less empowerment for production workers.

Bloom *et al.* (2008) test this theoretic result using a British international employer survey of management practices matched with a private technology database giving information at the establishment level on ICT uses. They find a positive relationship between some software use (ERP and CADCAM), employee discretion and management span of control, and a negative one between network technology and employee discretion. Spagnolo (1999) adds social relations to the analysis of communication and knowledge building. He shows that some value is generated from linking social and production relations. In other words, employing members of the same community in teams or encouraging social interactions between employees facilitate co-operation in production. A central reason is that it generates transfers of trust securing resource exchanges within teams, which are so critical for innovation (Tsai and Ghoshal, 1998).

Knowledge about the organisation's activity is a critical asset and the reviewed models identify some important trade-offs linked to the setting up of a business, to knowledge accumulation over time and to the organisation of its efficient use in production. Here, we further elaborate on what organisational designs are conducive to a high capacity to adapt and to compete through learning.

Dessein and Santos (2006) provide an answer to this question. Their team theory model of "adaptive organisation" is interesting from two standpoints: it pinpoints a key trade-off for organisations willing to adapt to their environment and it links it to the use of ICT. Adaptation needs an intensive use of information, but this information is local, dispersed among employees. Some organisational design options contribute to fixing how "adaptive" or "information intensive" an organisation will be: the number of tasks assigned to an employee (task bundling), how much an employee can tailor his primary action to his local information (discretion) and the communication intensity between employees. The choice of an organisational design has to deal with a central trade-off between specialisation and adaptation. There is a positive return to specialisation, but co-ordination is more costly when specialised employees adapt to local information. Thus specialisation is limited by how adaptive or information intensive the organisation is. Improved ICT has an ambiguous effect: on one hand, for a given level of employee discretion cheaper technology makes it easier to co-ordinate specialised activities; on the other hand, organisation can take advantage of improved ICT to become more adaptive, increasing the need

for task bundling. However, when the firm chooses its communication intensity, for a wide variety of communication technologies, intensive communication, broad task assignment and employee discretion are complementary organisational features. Thus, organisations tend to be of two very distinct types: either routine, specialised and with limited communication or adaptive, with broad task assignments and intensive communication.

In "adaptive organisation", the employee is given the discretion to adapt continuously production to local conditions. This kind of adaptation regime does not repeatedly put into question organisational design parameters. But what about repeated organisational innovation, is it sustainable?

Is it reasonable to think that an organisation could keep on changing its strategy and structure? According to Hannan and Freeman (1984), the process of selection among businesses tends to favour the stability of the system at the cost of a high level of inertia. Thus companies that initiate major organisational change to cope with environmental threats face a higher risk of failure or mortality. Evolutionist approaches stress the importance of the timing of changes. Three factors are fundamental: the temporal pattern of changes in the organisation's environment, the speed of learning mechanisms and the responsiveness of the structure to designed changes. Organisational structures will have a high degree of inertia "when the speed of *re-organisation is much lower than the rate at which the environmental conditions change*" (p. 151). When new sets of opportunities appear in the market, another key factor is the speed with which an entrepreneur can begin a new organisation. Hannan and Freeman (1984) also identify a trade-off between the reliability and accountability of modern organisations and the ability to respond quickly to new opportunities. As the modern world favours organisations that perform reliably and can account rationally for their actions, this trade-off generates structural inertia in a population ecology perspective. It does not mean, however, that inertia pressures are uniform among populations of firms; they vary with age, size and complexity of organisations.

These issues echo our previous discussion of the trade-off between standardisation and mutual adjustment. They have been further discussed in empirical work focusing on the effect of prior change on the likelihood of further change. A positive and significant relationship would imply that the process of change itself can be routinised. Nelson and Winter (1982) suggest that the opposition between routinisation and innovation may be overcome when the organisation innovates through new combinations of existing and reliable routines. Change routines and confidence in executing a certain organisational change develop with the accumulated experience of change, with a drawback, labelled as "competency" trap, where a change may be applied whether or not it actually solves problems. A consensus on the self-reinforcing nature of the process of change ("repetitive momentum hypothesis")

has emerged: in the long term, the inertia of an organisation tends to increase, but the occurrence of a change makes it temporarily more flexible. Once the inertia forces have been surmounted, change may gain momentum but deceleration occurs with the age of the organisation and elapsed time since the last change (Amburgey, Kelly and Barnett, 1993). A more recent empirical study shows however that when controlling for unobserved heterogeneity, the opposite result shows up : the observed repetitive momentum effect comes from structural differences in organisational change propensities, linked to the fact that some organisations face more turbulent environments (Beck and Brüderl, 2008).

In total, from an employer point of view, some organisational design parameters are going to be critical for the long term perspective of the organisation. Its initial organisational structure is a core decision for an entrepreneur who sets foundations for a new business. By fixing how employees have access to the organisation's critical resources and knowledge, it sets the basis of a psychological contract between the employer and the employees. As the initial critical knowledge resource expands through collective learning by doing, HRM practices become another key feature. The structuring of the information system is another important area of organisational design: how are knowledge tasks divided between direct producers and specialised problem solvers? How do ICT contribute to information processing and communication? How are social relationships articulated with production relationships? Employers appear to be confronted with a central trade-off between standardisation/routine and mutual adjustment/innovation when making decisions in these areas. Designing a stable organisational structure with some dynamic properties is a key issue behind this trade-off. Another way to express it is that the changes or innovations induced by "adaptive" or "learning" forms of organisations have to be sustainable. Changes or innovation have to be in a range that do not put the structure into question or that preserve inertia forces. The point of view of employees is going to be critical in building this thin line between disruptive and sustainable change.

Organisational change, innovation and employee outcomes

By focusing on learning organisations, this report explores one option for organisations to become more innovative, which is to encourage their employees to develop innovative work behaviours. But why would an employee contribute to the development of organisational capital by giving his good new ideas about how to improve the technology or reduce the cost of production?

Carmichael and MacLeod (2000) address this issue of worker co-operation by considering the incentive system. If the output produced by the employee is observable, a simple solution is to pay a fixed piece rate: as increased output would then directly be reflected in their own salaries, workers should co-operate with technical changes. However, this is not what seems to have generally happened in the history of Western manufacturing: it is very seldom that innovative firms commit to a constant piece rate, leading to the "ratchet effect" and to a bad outcome where workers prefer to keep their good ideas to themselves. The authors argue that the leakage of knowledge to other firms is the main reason why a fixed piece rate is not sustainable for the employer. This is the same type of motive as the one stressed by Rajan in Zingales (2001) for employers in human capital-intensive industries where it is difficult to protect critical knowledge resources. If piece rates are not optimal to obtain co-operation when firms face competition on their market, the employee's involvement in the organisational learning should respond to compensation systems. MacLeod and Parent (1998) propose a theoretical framework linking job characteristics and compensation forms and question the diffusion of performance pay (piece rate, bonus or commissions) in the United States without being able to analyse it jointly with trends in job characteristics.

However, research on intrinsic motivation challenges this view by showing that environments which emphasise more on extrinsic rewards like performance pay may crowd out motivation derived from internal values and preferences (Frey, 1997). In particular, it is sometime argued that workers will be most creative when they feel motivated primarily by the interest, enjoyment, satisfaction, and challenge of the work itself, like in artistic occupations, and not by external pressures or inducements. Further research is thus needed to establish whether employers should combine or set apart practices that favour extrinsic and intrinsic dimensions of motivation in a perspective of knowledge sharing and innovation. Galia (2007), using employer level data, makes a first step in this direction.

In their discussion of organisational change, Hannan and Freeman (1984) stress that the diversity of interest among members of the organisation generates loose coupling between the intentions of rational leaders and organisational outcomes. In this case, organisational outcomes depend on internal politics and on the balance of power among the stakeholders. The economic literature on employee resistance to change identify vested interest of different stakeholders in organisation as potentially disruptive for technological and organisational changes. When innovation generates productivity shocks on employees' relative productivity, some jobs may become threatened. If employees anticipate the future and adapt strategies accordingly, the group of employees with growing job insecurity may start

lobbying against innovation. As a result, when employers decide to change the strategy or structure of their organisation, they have to deal with an employee participation constraint: changes must be such that employees are willing to support it.

What are the factors generating support or resistance to change and innovation? In the economic literature, a classic determinant is *employee representation* or *union presence*. Unions are in the position to influence the adjustment costs of change and they can choose to oppose or support change, according to its consequences, through negotiation. Dowrick and Spencer (1994) refer to the Luddite revolts in England and try to identify when it is rational for trade unions to oppose labour saving innovation. They show that union opposition tends to occur when union value jobs rather than wage increases and when labour demand is relatively inelastic. Two interesting predictions also derive from the model: first, unemployment insurance, whether provided by the union or by government, is likely to reduce union concern about the threat of job loss and to generate more support for innovation. Second, as noted by Carmichael and McLeod (1993), multiskilling could mitigate resistance to innovation as an employee whose task is hit by labour-saving innovation can migrate to his other task without additional cost. Japanese firms would be better armed against asymmetric productivity shocks as those stemming from process innovation because they favour multiskilling. Van Reenen and Menezes-Filho (2003) survey the economic literature on the impact of trade unions on innovation and find no consensus, but a different pattern shows up between North American and European studies, the latter giving evidence of a more positive impact of unions. An interpretation of this pattern would be that European unions place a higher weight on jobs than on wages in their preferences (or utility function).

Canton, de Groot and Nahuis (2002) and Bellettini and Ottaviano (2005) explore the assumption that *age groups* may have diverging vested interest. Age directly creates differences in time horizon. Canton, de Groot and Nahuis (2002) investigate how these differences impact innovation. Their theoretical model, with three overlapping generations show how the demographic structure of a country may influence its growth. Belletini and Ottaviano (2005) assume that junior and senior employees do not value likewise different forms of innovation. The former prefer radical innovation, the latter incremental innovation (learning by doing) on the existing production process. This structure of preferences derives from differences in skill obsolescence induced by the two types of innovation for the two generations. Junior employees will encourage new routines whereas senior employees prefer not to challenge the organisational legitimacy. Hence, employees' anticipation about the benefits and costs of innovation will

contribute to the setting up of barriers against innovative projects or conversely to collective support and appropriation of innovation. Only very few empirical studies on the determinants of innovation investigate factors that could influence employee support. Using a German innovation survey in the service sector, Zwick (2002) analyses the determinants of an indicator of employee resistance to innovation declared by employers. He shows that employees oppose innovations that endanger employment, intensify work or imply large adoption costs. Diaye *et al.* (2006) analyse the determinants of the adoption of ICT and new organisational practices in French manufacturing firms. They find that age pyramids where junior employees are the most numerous are the most favourable to the adoption of technological and organisational changes. They also show that the employment instability of young workers relative to workers of intermediate age have a negative impact on changes.

More recent literature on the outcomes of innovation for employees allows going deeper into the factors that facilitate or inhibit innovation from an employee and group level perspective Janssen, Van de Vliert and West (2004) propose a psycho-sociological analytical frame to identify the factors that regulate positive and negative outcomes of innovation for individuals and groups when they take the risk to engage in innovative activities.

First, innovative work behaviour is demanding. It requires a broad variety of cognitive and socio-political efforts and investments which may lead to success or failure, high or low performance in the main task, conflict of cohesion with co-workers, positive or negative job attitudes and high or low levels of well being. The *characteristics of the innovative idea* are a first factor that moderates the outcome of innovative work behaviour. Radical innovation, directed to the core of the primary tasks of employees and with repercussions for the whole organisation should be more costly in terms of effort and more uncertain in terms of outcome than incremental innovation, directed to the periphery of primary tasks and limited to the work domain of the employee.

Skills and attitudes of the innovative employee are a second factor. Cognitive and interpersonal skills, willingness to discuss and resolve disagreements will facilitate innovation and lower the incidence of conflict. Highly job-involved innovators for whom innovative performance is identity relevant will produce greater inter personal conflict in cases where innovation meets the resistance to change other actors.

Group processes in the team of co-workers are a third factor. Innovation is very seldom the result of the activity of one individual alone. Teamwork and co-operation are essential. Appropriate team knowledge, skills and abilities will affect group processes. They include conflict resolution skills,

collaborative problem solving skills, communication skills, goal setting and performance assessment skills. Group effectiveness will be enhanced by clarity and commitment to shared team objectives and participation in decision making. Group diversity and team tenure are two characteristics of teams that should favour positive innovation outcomes.

The *leadership style of employee supervisors* is a fourth factor. Close monitoring of employees creates a negative climate for innovation. Innovators need some autonomy from organisational rules and procedure. Participation and direct support stimulate innovative work behaviour: a participative leadership implies consultation and delegation, and support relates to recognition and providing resources for innovation. Innovative employees are also likely to gain more from innovation if their supervisors approach and manage their innovative ideas from a mastery orientation rather than a performance orientation.

The *organisational context* is a fifth factor influencing the outcome of innovative work behaviour. It can be thought of negatively, in terms of barriers to innovation or positively, in terms of promoting an adaptive or innovation culture. "Silo" mentality, blame culture, poor communication, short-term perspective, risk avoidance, bureaucracy are organisational traits that impede positive outcomes from innovative work behaviour and thus negatively impact innovation. Innovating in a mechanistic organisation, designed to protect established courses of action is more likely to provoke conflict than in a more organic organisation where employees are expected to co-ordinate through mutual adjustment. Support for change, customer focus and organisational learning are three characteristics of the organisational context that contribute to the promotion of an innovation culture. Support for change is decisive in the face of potential conflict emerging from innovation. Customer focus is interesting from two standpoints: on one hand customers are an important source of feedbacks, comments and suggestions on the organisations' activities; on the other hand, changes initiated by customers' feedback have a "natural" legitimacy and lower conflict potential than changes initiated from inside the organisation. This is particularly true in the public and service sectors where a large fraction of the labour force works in direct contact with the customer (whether client, citizen, pupil, patient, etc.). Finally, as has already been stressed earlier, organisational learning is critical because it brings together and consolidates individual knowledge dispersed throughout the organisation as well as regulates knowledge appropriation by individual employees.

Empirical research studies based on large-scale databases and linking information on organisational structure and practices or innovation with employee outcomes are not numerous. Anderson, de Dreu and Nijstad (2004) note that although research interest among organisational scientists into

innovation in the workplace has been growing with a strong development of empirical studies, it is very seldom that they study innovation as an independent variable, across countries and within a multilevel framework where the employee, group and organisational levels are distinguished. However, in the industrial relations field, the concern about employee level consequences of workplace innovation has contributed to a debate opening a stream of empirical research that has first exploited some employer level sources of information. This literature is more focused on organisational innovation than on other types of innovation. Workplace innovation generally designates the use or implementation of new organisational practices or work methods. Practices at stake are those that are core in the 'learning' or "lean" models described in Chapter 2: team work, job rotation, quality norms, incentive systems etc. Their implementation in an organisation could signal employer's willingness to switch to a more 'adaptive' or "learning" type of organisation.

As summarised by Kalmi and Kauhanen (2008) empirical results on the impact of workplace innovations on employee outcomes have been somewhat conflicting in the field of industrial relations with a view arguing on mutual gains for employers and employees and another one, more critical.

The mutual gain literature emphasises the increase in discretion connected with workplace innovation and the resulting monetary and psychological benefits. Empirical studies mainly focus on well being, wages and employment stability. Ben-Ner *et al.* (2001), using an employer survey from a wide range of industries in the State of Minnesota, relate indicators of employee participation to decision making and financial returns with employer level indicators of performance and employee outcomes. They find mixed evidence where firms do not seem to benefit from their human resource practices and workers outcomes are only partly favoured. Employee participation is associated with higher wages, but lower employer performance and employment stability. Freeman and Kleiner (2000) show on United States data that employee involvement practices only have marginal productivity impacts, but they contribute to substantially increasing employee well being. Black, Lynch and Krivelyova (2004) show that self-managed teams, job rotation and profit sharing increase inequalities within establishments and that their effect on employment reductions are mixed, depending on the presence of trade unions within the establishment.

In contrast, the critical view argues that the limited gains accruing to employees are outweighed by increased stress, intensification and work injury (Ramsay *et al*., 2000; Godard, 2001; Green, 2005). For example, using an establishment level database linking the use of a set of organisational practices to the rate of cumulative trauma disorders, Brenner *et al.* (2004) find a significant and positive link for quality circles and just-in-time production

systems. This could reflect the loose coupling between employer and employee outcomes in the presence of a diversity of interest among members of the organisation or uncertainties about means–ends connections in a context of change (Hannan and Freeman, 1984).

Some steps forward have been made more recently by papers based either on employee level surveys or taking advantage of the development of new survey instruments linking employer and employee levels of information. Using an Italian employee survey on skills, Leoni and Gaj (2008) measure individual competences through self-assessments, with lickert scales of the activities required and performed on the job (job requirement approach). They explain these indicators of competences by a set of dummy variables indicating whether employees participate in continuous improvement groups or quality circles, make improvement suggestions, are submitted to formal performance appraisals, receive constant information flows and are involved and consulted by the organisation. They find a positive relationship for these five organisational practice variables and show that it is robust to various specifications, confirming the influence of the organisational context on the elaboration of problem-solving and interacting skills at the employee level.

Mohr and Zoghi (2006) and Kalmi and Kauhanen (2008) look at outcomes other than skills, linking them with organisational practices. Mohr and Zoghi (2006) exploit the potential of the linked employer-employee Workplace and Employee Survey (WES) pooled over 1999-2001 to investigate whether job enrichment increased job satisfaction. They examine the participation of employees in several forms of job enrichment: suggestion programmes, information sharing, task teams and training, controlling for a large set of employee and employer level characteristics (including workplace organisation controls) and find that they increase job satisfaction and have no effect either on the probability of preferring shorter hours because of work-related stress or number of sick days taken. Using the 2003 Finnish Quality of Work Life Survey, Kalmi and Kauhanen (2008) conduct similar regressions using a larger set of employee outcome indicators and fewer controls at the employer level. As employee outcomes, they consider work intensity, task discretion, job security, stress and job satisfaction measured on multi-item scales as well as wages. These outcomes are related to participation in self-managed team, participation in traditional teams, information sharing about changes, employer provided training and incentive pay. Their findings show that practices do not have the same outcome profile, but globally they support the mutual gain view: information sharing has positive consequences whatever the outcome considered, self-managed teams and training are related to higher task discretion, wages, job satisfaction and job

security (training only), incentive pay is positively related to task discretion and wages.

Barth *et al.* (2009) and Østhus (2007) link indicators of change with employee outcomes. The study by Barth *et al.* (2009) exploits another linked employer-employee survey, the 2004 British Workplace and Employee Relations Survey (WERS). Measures of well being and job satisfactions at the employee level are related to three change indicators based on eight dummies of workplace level innovation over the two years prior to the survey: any kind of change, labour changes (working time arrangements, organisation of work, work techniques or procedures, initiatives to involve employees), capital change (upgrading of computers, upgrading of other types of new technology, introduction of technologically new or significantly improved product or service). They show that all types of workplace innovations are associated with lower average employee well being and job satisfaction. Collective bargaining agreement coverage and recognised union for pay bargaining at the workplace appear to mitigate the negative impact of innovation on employee well being. Østhus (2007) uses the 2003 Norwegian Survey of Living Conditions to investigate the consequences of workplace downsizing or reorganisation (declared by employees) on composite indicators of task discretion, work demands, job insecurity, work related health problem and job satisfaction. Workplace changes in Norway increase demands on employees to exert more effort, without any positive counterparts in terms of task discretion, job security or job satisfaction. The results further suggest negative effect on work related health problems which are stronger for internal reorganisations than for downsizing.

Summary

This chapter has reviewed different strands in economic, industrial relations and socio-psychological literature that address organisational issues connected with innovation from the employer and employee points of view. One main organisational design challenge has been identified for employers: find ways of stimulating dynamic properties of organisations in a stable organisational structure. In dealing with this challenge, employers are confronted with a central trade-off between standardisation/routine and mutual adjustment/innovation. “Lean” and “learning” models described in Chapter 2 can be interpreted as two potential responses, the former incorporating more standardisation than the latter. From the point of view of organisation, innovation strategies also meet a challenge in the human resources area: employers willing to innovate have to deal with an employee participation constraint. If this participation constraint is not managed efficiently, conflicts between vested interests may arise that will constitute a strong barrier to innovation. In this context, human resources management practices are

essential tools: employer-provided continuing vocational training or multi-skilling policies contribute to alleviate skill obsolescence induced by innovation, formal systems of appraisals or evaluation interviews allow to address issues connected with the balance between effort and reward which can be upset by change; it also opens the path to some transparency in the incentives policy which is important to build in feelings of trust and fairness. The few available linked employer-employee surveys give some promising results on these issues. A linked employer-employee type of survey instrument covering more than one country with different institutional arrangements would allow going further in identifying best practices.

In Annex 4.A, multilevel learning organisation metrics are proposed based on the EU MEADOW project. They aim at capturing differences in the capacities of organisations to adapt and compete through learning across countries.

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Annex 4.A

Multilevel learning organisation metrics based on the European Union Meadow Project*

* The metrics are taken from the Meadow Project draft employer and employee-level questionnaires currently undergoing cognitive testing in eight EU member nations.
See *www.meadow-project.eu/index.php.*

Employer	Employee
Learning and knowledge use	
Do employees in this establishment regularly update databases that document good work practices or lessons learned? Does this establishment dedicate resources to continuously monitor external technological developments, or ideas for new or improved products, processes or services? What percentage of the employees at this establishment works in teams where the members jointly decide how work is done? These are sometimes referred to as *autonomous teams* or *self-directed teams*. What percentage of the employees at this establishment involved in groups who meet regularly to think about improvements that could be made within this workplace, for example a *problem-solving* or *service-improvement* group or a *quality circle*?	What proportion of the time does your job involve learning new things? What proportion of the time does your job involve helping your co-workers to learn new things? Over the last 12 months have you: a. Figured out solutions for improving areas of your own work? b. Thought up new or improved products or services for your employer? c. Tried to persuade your supervisor or manager to support new ideas? How would you compare the level of skills needed for your job with the level needed when you started working for you current employer? Would you say it has increased, decreased, or stayed the same?
Learning culture and HRM practices	
What proportion of employees has been given time off from their work duties to undertake training in the past 12 months? What proportion of employees has received instruction or training whilst performing their normal job in order to improve their skills in the past 12 months? Approximately what percentage of employees has a performance appraisal or evaluation interview at least once a year? Are decisions about employee promotion linked to the outcome of their performance appraisal? Approximately what percentage of the employees at this establishment has some part of their pay directly determined by their performance, or the performance of a wider group, rather than just by the number of hours worked? Do you have meetings between line managers or supervisors and all the workers for whom they are responsible?	How much do you agree or disagree with the following statement? "In my current job I have enough opportunity to use the knowledge and skills that I have." To what extent do you agree or disagree with the following statements about working for your employer? a. I share many of the values of my employer b. I do not feel loyal to my employer c. I am willing to work harder than I have to in order to help my employer. Over the last 12 months, have you done any of these types of training or education connected with your *current* job? a. Received instruction or training from someone which took you away from your normal job b. Received instruction whilst performing your normal job Over the past 12 months have you participated in a performance appraisal or evaluation interview?

Conclusion

This report began with a survey of the literature on learning organisations in order to provide greater definitional clarity. Although the literature is highly disparate and there is nothing like a unified definition or concept of the learning organisation that has been developed and empirically tested in a cumulative manner, some common definitional ground has been identified.

First, most authors see the learning organisation as a multilevel concept involving interrelations between individual behaviours, team organisation, and organisational practices and structure.

Secondly, there is an important emphasis in the literature on the role of learning cultures understood as beliefs, attitudes and values supportive of employee learning.

Further, an important strand in the literature identifies specific HRM policies that are supportive or constitutive of learning cultures.

The multilevel nature of the concept as well as the emphasis on organisational culture poses a challenge for measurement and quantitative analysis. Drawing on the results of successive waves of the European Survey of Working Conditions carried out at the individual level, the report provides evidence on the spread of learning organisations within private sector establishments across the European Union and on the evolution of their characteristics over time.

The results show firstly that while a large share of European workers have access to work settings that draw on their discretionary capacity for learning and problem-solving, there are important variations in the spread of learning forms of work organisation across EU member nations, with the percentage of salaried employees involved in 2005 ranging from a high of over 65% in Sweden to a low of about 20% in Spain and Bulgaria. Moreover, in the nations where work is organised to support high levels of employee discretion in solving complex problems, the evidence shows that firms tend to be more active in terms of innovations developed through their own in-house creative efforts. In countries where learning and problem-solving on the job are constrained, and little discretion is left to the employee, firms tend to engage in a supplier-dominated innovation strategy.

Secondly, the results show that in many European nations, and for the EU15 on average, there has been a slight downward trend over 1995-2005 in the percentage of employees having access to work settings characterised by high levels of learning, complexity and discretion. When structural factors are taken into account in a multilevel model involving an individual level and a country level, this decreasing trend in work complexity grows in size and significance. This result is surprising given the emphasis placed in the European Union on policies for constructing knowledge-based economies,

and notably on those designed to increase the level of R&D expenditures, to augment the supply of persons in the labour market with tertiary science and technology degrees, and to promote the wide diffusion of information and communication technology (ICT).

Taken together these cross sectional and longitudinal results have some important implications for understanding the performance of national innovation systems.

Firstly, in line with the OECD emphasis on widening the concept of innovation, they imply a need to put the organisation of work more centrally in the analysis of innovation. Learning and interaction within organisations is at least as important for innovation as learning through interactions with external agents, and indicators for innovation need to capture how material and human resources are used and whether or not the work environment promotes the further development of the knowledge and skills of employees.

Secondly, policies designed to promote innovation, especially in countries that are trailing or behind, have tended to focus on the need for increased expenditures on R&D, on raising the percentage of the population with tertiary educational attainment and on furthering the diffusion of ICT. Considerable progress has been made with respect to the latter two indicators. The results presented here suggest that the bottleneck to improving the innovative capabilities of European firms might not be low levels of R&D expenditures, which are strongly determined by industrial structure and consequently difficult to change, but the widespread presence of working environments that are unable to provide a fertile environment for innovation. If this is the case, then an important policy measure would be to encourage the adoption of "pro-innovation" organisational practices, particularly in countries with poor innovative performance. While the analysis draws on European data, the lessons may be extended to other OECD regions.

Policy programmes

There exist a variety of national and regional framework programmes that have been established in order to promote workplace change and innovation. Many of these programmes combine economic performance enhancing objectives with social objectives such as promoting greater workplace democracy, improving work-life balance or reducing gender-based inequalities at work. An underlying premise, which is in keeping with the analysis of learning organisations developed here, is that there are important synergies between the economic and social objectives of organisational change. A 1999 survey of government support programmes commissioned by the DG Employment and Social Affairs evaluated 18 programmes designed to develop workplace organisation across 11 European countries (Business Decisions Limited, 2000).

Another DG Employment commissioned survey using stricter criteria identified active workplace programmes in seven EU member states (Brödner and Latniak, 2003). A recent benchmarking exercise carried out in the context of the EU WORK-IN-NET project provides a detailed description and evaluation of 10 national and regional programmes in seven European nations (Alasoini et al. 2005).[1]

While these overviews and assessments of framework programmes point to considerable diversity within Europe in terms of goals and policy instruments, they also strongly suggest that many of the most ambitious workplace development programmes both in terms of funding and outreach can be found in Nordic nations that figure amongst the highest adopters of learning forms of work organisation within Europe (see Table 2.5 in Chapter 2). Many of these Nordic programmes have been officially evaluated and while there is a need for better statistical evidence on their economic and social impacts the continued commitment of often substantial amounts of public funding to these programmes supports the presumption of a positive contribution to workplace development and change.[2] After providing brief overviews of Norwegian, Swedish and Finnish framework programmes, we identify certain common features which could serve as a basis for establishing general guidelines or benchmarks for establishing policies for the wider diffusion of learning forms of organisation.

Norway has the longest tradition of policy initiatives in this area, with programmes based on the principle of social partnership and tied to the objective of enhancing workplace democracy dating to the 1960s. A key milestone was the 1982 agreement between the LO (Confederation of Trade Unions) and the NHO (Confederation of Business and Industry) to centrally support bipartite local initiatives for workplace co-operation and organisational change. These agreements and the co-operative structures they established formed the basis of the Enterprise Development Programme (1994-2001) and its successor, the VC (Value Creation) Programme (2001-10). A key feature of the VC Programme is that it is implemented at the regional level through the creation of networks or partnerships between local firms and other organisations, including local universities, colleges, and research institutes. Funding focuses on supporting the work of researchers who are active participants in development projects carried out in local firms (Alasoini *et al*., 2005; Gustavsen *et al*., 2001).

Sweden has a well-known history of experiments with job design and re-organisation of factory layout dating to the late 1960s. These are often associated with socio-technic systems theory and oft-cited examples of putting socio-technic design principles to work include the work re-organisation projects carried out at Volvo's Kalmar and Uddevalla car plants (Sandberg, 1995). Major national programmes in Sweden include the LOM Programme

(1985-1990) which emphasised democratic dialogue as a vehicle for promoting workplace change, and the Work Life Fund Programme (1990-95) which is reported to have provided support for as many as 25 000 projects over the five-year period of its lifetime (Alasoini, *et al.* 2005). In 2001, two new agencies with responsibilities in the area of workplace development were created, FAS (Swedish Council for Working Life and Social Reseach) and VINNOVA (Swedish Agency for Innovation Systems). FAS's mission is primarily research oriented and has as a key objective the support of basic and applied research of relevance for working life. VINNOVA supports both research activities and enterprise or network development projects and is divided into six separate programmes. The 'Knowledge Creating and Organizing' programme includes within its remit work organisation (Zettel, 2005).

Finland's experience with work development programmes is relatively recent compared to Sweden and Norway, with the first national framework programme, TEKE (1996-1999), dating to the 1990s. This was followed up by the TEKE (2000-2003) and the TEKES (2004-2009) programmes. Between 1996 and 2003 the two TEKE programmes provided funding for approximately 670 projects involving a total of 135 000 active persons in about 1 600 enterprises. Projects were mainly carried out with individual enterprises and the principal aims included improving work processes, personnel management, team-based work, and external networking. Based in part on the results of the evaluation exercise for the 1996-2003 period (Ramstad, 2005), under TEKES (2004-2009) the amount of funding was increased and some changes in strategic focus and policy instruments were introduced. In 2008 alone, around 2000 research and development projects were funded for a total of EUR 516 million. Approximately 40% of the funding went to non-technological projects such as business competence and service models. TEKES (2004-2009) can be distinguished from the previous programmes by the emphasis on funding projects carried out through network of firms and organisations rather than within individual companies. There has also been an increasing focus on SMEs, with about half of the firms receiving funding employing 10 or fewer persons (TEKES Annual Review 2008).

Alasoini (2005, pp. 145-46) in a recent overview of EU programmes for workplace change brings into relief certain common features of the Nordic programmes. He identifies a traditional programme strategy focused on identifying best practice methods based on experiments or demonstration projects carried out in a small number of progressive enterprises or establishments. In such approaches there is typically a strong emphasis on disseminating these best practice solutions through seminars, training and consultancy. He suggests that this type of approach remains the most common within Europe.

In contrast to this traditional approach, he identifies a more ambitious type of policy where the aim is directly to involve a relatively large number of enterprises, including less progressive ones, in carrying out workplace organisational change. As opposed to funding design oriented research and seeking to disseminate the practices of a few demonstration cases, in the latter sort of programme competitive funding is provided for the active implementation of change within individual firms or within networks of organisations with management and staff actively working along with outside researchers or experts. Dissemination is promoted primarily through exchange of knowledge and information between different projects teams or through the practical work activity of networks of organisations.

Although there are significant differences between the Nordic programmes in terms of such factors as the role of the social partners at the national or regional level, they nonetheless share a common strategy of promoting workplace change and innovation through the competitive funding of a large number of projects carried out at the level of the enterprise or through networks of organisations. This approach serves to override the typical objection to developing policies for organisational change that decisions on the internal organisation of the enterprise should remain exclusively managerial prerogatives. A central feature of this policy approach is that projects are carried out by management and staff at the initiative of the employer who seeks competitive funding. Another implication is that projects for organisational change and innovation are based on research implementation strategies adapted to the local conditions of the plant, which avoids the problem of proposing universal best-practice solutions which may be poorly adapted to the local technological or organisation context.[3] Further, since projects focusing on improvements in competences, work practices and organisational methods are often incorporated into wider projects that include significant investments in new technology or are linked to processes of product or process innovation, it proves easier to integrate policies for organisational change into broader industrial policy frameworks.

There is a clear presumption in Alasoini (2005, pp. 147-48) that the traditional policy approach should be abandoned in favour of the more ambitious approach involving the competitive funding of a large number of projects in which individual companies or networks of organisations collaborate with outside researchers in the design and implementation of workplace organisational change and innovation. He supports this view primarily by observing that there have been limited spill-over effects to wider populations of firms from the successful experiments carried out in a limited number of demonstration projects. To this we would add that our own evidence on mapping forms of work organisation across the EU shows that those nations with the most sustained experience in implementing the

more ambitious type of policy approach figure amongst the leaders in the adoption of the learning forms of work organisation.

In conclusion it is worth emphasising that treating programmatic efforts for organisational change as parts of broader policy frameworks focused on issues of industrial policy and performance raises the issue of structural reforms. The analysis of institutional framework conditions for employee learning presented in this report provides some guidance for the design of national policies. The results indicate that the way work is organised is closely connected to the structure of national labour markets and to the level of expenditures on labour market policies in the form of income maintenance for the unemployed and in the form of measures designed to move the unemployed into employment. There are alternative ways to build systems of learning and innovation, and different systems tend to organise work and distribute security and protection differently among citizens. While these conclusions are preliminary and there is clearly a need for a more comprehensive analysis, they suggest that the institutional set-up determining the dynamic performance of national systems is much broader than normally assumed when applying the innovation system concept. They point to the need for a transversal approach to policy that can take into account the interconnections between learning, innovation and the different institutional sub-systems of the knowledge-based economy.

Notes

1. The benchmarking exercise included the following programs: the Finnish Workplace Development Programme (TYKES) financed by the Ministry of Labour; the 'Innovative Development of Work – The Future of Work' financed by the German Federal Ministry of Education and Research; the Programme "Work-Oriented Modernization" (MWA) organized through the Ministry of Economy and Labour Affairs of the German Federal State of North-Rhine Westphalia; the Programme "Health and Safety at Work" by the Institute for Labour Foundation (IpL) on behalf of the Ministry of Health of Emilia-Romagna, Italy; the Value Creation (VC) 2010 Programme by the Research Council of Norway (RCN); the Programme 'Goal-Oriented Projects for Small and Medium-Sized Enterprises' by the Polish Federation of Engineering Associations (FSNT NOT) on behalf of the Ministry of Scientific Research and Information Technology; the Innovation and Enterprise Centres for small and medium-sized enterprises by the Polish Federation of Engineering Associations (FSNT NOT); the Swedish Council for Working Life and Social Research (FAS); the Knowledge Platform 'Learning and Health in Working Life' and the DYNAMO Programme of the Swedish Agency for Innovation Systems (VINNOVA).

2. See Ramstad (2005) for the results of the evaluation of the Finnish TEKE programmes between 1996 and 2003.

3. This was arguably a major weakness with policy approaches advocating the wide diffusion of the 'lean' or 'high performance work practices' which may be poorly suited to organisations in such knowledge-intensive industrial sectors as pharmaceuticals or a wide range of service sector organisations.

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ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

The OECD is a unique forum where governments work together to address the economic, social and environmental challenges of globalisation. The OECD is also at the forefront of efforts to understand and to help governments respond to new developments and concerns, such as corporate governance, the information economy and the challenges of an ageing population. The Organisation provides a setting where governments can compare policy experiences, seek answers to common problems, identify good practice and work to co-ordinate domestic and international policies.

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Innovative Workplaces

MAKING BETTER USE OF SKILLS WITHIN ORGANISATIONS

As human capital is the source of innovation, one of the policy principles of the OECD Innovation Strategy is to "foster innovative workplaces". Education and training systems must rise to the challenge of providing people with the means to learn and re-train throughout their life. Companies and organisations need to maximise the human resources they have at their disposal.

Do employers make the best use of people's skills for innovation? Are some work organisations more associated with innovation than others? If so, are these organisations more widespread in some countries than in others? Are they associated with particular labour market policies, managerial practices, learning cultures or certain levels of education? What are the challenges for innovation within organisations?

This volume shows that interaction within organisations – as well as individual and organisational learning and training – are important for innovation. The analytical tools and empirical results this study provides show how some work organisations may foster innovation through the use of employee autonomy and discretion, supported by learning and training opportunities.

Innovative Workplaces will be of interest to policy makers in the fields of education, employment and innovation as well as business leaders, academics and all readers interested in social issues.

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