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LABOUR MARKET AND SOCIAL POLICY - OCCASIONAL PAPERS NO. 50

KNOWLEDGE, WORK ORGANISATION AND ECONOMIC GROWTH

Elena Arnal, Wooseok Ok and Raymond Torres

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KNOWLEDGE, WORK ORGANISATION AND ECONOMIC GROWTH

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SUMMARY

It is sometimes asserted that an era of faster economic growth has come about --the so-called New Economy. New technology, notably information and communications technology (ICT), is seen as a key factor at work, together with international economic integration. This report examines the issue from a labour market perspective. The findings suggest that sanguine predictions about the New Economy are unlikely to materialise unless the appropriate policy environment is in place, notably as regards employment and human capital development policies.

New technology holds the promise of higher economic growth, ...

True, new technologies hold the promise of higher economic growth and improved living standards. Besides the potential impact of technology on efficiency gains, ICT may provide opportunities for better utilising existing skills. In this regard, the availability of telework to groups so far under-represented in the labour market is a positive phenomenon. Also, new technology will move the boundaries of markets, thereby changing the way business is conducted, which could create jobs in certain businesses and destroy them in others, but also improve allocative efficiency.

... but for the gains to materialise, firms and workers need to adapt

However, for these gains to be realised, it is essential that firms adapt their organisational structures, skills be upgraded to match the changing labour market requirements, and individuals be mobilised to seize the new business opportunities. This paper shows that:

- organisational change, understood as the implementation of new work practices such as team-work, flatter management structures and job rotation, tends to be associated with higher productivity growth. Interestingly, productivity gains of firms that combine new technology with organisational change are considerable, whereas there does not appear to be much economic benefit in implementing new technology alone. In other words, work needs to be reorganised to use ICT effectively;

- there is a complementarity between high-skilled labour on the one hand, and physical capital and new technology on the other. Therefore, unless there is a sufficient supply of these skills and competencies, the growth process will face supply constraints; and

- productivity gains may come about not only as a result of a reorganisation of work within firms but also when employment can move between firms and sectors. Though there is no evidence of a generalised change in mobility, it is interesting to note that employee tenure is relatively low in most countries where multi-factor productivity accelerated during the second half of the 1990s.

Governments and social partners can facilitate adjustment, ...

From the policy perspective, it is therefore essential to prepare the ground so that the benefits of new technology are exploited and costs minimised. There is a need for ensuring that workers participate in

the labour market actively and individuals seize business opportunities. Governments have to create an environment conducive to the acquisition of skills and competencies. Finally, the issue of whether (and how) labour-management institutions will adapt to the changing economic situation needs to be addressed.

... firstly, by mobilising labour supply, ...

Achieving a greater mobilisation of labour supply should continue to rank high in the policy agenda. Discussions about the New Economy should not divert attention from the fact that many OECD countries continue to suffer low rates of labour utilisation. This underlines the continued importance of policies that encourage the labour market participation of would-be workers, such as making work pay systems and effective active labour market programmes. In countries where labour shortages have emerged, it is particularly urgent to reinforce the activation elements of labour market programmes – in this regard, the coexistence, in certain countries, of labour shortages with relatively high unemployment rates is a matter of considerable policy concern. Also, given evidence that labour needs to be mobile to exploit the growth potential of new technology, features of employment regulations that unduly inhibit labour mobility need to be reconsidered. However, ensuring that the job opportunities are exploited requires not just a well-functioning regulatory environment, but also wider access to the new technologies --i.e. closing the digital divide, so as to enhance the job prospects of certain categories of would-be workers (e.g. those living in remote areas or the disabled).

... secondly, by enhancing the incentive to invest in the human capital of workers, ...

The success of technological and organisational innovation depends to a large extent on the ability of individuals to absorb change. It goes without saying that education and a well-functioning training system are of paramount importance in this respect. There is some evidence that the rate of adoption of new work practices is positively associated with both the level of educational attainment and firm training. This can be interpreted as a need for training workers in order to implement new work practices. Moreover, the paper shows that many "knowledge-workers" have acquired their skills through either training or on-the-job experience. One problem, however, is that firms and individuals tend to under-invest in human capital and the problem may aggravate to the extent that labour turnover rises with the process of workplace change. To address this problem, the paper examines some policy avenues.

... finally, by adapting labour-management institutions to the new economic environment

Institutions which allow a closer contact between management and employees (such as works' councils) can help build a high-skill, high-trust enterprise climate. The study estimates that the existence of a collective agreement raises the probability of firms adopting team-working and new work practices. However, changes in work practices also raise a number of challenges to collective bargaining institutions and government regulation. Thus, the growing importance of performance-related remuneration reduces the importance of collectively agreed basic wages. Also, the proliferation of different forms of employment has blurred the traditional distinction between management and employees --which forms the back bone of collective bargaining institutions. Finally, the emergence of telework also raises challenges to collective bargaining, since, in most countries, there is no national legislation on telework. Working-time regulations should include or enhance hours' flexibility arrangements so as to reduce obstacles to team work and other new work practices.

Going beyond the impact on economic growth, the trends analysed in the paper may signal a significant change in the nature of work, with major socio-economic consequences. More work is clearly needed to analyse the multi-faceted aspects of the issue.

A. INTRODUCTION

1. There is an interesting debate over whether OECD countries are on the eve of a New Economy, an era of higher non-inflationary growth. According to some analysts, the adoption of information and communications technology (ICT), combined with increased economic integration among countries, is transforming economic systems, much like the "electricity revolution" in earlier episodes of economic history (see Helpman, 1998). This view does not preclude business cycles, but it does imply that GDP growth rates would be higher over the medium to longer-run.

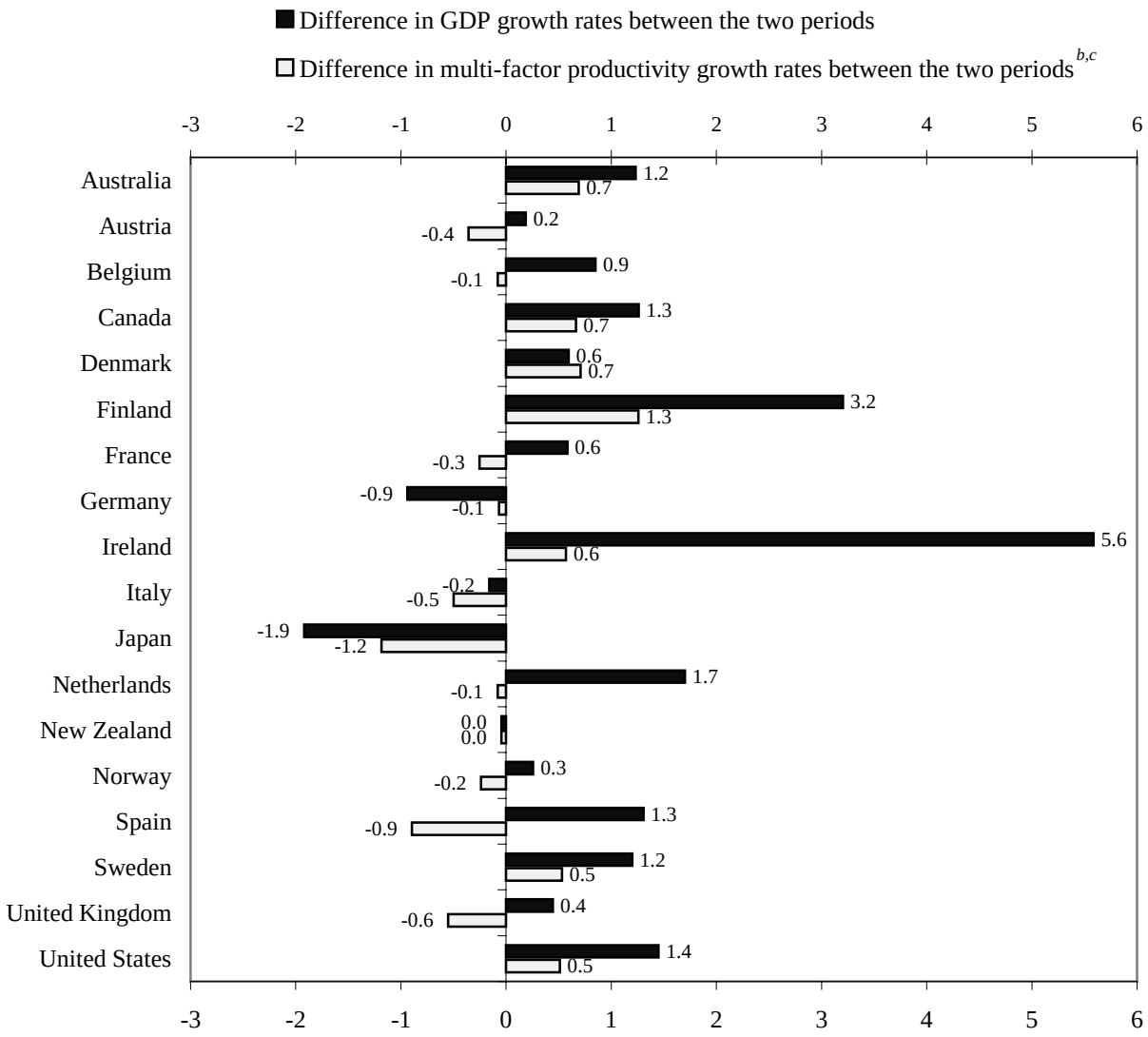
2. It is still too early to assess whether these sanguine predictions will materialise. There is some evidence that the economic performance of the United States has been exceptional (at least until recently), but the same cannot be asserted in the case many other OECD countries (Chart 1). In addition, the current weakness of the American economy will undoubtedly instil a measure of caution in this debate. More importantly, although new technology may hold the promise of higher economic growth, policies have a key role to play in ensuring that these potential gains will materialise (OECD, 2000*a*). In particular, the labour market should play an important part in this process. Unfortunately, relatively little attention has been devoted to this question. The aim of this paper is precisely to shed some light on the labour market issues at stake.

3. More generally, an economy grows either through a wider mobilisation of labour supply or through raising its productivity. Without neglecting the importance of the first factor, this paper focuses mainly on productivity. It analyses the importance for technology-use and productivity of work reorganisation, human capital and labour mobility.

4. More specifically, the purpose of this paper is a) to shed light on emerging trends in the structure of labour markets, notably as regards work practices and the nature of skill requirements (Section B); b) to analyse the possible links between labour markets and the growth process (Section C); and c) to discuss policy-related challenges (Section D).

Chart 1. **Difference in GDP and multi-factor productivity growth between 1995-2000 and 1980-1995**[a]

Percentage point changes



a) For the estimates of multi-factor productivity growth, the difference compares 1995-1999 to 1980-1995.

b) For Germany, productivity data for 1990-1991 are missing. The figure provided here uses an estimate for the years for which data are available.

c) 1997 instead of 1999 for Austria, Belgium, Italy and New Zealand. 1998 instead of 1999 for Australia, Denmark, Ireland, Japan, the Netherlands and the United Kingdom.

Sources: *OECD Economic Outlook*, No. 68, December 2000 and Secretariat estimates for multi-factor productivity.

B. THE CHANGING NATURE OF WORK

5. Over the past few years, the labour market situation has improved significantly in the majority of OECD countries. Unemployment has followed a downward trend for the area as a whole, and few countries continue to suffer from double-digit unemployment rates. This improvement reflects a combination of cyclical and structural factors, including changes in the functioning of labour and product markets resulting from policy reforms and the introduction of new technology. However, this improvement does not come alone, but is accompanied by some significant changes in the nature of work. The purpose of this section is to identify, without pretending being exhaustive, some of these changes which are often masked by the job creation process. These developments include a re-organisation of work within firms, a rising demand for certain types of skills and a change in the employer-employee relationship for certain workers.

1. The diffusion of new work practices and new forms of work

6. In the face of an increasingly competitive environment, firms may respond in two different ways. On the one hand, they may reorganise production and work to improve flexibility and reduce X-inefficiencies. This strategy encompasses what is termed in this report "new work practices" (See Box 1). On the other hand, firms can have recourse to external or numerical forms of flexibility, for instance by relying on atypical forms of employment. In this respect, tele-work is one emerging phenomenon of particular interest.

Box 1. New work practices: a real phenomenon or management fad?

The literature contains numerous discussions of the so-called “organisational revolution”. The argument is usually that new work practices have profoundly changed the way firms operate (Lindbeck and Snower, 2000). According to this view, "traditional" organisations require their employees to have specialised skills consistent with standardised production processes. Reflecting this job specialisation, the argument goes, traditional organisations operate a clear-cut distinction between narrow occupations. In this environment, relatively little attention is given to workers' capacity to acquire multiple skills. In the new types of firms emerging nowadays, this clear-cut distinction of occupations would be breaking down. Workers would be given responsibilities in the area of production, administration, training, marketing, customer relations, and even product innovation. The new, smaller, customer-oriented teams require versatility, cognitive and social competence, as well as judgement. In addition, employees would be involved in management issues such as the evaluation and supervision of their peers, the training of new recruits, the organisation of input supplies, and the choice of financial and accounting procedures. In such a context, what matters is not only the competence in a particular activity, but the ability to change jobs, as well as “soft skills”.

In practical terms, new work practices encompass three broad directions of change:

- the new approach is often associated with making production processes "lean" and more responsive to market changes. This is the case of strategies that aim at returning to "core business", "re-engineering" and "outsourcing", all of which are supposed to entail a concentration of the activities of the firm on essential parts of the business, where comparative advantage lies. "Just-in-time" production, "total quality control" systems and "benchmarking" are intended to make the firm more responsive to the market while at the same time encouraging the adoption of practices successful in other organisations.

- other practices involve changes in work arrangements, generally with the aim of decentralising decision-making and improving the flow of information between management and workers. Team-work encompasses a delegation of responsibility to a group of workers, who can suggest or decide jointly the way they work and are responsible for the outcomes. In this case, individual workers are asked to be involved more actively in the task of the other members of the team and are required to have a wider range of knowledge than in traditional organisations. Suggestion schemes, quality circles, flatter management structures and "employee involvement" are supposed to bring front-line workers closer to top-management.

- systems of performance-related pay, though by no means new, are often implemented as part of work reorganisation. Accordingly, workers' pay depends in part on either the performance of the firm (e.g. bonuses, profit-sharing schemes, stock options), or individual performance. In principle, these systems offer stronger incentives to employees to raise their performance and they tend to be associated with team-work and the move to a greater autonomy of workers.

These discussions, however, should be treated with caution. To start with, the terminology is not standardised, so that the concepts often mean different things to different authors. Also it is difficult to understand what is really "new" in this area, and, more importantly, the economic significance of the work practices in question is often unclear. The business literature might tend to exaggerate the extent to which the new practices alter the organisation of work in reality (see Annex A for a discussion of various business models). In order to gauge whether "new" work practices reflect real economic change, as opposed to management "fad", an attempt is made below to measure their diffusion and to provide an economic interpretation of the different practices, following previous OECD studies (1996a; 1998; 1999). It emerges that, in many cases, new work practices do reflect a meaningful economic change.

(a) How prevalent are new work practices among firms?

7. It is difficult to measure statistically the incidence of new work practices. There are inherent difficulties in measuring some of the practices in question. In certain surveys, the question is labelled in terms of whether a specific practice is introduced, and not how many employees are involved in the practice.[1] Inter-temporal and cross-country comparisons are complicated by the fact that surveys often change through time and vary across countries. Only two surveys have been designed for the purpose of cross-country comparison, namely "EPOC" for ten European countries and "Nordflex" for four Nordic countries. Keeping these limitations in mind, interesting empirical regularities emerge from existing surveys (see Table D.1 in Annex D).

8. First, a significant number of respondents report that their firm is adopting *new systems of production* – though these practices do not cover a majority of enterprises as yet. Thus, according to a survey of firms of European Union countries conducted during the period 1994-1996, some 14% of establishments had decided to "downsize" production, 23% had taken initiative to "outsource" certain activities and 13% had adopted a "back to core business" strategy. Likewise, in 1998, the incidence of "just-in-time" production systems was 23% in the United Kingdom and 36% in France. Finally, in 1996, "best-practice" arrangements such as "benchmarking" were used in 20% of surveyed firms in the United States. Another approach is to adopt "quality management", as recommended by public agencies such as

1. See Annex B for the description of available surveys.

the International Standards Organisation (ISO). In 1998, about 29% of workplaces had an ISO certificate in France and the figure was 24% in the United Kingdom.[2]

9. Second, *team work and practices which aim at a greater proximity between management and labour* have been adopted on a much larger scale than is the case of new systems of production. Particularly large is the rate of adoption of practices which can be accommodated with relatively little change in the overall work organisation structure, e.g. suggestion schemes and weakly autonomous teamwork. The rate of diffusion is somewhat lower in the case of autonomous team-working and employee involvement in decision making, which imply a sizeable departure from the traditional work organisation model. Thus, about 90% of large companies in the United States have suggestion systems and survey feedback, whereas self-managing work teams and mini-business units exist in 78% and 60%, respectively, of these companies. In the United Kingdom, information-sharing schemes that can be easily articulated into the existing organisational structure (such as "use of management chain/cascading information" or "regular meetings with entire workforce") are more widely used than is the case of autonomous team-working. In France, work groups with weak discretion such as quality circles and project groups exist in, respectively, 49% and 57% of firms, compared with 37% in the case of autonomous production teams. In Finland, individual autonomy exists in 26 to 46% of surveyed firms, while team autonomy exists in 10 to 16% of these firms.[3]

10. Third, there is some evidence that *the proportion of firms adopting new work practices is on the rise*. In the four countries where comparisons through time can be made (Australia, France, the United Kingdom and the United States), the rate of adoption of each practice (except quality circles) is on the rise (see Table D.1 in Annex D). It is interesting to note that, despite their still low incidence, practices aiming at encouraging workers' participation in managerial matters are on the rise (see figures concerning self-managed team and minibusiness units in the United States, autonomous production team in France and information sharing about investment plans in the United Kingdom). In other words, a significant transformation in decision-making may be taking place in some OECD countries.

(b) Telework: an emerging form of work

11. A number of labour market analysts believe that, increasingly, employers will have recourse to atypical work arrangements, such as contingent labour. This is illustrated by the trend-rise in temporary employment observed in a majority of OECD countries – a well-documented phenomenon. Other forms of atypical work, such as telework, have received considerable attention since it is related with new technology (see Box 2).

12. Official statistics provide little information on telework and unofficial studies use definitions and methodologies that vary widely.[4] Comparisons between countries are therefore problematic. Despite these difficulties, some patterns can be observed in the OECD area:

- According to a European Commission survey (the EcaTT project), there were in 1999 almost 9 million teleworkers in the European Union, accounting from 6 per cent of the total

2. In the case of the United Kingdom, the figure concerns BS5750 (standard laid by British Standard Institute) as well as ISO 9000.

3. As mentioned above, one should be cautious when making international comparisons on the basis of existing national surveys.

4 . Some surveys take into account employees only, in others all forms of employment are considered; some analyse only telework based at home, while others include telework in any location; some specify a minimum number of hours and others take into account only full-time telework.

workforce.[5] This survey includes not only those regularly working at least one day a week away from the office, but also those performing telework occasionally.[6] In two thirds of the cases, telework is performed regularly and in the remaining third as an occasional activity – except in Ireland, the Netherlands and Sweden where the proportions of regular and occasional teleworkers are practically identical. Evidence suggests that the incidence of telework is considerably higher in Nordic countries than in Southern Europe (see Table D.2 in Annex D). As illustrated in Chart 2, cross-country patterns are associated with differences in ICT penetration. But the quality of telecommunications and attitudes towards this kind of work also play a role in explaining cross-country differences in the incidence of telework.

- In the United States, in 1998, there were almost 16 million teleworkers (or telecommuters as defined in the relevant survey), that is 13 per cent of the workforce. [7] The American survey defines teleworkers as those working at home for an outside employer during normal business hours, at least one day a month. Three categories are distinguished, namely full-time employees, contract workers and part-time employees who telecommute informally. The first group represents almost half of the total and the other two groups one quarter each.

- In Japan, there are about 2 million teleworkers, or 8 per cent of the workforce.[8]

Box 2. What is telework?

There is no agreed definition of telework. According to the European Foundation for the Improvement of Living and Working Conditions, telework covers work performed under the following conditions: a) the place of work must be other than the normal workplace of the employer; and b) work necessitates the use of telecommunications (computer, fax, telephone, Internet, etc…). Telework is thus defined functionally and not in legal terms.

Based on this broad definition, some authors (Huws, 1997; Gillespie *et al.*, 1995) have distinguished five main categories of telework: (i) Multi-site telework, *i.e.* work partly based in the office and partly at home; (ii) telehome work, *i.e.* work from home and carried out for a single employer; (iii) freelance telework, *i.e.* work from home and carried out, on a freelance basis, for different employers; (iv) mobile telework, *i.e.* work done in different sites using portable equipment to keep in touch with the employer; and (v) relocated back-officers which perform work at distance on the employer's premises.

13. Telework can facilitate higher labour force participation by creating more room for combining work and family responsibilities. It also gives labour market opportunities for disadvantaged groups such as those with physical disabilities or living in communities in remote or depressed areas. On the other hand, however, telework entails a risk of a deterioration of working conditions, social isolation, exclusion

5. See Electronic Commerce and Telework Trends final Report (2000).

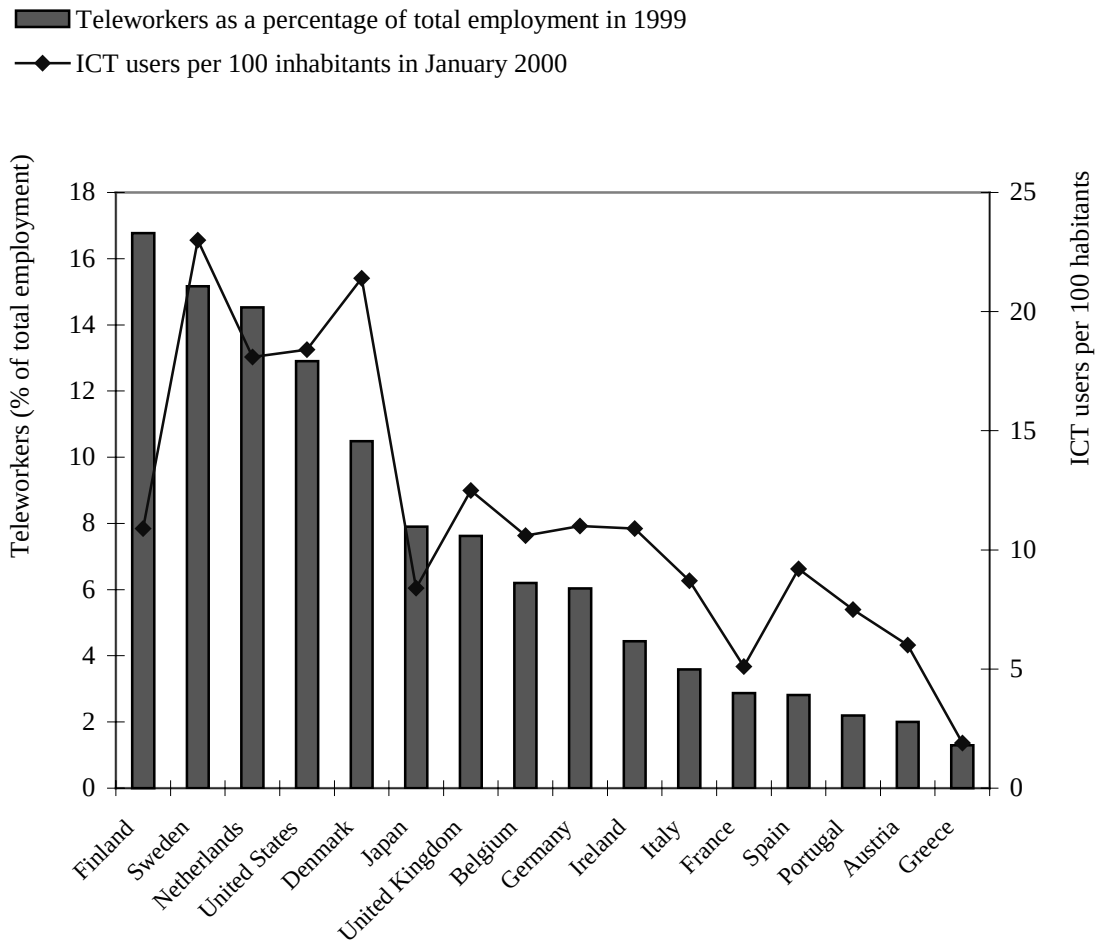
6. The EcaTT survey uses a broad definition of telework which seems to include the five categories defined above.

7. See Electronic Commerce and Telework Trends final Report (2000) and http://www.cyberdialogue.com.

8. Data for Japan are also reported in the EcaTT project, based on Wendy Spinks' sources. Teleworkers are here estimated on the basis of a 1996 survey, which covers only full-time, white-collar employees. So, the definition considered for Japan is much more restricted than is the case for European Union countries.

from career opportunities, and downgraded contractual arrangements. There are also risks in terms of privacy (see Box 3).

Chart 2. **Teleworkers and ICT penetration in some OECD countries, 1999-2000**



Sources: Secretariat estimates, for ICT users per 100 inhabitants; and *EcaTT Final Report*, "Benchmarking progress on new ways of working and new forms of business across Europe", August 2000, for teleworkers.

14. One key question for this report is whether telework is likely to encourage the labour market participation of under-employed individuals. Partial evidence suggests that, in the European Union, telework has not had much impact on labour supply, at least until recently. According to the European survey, teleworkers are mainly men (75 per cent), of middle age (63 per cent of teleworkers are aged between 30 and 49), highly educated (almost 60 per cent have a high level of educational attainment), and two thirds of them are either professionals or managers. The majority of regular teleworkers work less than 20 hours a week and indeed most teleworkers alternate telework with working on the site firm. By contrast, permanent home-based telework is a marginal phenomenon – representing 2 per cent of total EU workforce only. Telework is concentrated among large firms – telework is possible in three quarters of all establishments with over 500 employees, compared with only 15 per cent in the case of establishments with less than 10 employees.

15. By contrast, in the United States, telework may have facilitated the labour market integration of disadvantaged groups. Slightly over half of American teleworkers are women (even though among full-time employees the majority of telecommuters are men, relatively young, and are better paid than average). American part-time teleworkers tend to work from home to supplement their regular income, a phenomenon which concerns not only the high-skilled but also other categories like pensioners. Half of the American full-time teleworkers work in small and medium-size firms (of less than 100 employees). Among contract-based teleworkers, 90 per cent are employed in firms with less than 100 employees.

Box 3. Pro's and con's of telework

Benefits/Opportunities	Risks/Uncertainties
1. For employers and work organisation	***1. For employers and work organisation***
• Lower costs (in terms of office space etc). • May increase productivity. • Improved motivation derived from a more independent style of work. • Flexibility. • Skills retention: the firm can retain people who might not stay in the firm (*e.g.* the other family member has to move; employees taking a career break can continue part-time and remain updated; employees on maternity leave can continue to undertake some tasks).	• Polarisation of the work force between protected and unprotected workers. • Not all the tasks are better done in a self-managing environment. Many tasks gain considerably from close interaction with team members. Hence, telework could hurt productivity or closeness to consumers.
2. For individuals	***2. For individuals***
• Telework may help combine work and family life. • Reduction of travel time and costs.	• Erosion of workers' social protection. • New stresses and damages to family life caused by the difficulty of differentiating work and private life. • Loss of on-the-job training opportunities. • Not necessarily good for everybody (people needing external discipline provided by set hours and a managed environment).
3. Other socio-economic dimensions	***3. Other socio-economic dimensions***
• Wider employment opportunities: by reinvigorating remote, rural or economically depressed areas. • Access to work for people with specific difficulties (disabled people; single parents who need to be at home for childcare; people with responsibility for an elderly or sick relative). • Reduction of traffic congestion and pollution.	• Some argue that there could be "social dumping" resulting from the "export" of jobs to low-wage locations.

2. A higher demand for knowledge-intensive employment

16. From the outset, it is important to stress that the current growth process is accompanied by high labour demand for all categories of skills. Labour shortages have emerged across the entire occupational spectrum, illustrating a lifting-all-boats effect. In this sense, claims that only highly-qualified labour can participate in today's labour market are unjustified. However, the issue arises whether the diffusion of new technologies and changes in work practices will somehow impact on the relative demand for skilled versus unskilled labour. This is a major policy concern, not only because it raises issues of income inequality but also because certain skills may be regarded as complementary to new technology and work organisation changes – thereby raising efficiency concerns.

(a) Emerging labour and skill shortages

17. Labour shortages in different sectors and occupations (from ICT workers to agriculture and retail) have been identified as the main factor hampering economic growth in the most recent National Action Plan for Belgium, Denmark, Ireland, Northern Italy, the Netherlands, Finland and Sweden (European Commission, 2000).

18. Labour shortages are especially acute at both ends of the labour market, i.e. among the unskilled and the highly skilled. Thus, the so-called New Economy has raised the demand for many types of labour, not just computer specialists. For example, according to the French Ministry of Labour (2000), during the first six months of 2000 labour shortages have been particularly serious in occupations related to hotels and restaurants, computers, electricity and electronic production as well as agricultural activities and construction. In Australia, skill shortages have emerged in many sectors, particularly in construction, engineering, transport and storage, health occupations and ICT (DEWRSB, 1999).

19. Regarding the ICT sector, in 2000, there was a shortage of more thant 800,000 new technology specialists in the United States.[9] Other sources also stress the problems associated with the shortage of ICT specialists, without however quantifying the job requirements (U.S Department of Labor, 1999*a*). The Bureau of Labor Statistics forecasts that, starting in 2006, about 138,000 new highly skilled ICT workers will be needed every year (Meares and Seargent, 1999). The European Commission has estimated that the shortage of ICT specialists in Western Europe could reach the equivalent of 1.7 million jobs in 2003.

20. Going beyond the occupations where labour shortages occur, it seems that "soft skills", understood as communication and inter-personal skills, are in high demand. In the United Kingdom, the National Training Organisation for ICT has identified the following six skills as critical to the ICT industry: oral communication, problem solving, team working, business awareness and creativity and innovation (DfEE, 1999). Likewise, in the United States, the Information and Technology Association of America estimates that in more than one third of the businesses surveyed, non technical, generic skills - such as communication, problem solving, analytical capacity and the ability to learn quickly- form the core skills needed by ICT managers (ITAA, 2000). More generally, the work practices discussed earlier, notably team work, are likely to raise the demand for soft skills.

21. Valuable as they are, however, "soft skills" remain complementary to the traditional skills associated with substantive areas of knowledge. Among the latter, ICT literacy is becoming as important as general literacy and numeracy (OECD, 2000*b*).

(b) A shift towards knowledge-intensive employment

22. Though the current expansionary phase is accompanied by higher labour demand for both unskilled and skilled labour, there seems to be evidence of a bias in favour of "knowledge-intensive" employment. It is indeed sometimes argued that developed countries have experienced in the past few decades a transformation in which knowledge has become a central element for the organisation and development of economic and social activities.[10]

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9. These estimates come from the business association of the sector. Therefore they have to be taken with care because, as stated by Matloff (2000), the business association is prone to present a pessimistic picture, with the aim of raising the number of H-1B visas for foreign workers.

10 . As defined by Dosi (OECD, 1996*b*), knowledge includes "cognitive categories, codes of interpretation of the information, tacit skills and problem-solving and search heuristics irreductible to well-defined

23. To the extent that knowledge plays a more important role in economic systems, the demand for workers that generate ideas and knowledge will rise. Therefore, in order to grasp the statistical importance of knowledge for economic growth, it is useful to examine recent changes in occupational patterns based on a conceptual framework developed by Wolff and Baumol (1989) and applied to the Canadian labour market by Lavoie and Roy (1998).[11] According to this approach, occupations can then be categorised into two main groups: non-information and information occupations (or workers), the latter being divided into two sub-categories, namely those manipulating information (data workers) and those generating ideas (knowledge workers).[12] This distinction is supposed to reflect the different aspects of human activity, namely producing goods, providing personal services (non-information occupations) and generating information. The knowledge-worker category includes those occupations which involve the production of knowledge or the provision of expert opinion not easily transferable (*e.g.* engineers, scientists or computer specialists). Data workers include occupations requiring some knowledge on how to manipulate data. Service workers are those employed mainly in personal services. Goods-producing occupations refer to the transformation and processing of materials and physical objects.

24. Preliminary findings suggest that the number of knowledge workers, as defined above, has increased markedly over the past few years (Chart 3). Between 1992 and 1999, in the OECD countries for which data are available, the number of knowledge workers rose by almost 5.5 million, that is almost 30 per cent of the net employment gains recorded during this period. Moreover, the incidence of knowledge employment is on the rise.

25. In the United States alone, the number of knowledge workers rose by almost two million between 1992 and 1998, representing over 14 per cent of the net employment created during the period. In European countries a similar pattern can be observed, though in the context of a less intensive job creation process than in the United States. There is considerable variation across countries, however: between 1992 and 1999, Italy, the Netherlands, Spain and the United Kingdom created over 400 thousands jobs in the knowledge occupations, while the number of such jobs fell in France and Portugal.[13] It must be noted, however, that methodological differences make cross-country comparisons problematic in this area. In particular, it is sometimes difficult to separate knowledge occupations from managerial ones. In addition, occupational classifications change over time, as has happened in France – which might explain the drop in the registered number of knowledge workers during the 1990s in this country. Notwithstanding these methodological problems, the contribution of knowledge workers to employment growth is significant among European countries, being responsible for over one in five jobs during the second part of the 1990s (Chart 4). In most OECD countries, knowledge and management workers combined accounted for over half of total jobs created during the 1990s.

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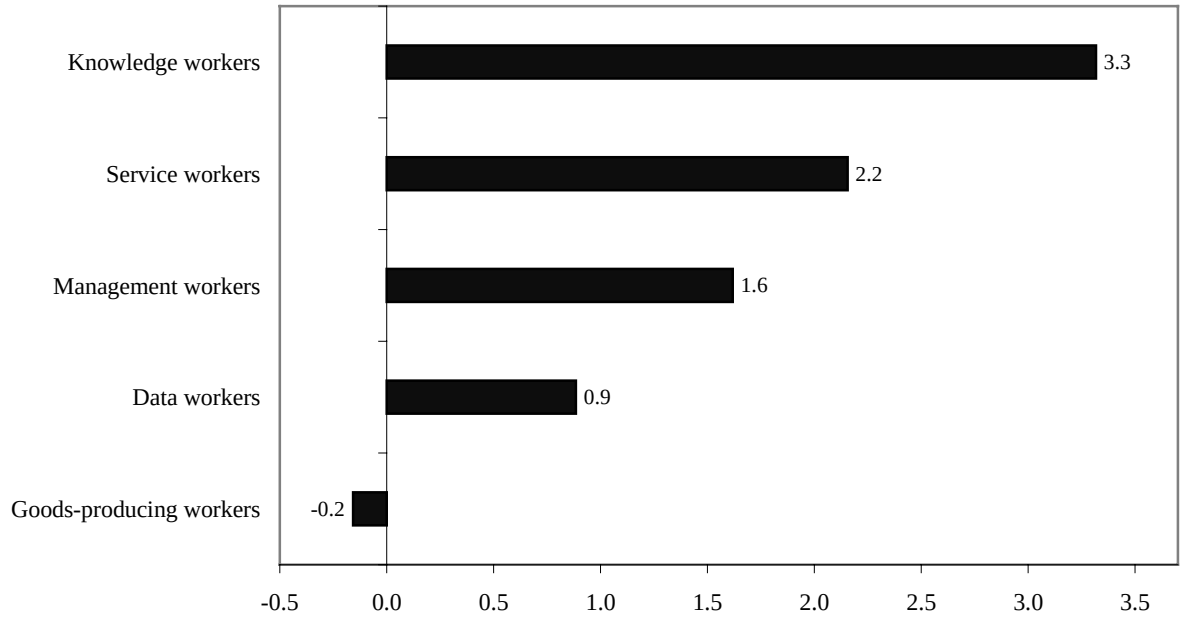
algorithms". Admittedly, however, measuring knowledge is not an easy task, as its limits are not clearly and universally defined.

11 . There exist other measures of knowledge-intensive employment, *e.g.* mesures based on literacy data (OECD, 2001*a*). The results are, however, similar to the ones presented here which are founded on a well-known conceptual framework and have the added advantage of offering a wide scope for empirical analysis vis-à-vis other measures of knowledge-intensive employment. For instance, it is possible to calculate the earnings of knowledge workers and thus to test whether the rise in this type of employment reflects demand or supply factors.

12 . See Annex B for a detailed classification of occupations.

13 . There is a break in Portuguese data which makes time comparisons during the period under analysis problematic. It seems, in fact, that knowledge-intensive employment is on the rise.

Chart 3.
The rising importance of knowledge-intensive employment
Employment growth by group of occupations in selected OECD countries[a],
average annual percentage change, 1992-1999



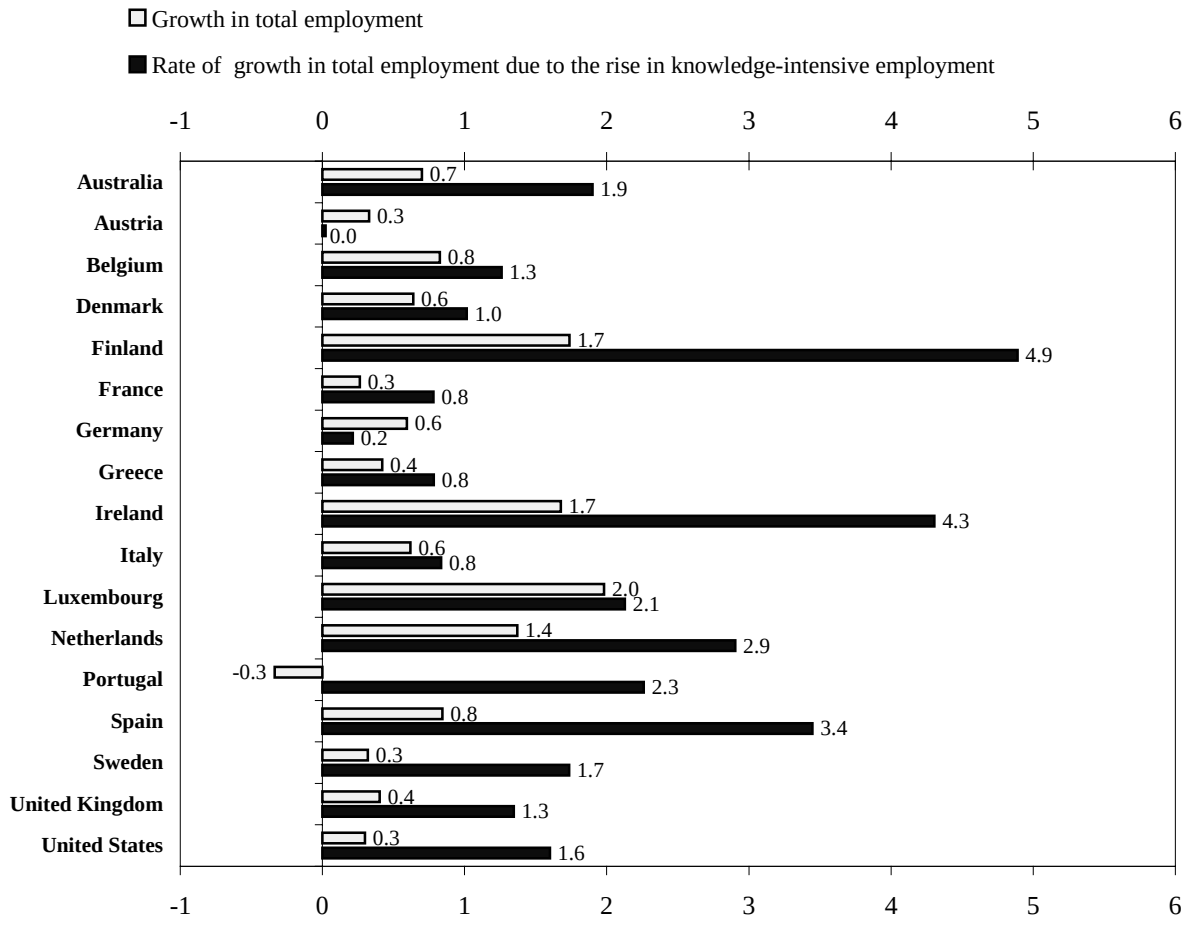
a) The countries considered include European Union member countries and the United States.

Sources: Secretariat estimates based on European Labour Force Survey for European countries and BLS, *Current Population Survey* for the United States.

26. Importantly, available evidence suggests that the rise in the number of knowledge workers reflects mainly demand developments (possibly related to the adoption of ICT and skill-biased technological change) and not just the trend increase in educational attainment. Indeed, in the United States (the only country for which such data are available), the wage of knowledge workers has risen much faster than is the case for other occupations, illustrating the shift in demand patterns. Between 1985 and 1998, nominal hourly earnings of knowledge workers grew at an average annual rate of 4.1 per cent, higher than the growth observed for the other categories of occupations and almost one point above the overall average. In addition, the level of earnings is also higher: in 1998, knowledge workers earned, on average, 20 to 50 per cent more than other workers - including managers (see Table D.3 in Annex D). In real terms, as shown in Chart 5, wage differentials are even more pronounced. While goods-producing workers have recorded a loss in the purchasing power of their earnings over the period 1985-98, the real wages of the other categories of occupations have increased. Since 1985, real hourly earnings have increased at an average annual rate of 1.2 per cent for the U.S. knowledge workers, three times the rate of increase observed for the overall economy. Women have seen an increase of their real earnings relative to their male counterparts in all groups of occupations, even if, on average, they still earned in 1998 between 12 and 25 per cent less than men.

Chart 4. **Contribution of knowledge-intensive employment to total employment growth in selected OECD countries, 1995-1999**[a,b]

Annual averages in percentage



a) Data for Australia refer to the period 1996-1999.

b) Data for the United States refer to the period 1995-1998.

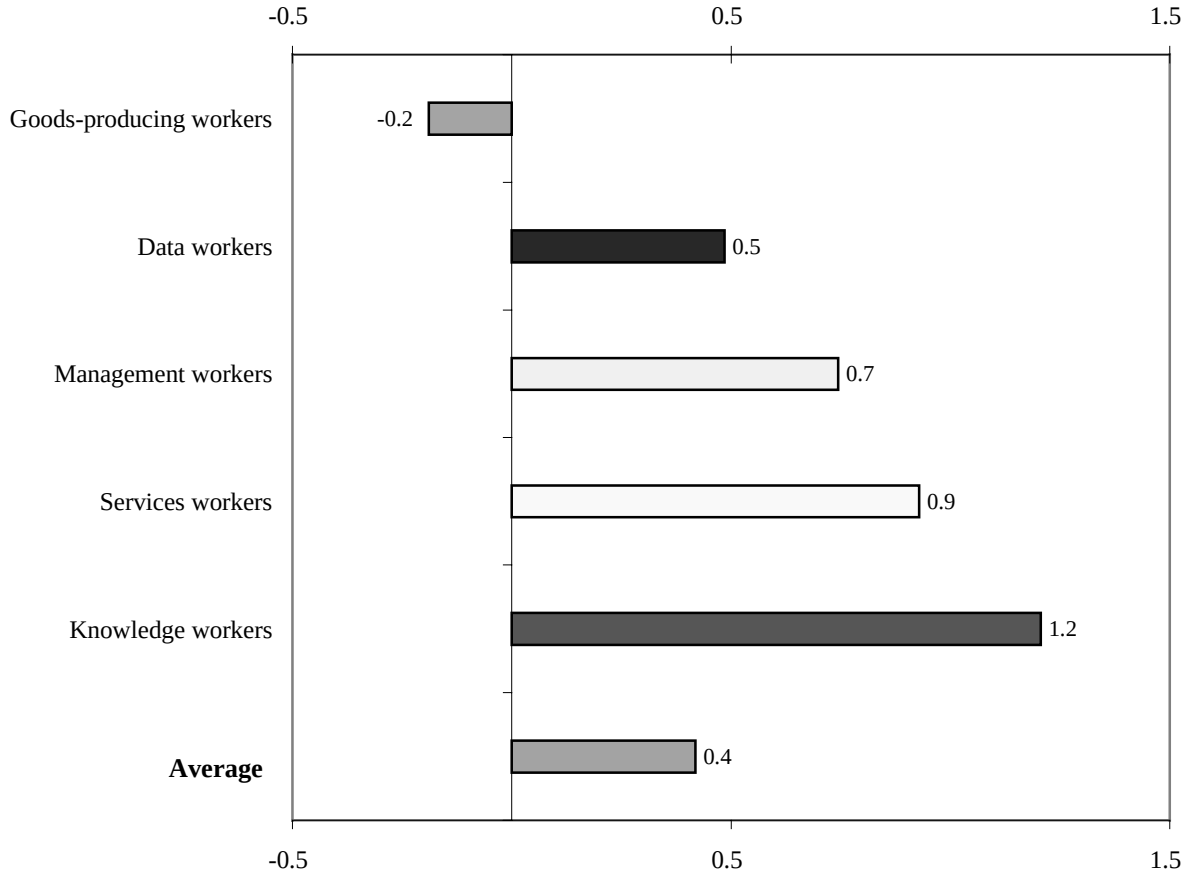
Sources: Secretariat estimates based on European Labour Force Survey for European countries, ABS, Labour Force Survey for Australia and BLS, *Current Population Survey* for the United States.

27. Among the knowledge-intensive occupations, computer specialists have recorded since 1995 the best employment opportunities in Sweden, the United Kingdom and the United States. Nevertheless, the share of computer specialists in total employment remains low (Chart 6). Computer workers have enjoyed an increase of their nominal average hourly earnings of 5 per cent during the period considered, with a clear acceleration in the past three years.[14]

14 . However, it will be necessary to check this trend with more recent data. The latest stock market trends of information technology industries may have a large negative impact on the earnings of computer workers.

Chart 5. **Real hourly earnings by group of occupations in the United States**[a]

Average annual growth - both sexes, 1985-1998

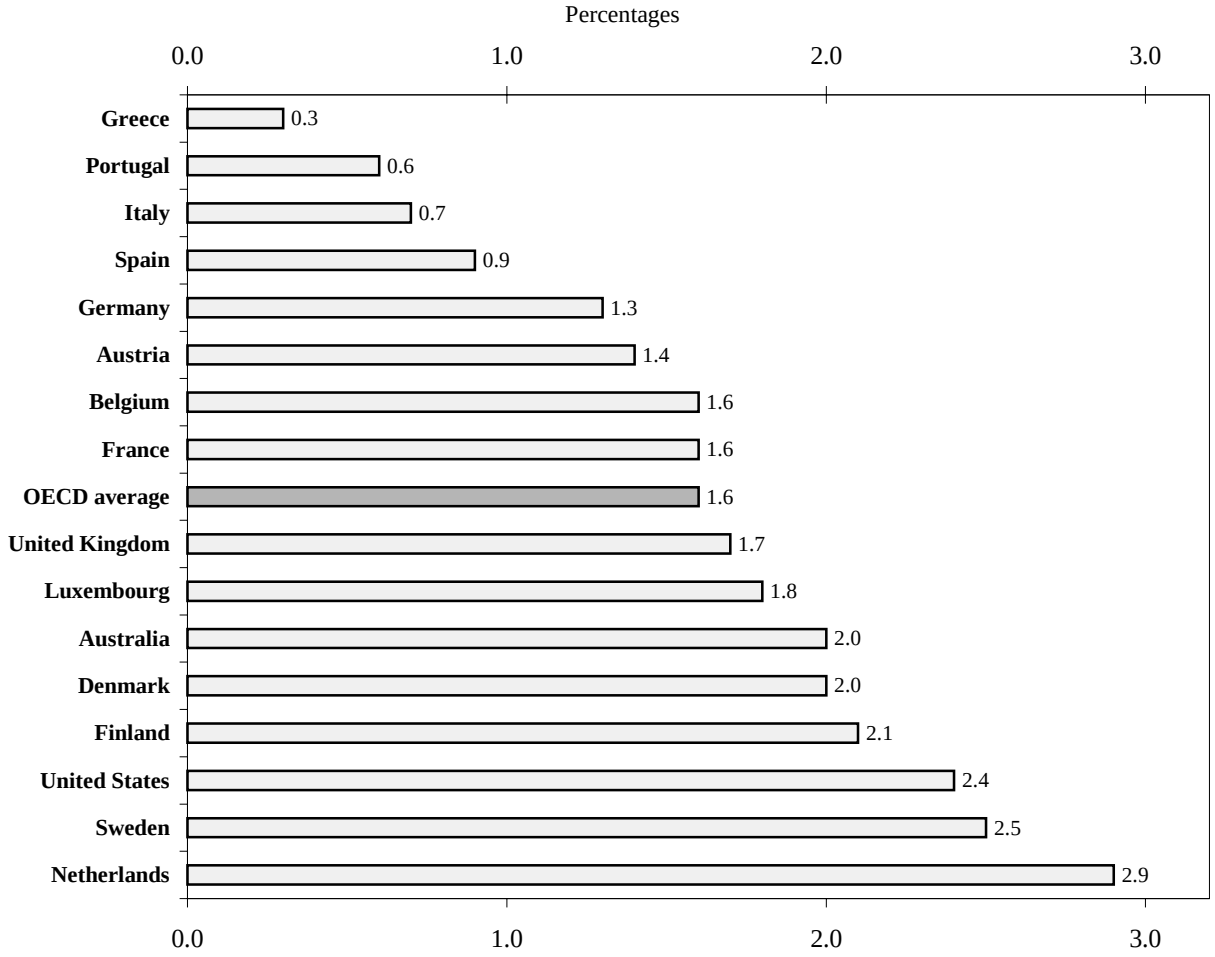


a) Real hourly earnings are calculated as nominal hourly earnings deflated by the private consumption deflator.

Source : Secretariat estimates based on BLS, *Current Population Survey.*

28. Some analysts have suggested that with the expansion of ICT and the Internet, the demand for individuals with special talents or skills will rise considerably. This "winner-takes-all" principle would thus apply to a range of knowledge-intensive occupations. Accordingly, a premium to talent would be paid in the form of higher basic wages and performance-based remuneration, *e.g.* stock options. There seems to be partial evidence in support of this view: as shown in Table D.3 in Annex D, the standard deviation of nominal earnings has increased for all categories of workers between 1985 and 1998 but the highest increase has been observed among the knowledge workers, suggesting the presence of a premium-to-talent principle within these occupations. This phenomenon, however, has not been extended to other occupations.

Chart 6. **Share of computer workers in total employment, 1999**[a]



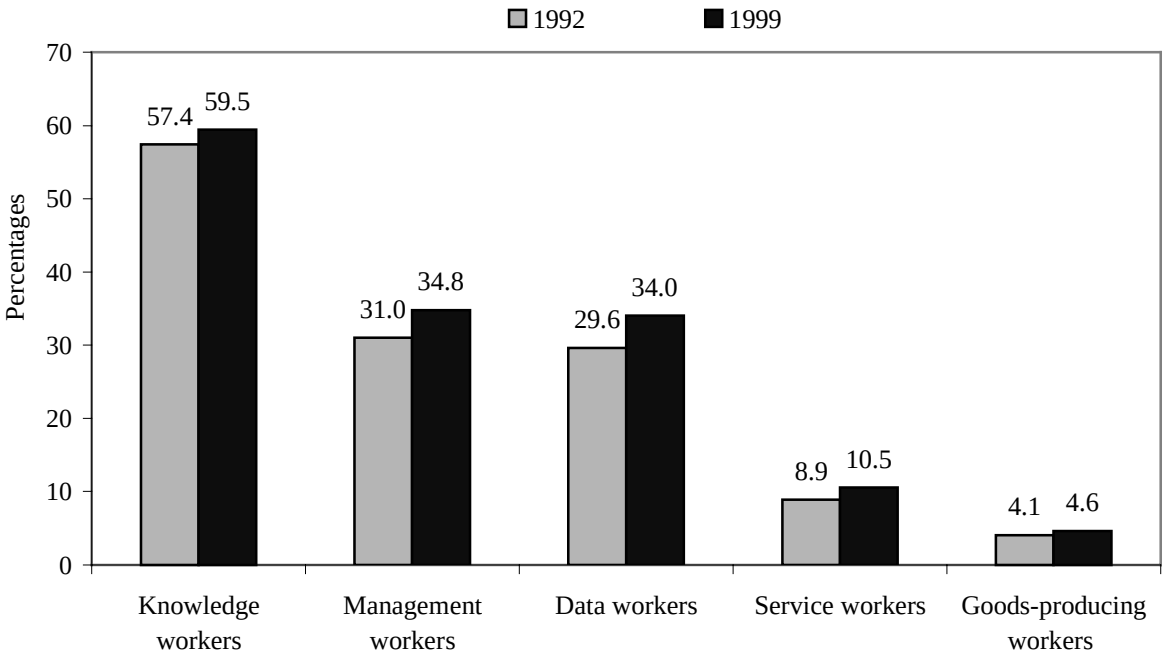
a) Data for the United States refer to 1998.

Sources: Secretariat estimates based on European Labour Force Survey for European countries, ABS, Labour Force Survey for Australia and BLS, *Current Population Survey* for the United States.

29. It could be argued that the dynamism of knowledge-intensive employment simply reflects higher educational requirements. In fact, the educational attainment of the workforce has improved in the five groups of occupations considered, as shown by the increase in the shares of those having high education as well as by the decrease of the shares of those having low education – a trend which is especially pronounced for female workers in most OECD countries. The ratio of high-educated versus low-educated - defined as the ratio between the number of people employed having tertiary and/or university studies to those having up to secondary studies - has increased in the past years in most countries for all the groups of occupations (Chart 7). Evidence shows that knowledge workers have on average a higher educational attainment than the other groups of occupations. Almost half of the highly educated workers are among the knowledge occupations. On the other hand, between 50 and 65 per cent of the knowledge workers in European countries have a high educational attainment, defined as tertiary and/or university education, a share that is even higher in the case of the United States (77 per cent). Nevertheless, what is important is that between half and one third of these workers have not reached a university degree, which underlines the importance of on-the-job experience.

Chart 7. **Employment shares by educational attainment and groups of occupations, OECD average**

Percentage of high-educated workers within each occupational group



Sources: Secretariat estimates based on the European Labour Force Survey for the European countries and on BLS, Current Population Survey for the United States.

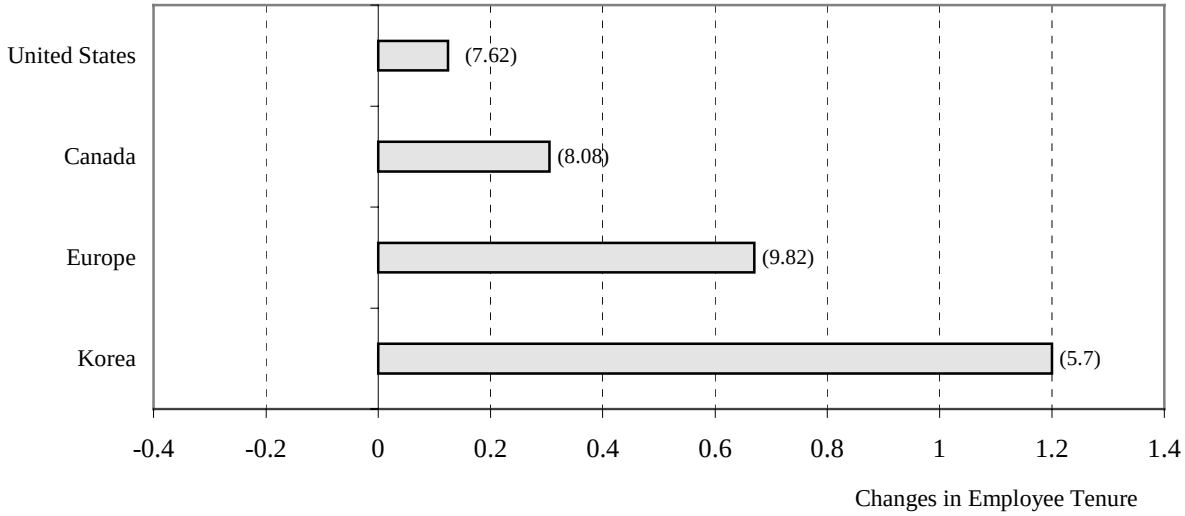
3. Employee tenure: overall stability which masks important underlying changes

30. In traditional firms, the links between employers and employees have been characterised by relatively long employment attachments. How have these patterns changed in the new economic context? This is an important question not only because employment stability is a crucial dimension of job security and well-being but also because it may be related with economic growth. The length of the employment relationship may indeed be linked with productivity, therefore growth, though the links may go in both directions. On the one hand, a relatively short employee tenure may reflect a greater degree of labour mobility between firms and occupations, thereby facilitating adjustments. This would enhance the extent to which economies will seize the new business opportunities, which would be good for growth. On the other hand, a short employee tenure may deter long-term commitments between workers and employers, reducing firms' incentive to provide training.

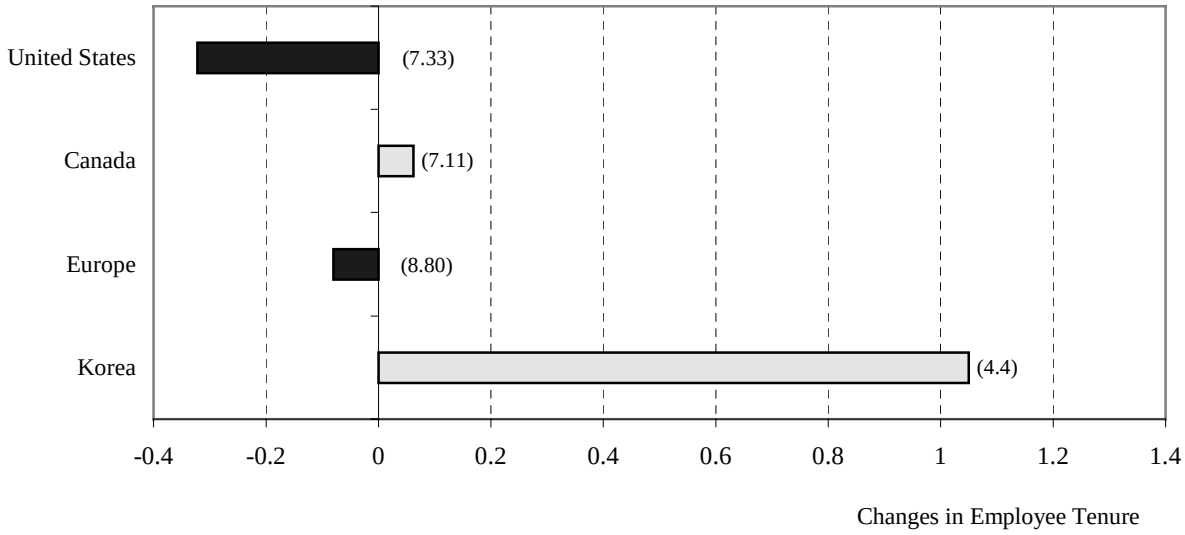
31. As is well known, in English-speaking countries such as Australia, Canada, the United Kingdom and the United States, employee tenure (a measure for job stability) is generally lower than is the case of continental Europe and Japan. Moreover, tenure has generally not changed during the 1990s. It became somewhat longer in Belgium, Canada, France, Japan, Netherlands, Portugal, Spain and United Kingdom, whereas it was somewhat shorter in Australia, Denmark, Germany, Greece, Ireland and Switzerland.

Chart 8. **Changes in employee tenure for selected occupations[a] , 1992-98[b]**

Panel A. **Higher skill- intensity occupations[c]**



Panel B. **Lower skill- intensity occupations[d]**



a) Numbers in parentheses refer to the level of employee tenure in the initial year. Employee tenures for "Europe" are calculated as a simple average over the European countries for which data are available. These countries are Denmark, France, Germany, Netherlands, Portugal, Spain, Switzerland, and United Kingdom.

b) 1993-1998 and 1996-2000 for Korea and the United States, respectively, instead of 1992-1998.

c) "Professionals (ISOC 2)" and "Technicians and associate professionals (ISOC 3)" except the United States. For the United States, "Professional Speciality Occupations (43-199)" and "Technicians and Related Support Occupations (203-235)" according to the Current Population Survey Code are used.

d) "Plant and machine operators and assemblers (ISOC 8)" and "Elementary occupation (ISOC 9)". For the United States, "precision productions, craft, and repair occupations" (503-699) and "operators, fabricators, and labourers" (703-889) according to the Current Population Survey Code are used.

Sources : National Submissions for Canada, Korea and Switzerland; Current Population Survey for the United States; and Eurostat for other countries.

32. However, this overall stability hides important underlying changes. First, it appears that tenure for skilled workers has tended to increase, while tenure for unskilled workers has tended to decrease. In many OECD countries, the tenure for unskilled occupations such as "elementary occupations" and "plant and machine operators and assemblers" has been reduced whereas tenure for skilled occupations such as "professionals" and "Technicians and associate professionals" has increased in almost all countries for which data are available (Chart 8). Even in countries where the tenure for low-skilled workers increased, it has done so much less than in the case of skilled occupations.

33. Second, tenure has followed diverging patterns by gender. Tenure of female workers tends to increase while the opposite goes true for male workers in many OECD countries. This may reflect a "catch-up" effect and indeed the employee tenure of female workers remains far below that of male workers.

34. Third, a sectoral analysis of tenure patterns shows that overall stability masks two conflicting phenomena. On the one hand, there is a change in the industrial structure towards low-tenure industries (Chart 9).[15] On the other hand, tenure tends to increase "within" sectors.

35. Finally, the age profile of the workforce needs to be taken into account. Older workers typically have longer tenure than young workers who just entered the labour market. Hence, population ageing automatically translates into higher tenure – even though the underlying trend may be different. In the case of the United States, employee tenure would have been reduced by 0.2 year during 1996-2000, if the share of each generation had been constant over the period. But what is important is that between 1983 and 2000, median tenure for American male workers aged 55-64 shortened by more than 5 years (Rajnes, 2001).

36. In sum, although at the aggregate level employee tenure is stable, evidence suggests that tenure at low-skilled workers has declined. This, combined with a structural employment shift towards low-tenure sectors, suggests that the perception of weaker employee-employer attachments is not entirely unjustified. Further analysis is clearly needed to better understand these trends.

37. Whatever the stylised facts, is tenure important for growth? As mentioned earlier, the possible links between tenure and productivity can go in both directions, and the matter should be explored empirically. It seems that low tenure countries have enjoyed faster productivity growth in the recent years (Chart 10). In addition, it seems that low tenure is associated with higher job creation. These relationships may reflect the fact that, hand-in-hand with new technology, new business opportunities have emerged, and countries where labour is more mobile (and tenure correspondingly lower) are better placed to exploit these opportunities at least in the short-run. Over the long-run, however, even high-tenure countries can considerably take advantage of the new economic environment.

38. Finally, despite the improved economic environment, workers continue to regard job security as an important dimension of their job. Table 1 presents selected indicators of job insecurity. Given the qualitative nature of the surveys on which they are based, the indicators capture individual perceptions. The picture that emerges is one of persistently high job insecurity, despite the new economic context. For the OECD countries as a whole, it is estimated that over half of all workers are worried about the future of their company, and 29 per cent are unsure of their job even if they perform well. True, the situation has improved compared with 1996 – both indicators have declined by 6 percentage points between 1996 and 2000. However, the fact that perceptions of significant job insecurity persist is suggestive. One interpretation of this finding is that job insecurity may be related with firm reorganisation and changes in job requirements – rather than lower employment tenure, for which there is no general evidence.

15. See Box 4 for detailed explanations about the method and interpretation of these results.

Box 4. Changes in employee tenure between sectors and within them: a methodology

Changes in employee tenure may be attributable to either shifts in employment patterns between sectors or structural factors within sectors. The latter reflect a modification in the employer-employee relationship, whereas the former are related to the structure of the economy. It is therefore useful to assess the relative importance of each factor, which is the purpose of this Box.

Employee tenure varies considerably across sectors. For instance, manufacturing workers and civil servants usually have longer tenure than is the case in private services. Changes in sectoral employment shares may therefore have an impact on aggregate tenure, even in the absence of any evolution within sectors. To disentangle the different effects, aggregate tenure is decomposed as follows:

$$(1)\ \Delta\sum_{i} P_i T_i = \sum_{i} \Delta P_i \overline{T_i} + \sum_{i} \overline{P_i} \Delta T_i + \sum_{i} \Delta P_i \Delta T_i$$

where Pi and Ti represent, respectively, the share and average tenure of workers employed in sector i; Δ means a change during 1992-1998 (except for the United States where the period 1996-2000 is used) ; and the bar over a variable refers to the value of the variable at the start of the period under analysis.

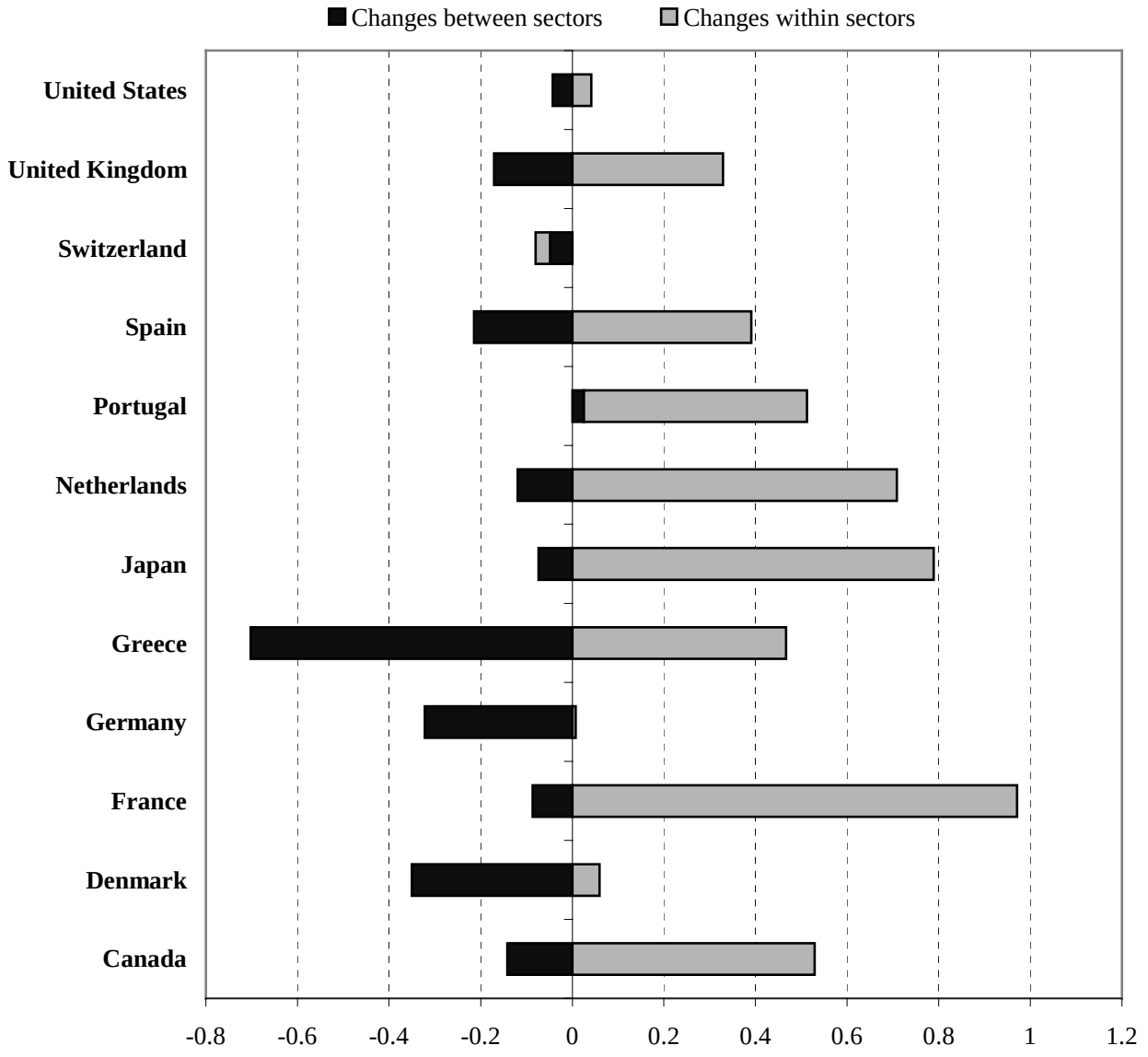
The first term of the right-hand-side of (1) represents changes in tenure “between” sectors, and the second term represents changes “within” sectors. The third term is a residual, which reflects the “interaction” between the other terms.

As discussed in the text, evidence based on this decomposition suggests that tenure tends to rise within sectors, which may be due to the expansion of several OECD economies – although it could also be attributable to a underlying lengthening in employer-employee relationships.

The evidence also shows that the economic structure is moving towards low-tenure sectors (i.e. the change "between" sectors is negative). This is an important policy-relevant finding. It means that, over the longer-run, workers may have to change jobs more often than is apparent when looking at the aggregate data – and adjustment costs will therefore rise.

39. The indicators also suggest considerable variation in job insecurity across countries. It is relatively low in Denmark, Finland, Ireland, the Netherlands and Norway and high in Greece, Japan, Korea, Poland, Spain and the United States. Interestingly, job insecurity is not necessarily low in low-unemployment countries.

Chart 9. **"Between-" and "within-" sector decomposition of tenure changes, 1992-98**[a]

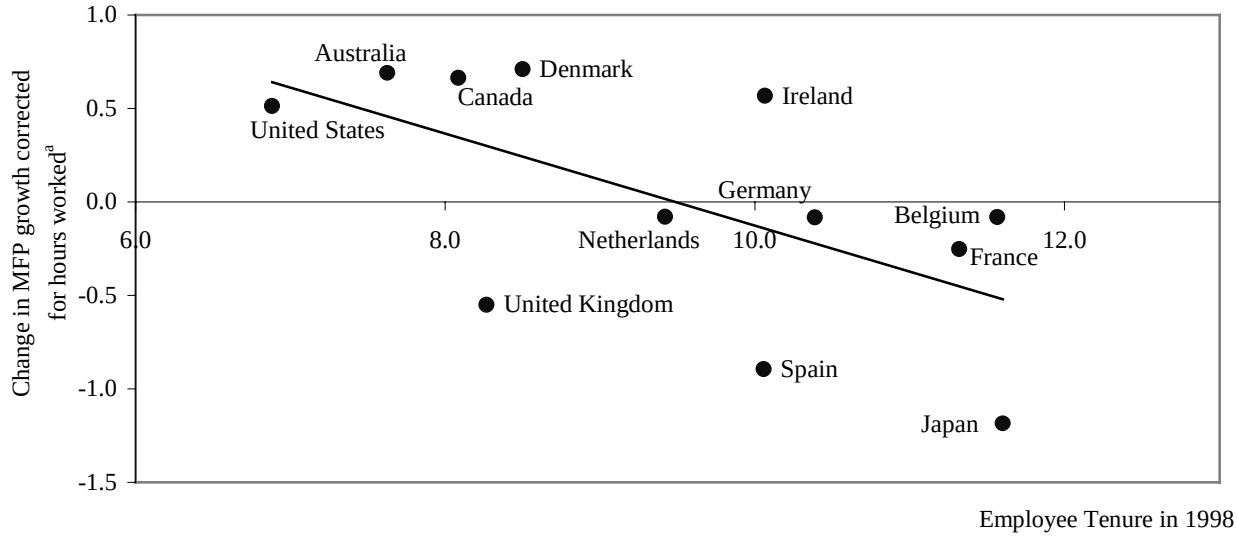


a) 1996-2000 for United States. Figures for Japan and the United States cannot be directly compared with those of the other countries due to the different industrial classification.

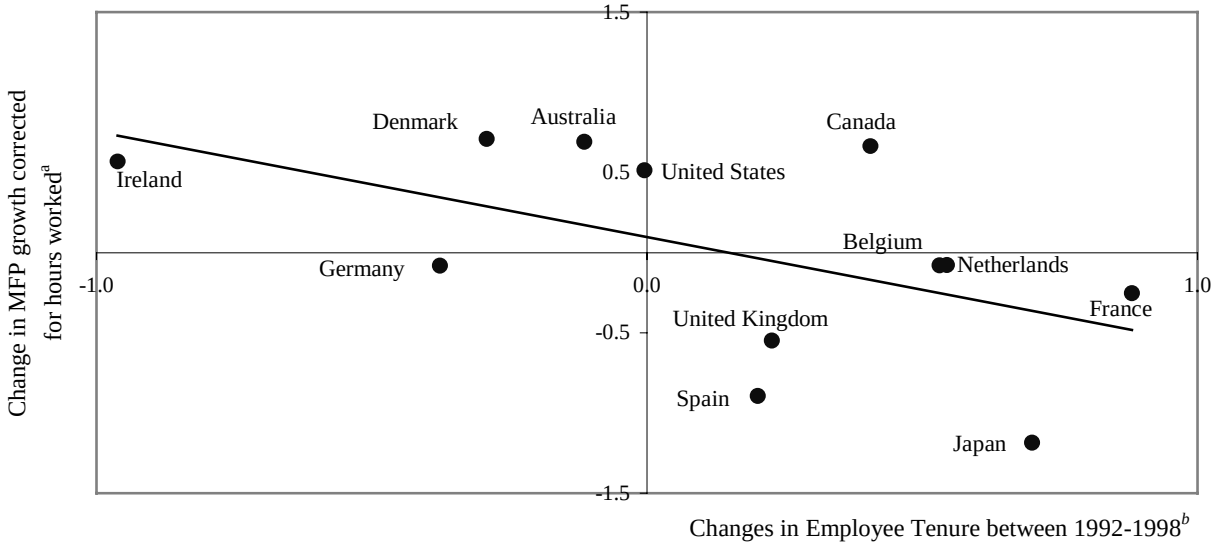
Sources : National Submissions for Canada and Switzerland; Year Book of Labour Statistics, various issues for Japan; *Current Population Survey* for the United States; and Eurostat for other countries.

Chart 10. **Employee Tenure and Multi-factor productivity acceleration**

Panel A. **Tenure level and MFP acceleration**



Panel B. **Changes in tenure and MFP acceleration**



a) MFP growth rate differntial between 1980-95 and 1995-99.

b) Data on employee tenure for the United States refer to 1996 and 2000 instead of 1992 and 1998.

Sources: Labour Mobility, Catalogue No. 6209.0, February 2000 for Australia; National Submissions for Canada; Year Book of Labour Statistics, various issues for Japan; *Current Population Survey* for the United States; and Eurostat for other countries. MFP growth rates are estimated by the Secretariat.

Table 1. **Recent developments in job insecurity in OECD countries**

	Percentage worried about the future of their company		Percentage unsure of a job with their company even if they perform well	
	1996	2000	1996	2000
Australia	42	50	33	37
Austria	50	52	23	23
Belgium	62	48	32	26
Canada	55	49	39	27
Czech Republic[a]	55	47	34	35
Denmark	48	43	32	20
Finland	63	42	47	31
France	72	49	42	37
Germany	54	50	36	34
Greece	59	62	25	29
Hungary	67	55	36	26
Ireland	53	40	40	23
Italy	63	47	32	32
Japan	63	65	36	38
Korea	71	62	44	46
Mexico	75	58	18	13
Netherlands	40	43	34	22
New Zealand	36	40	27	34
Norway	40	42	27	17
Poland	63	56	37	31
Portugal	73	75	25	21
Spain	79	70	32	27
Sweden	56	49	40	36
Switzerland	49	45	38	26
United Kingdom	61	48	53	41
United States	62	54	48	37
Unweighted average	**58**	**52**	**35**	**30**

a) For the Czech Republic, figures in 1996 columns refer to 1997.
Source: Data supplied by International Survey Research.

C. NEW WORK PRACTICES, SKILLS AND ECONOMIC GROWTH

40. Human capital is an important engine of economic growth. The skills and competencies of the workforce have an impact not only on the level of productivity (thus per capita income) but also on its growth rate. In particular, technological innovations are likely to be diffused all the more effectively and rapidly when human capital is high. Chart 11 shows that, over the 1990s, countries with a high level of educational attainment have tended to enjoy a relatively faster multi-factor productivity growth compared with the 1980s, while a recent study based on a new database finds a significant effect of educational attainment on economic growth (OECD, 2000*c*). Going beyond these general findings, labour market institutions are likely to shape the extent to which human capital is effectively utilised in the economy, and thus its impact on economic growth. Unfortunately, this is an under-researched issue, and the purpose of this section is to contribute modestly to fill in the gap by analysing a) how new work practices can help increase productivity, and b) the kind of skills that are likely to be complementary with new technology.

Chart 11. **Multi-factor productivity growth and human capital**

a) For Germany, productivity data for 1990-91 are missing. The figure provided here uses an estimate for the years for which data are available.

b) Changes in multi-factor productivity growth corrected for hours worked, average 1990s minus average 1980s. 1997 instead of 1999 for Austria, Belgium, Italy and New Zealand; and 1998 instead of 1999 for Australia, Denmark, Ireland, Netherlands and the United Kindom.

Source : Secretariat estimates.

1. New work practices and growth

41. It is sometimes argued that new work practices may contribute to raise productivity at the firm level, and this development, in turn, would translate into economic growth at the macro level (Black and Lynch, 2000). There would be two main reasons for this positive relationship:

- organisational change can be regarded as part of technological change, which contributes directly to the growth process.[16] Organisational change may indeed enhance the efficiency of human and physical capital, thereby paving the way for productivity gains. As the work organisation system founded by Taylor and Ford contributed to boost the productivity of mass-production of homogeneous products, new work practices are considered to play a similar role in the present economic environment characterised by a high degree of product differentiation and stiff product market competition.

- organisational change may contribute to economic growth indirectly, through its mutually-reinforcing relationship with new technologies, notably ICT. Some authors even argue that the so-called "Solow-Paradox" (*i.e.* the observation that, until recently, new technology had not translated into productivity gains) can be attributed to an insufficient response of work organisation systems to the new economic environment (Askenazy, 1999). Introducing new work practices may prove necessary to ensure that ICT is implemented effectively. In fact, new work practices and ICT may be regarded as complementary factors, each of them being a necessary condition for the other to lead to efficiency gains. This point is essential for understanding the role of ICT-use (as opposed to ICT-production) as a factor of economic growth.

42. However, there are also reasons to be sceptical about the possible economic impact of new work practices. Firstly, new practices are not necessarily more efficient than existing ones. There are advantages to traditional systems of job specialisation and management-employee relations. For instance, the delegation of responsibility entails a weaker monitoring on the part of managers, possibly posing a risk in terms of product quality and overall coherence of the tasks of the different employees. Moreover, one should not neglect the costs involved in organisational restructuring (i.e. organisational change is not a free good). An enterprise operates on the basis of norms and arrangements established through time and any major change in these norms and arrangements will inevitably entail some adjustment costs. Secondly, what is efficient for an individual firm is not necessarily efficient for the economy as a whole. Even if new work practices may raise productivity of the firms that implement them, this improvement can well be accompanied with lower productivity in other firms (with little overall effect). This is possible, for example, in the case of outsourcing and when firms lay off "low-productivity" workers and reorganise production with remaining, "high-productivity" ones.

43. In order to examine the validity of these conflicting arguments, this section presents a brief review of the literature and then carries out a range of empirical tests of the relationship between new work practices and economic growth.

(a) The literature on the link between work organisation and economic performance

44. A review of available studies suggests that there is a positive relationship between new work practices and firm-level performance (Box 5). Most studies for the United States find a positive relationship between the incidence of new work practices and labour productivity, Tobin's q, or rates of

[16] In terms of the neo-classical production function, organisational change would be part of the "technology" factor, i.e. the factor that raises the efficiency of labour and capital inputs.

return.[17] Studies for Australia and the United Kingdom, based on managers' self-evaluation of performance, find that new work practices tend to be associated with higher-than-average labour productivity, better financial performance and improved product quality (Addison *et al.*, 2000; Crockett, 2000; Ramsey *et al.*, 2000). Likewise, in a comparative project for Nordic countries, "flexible" work practices are positively correlated with labour productivity. In France, evidence is mixed. Earlier studies found a weak association (Coutrot, 1996; Greenan, 1996*a*; 1996*b*), whereas more recent ones point to the existence of a positive correlation (Caroli and Van Reenen, 1999; Coutrot, 2000*a*).[18]

45. Interestingly, the studies give some guidance on how new work practices matter:

- Like many other types of innovation, changes in work practices do not bring about their results immediately. Both employers and employees need to learn how the new practices can be used effectively. As a consequence, it is perfectly possible that their introduction will reduce the level of productivity in the short run. The weak evidence of the relationship between new work practices and firm performance found by some studies could be interpreted in this light (Askenazy, 2000).

- The most consistent finding is that new work practices are associated with improved firm-performance only when the practices are implemented as a bundle – and not separately. In other words, it is the entire system of new practices that brings about efficiency gains, and not each individual component of this system implemented in isolation. This is probably due to the complementarity existing between different practices.

- There is some evidence that the adoption of new work practices goes together with that of ICT. According to some studies, employers rarely regard ICT as an important motivation for organisational change (NUTEK, 1996). However, these studies also show that the adoption of new technology (including computer hardware and software) affects a larger proportion of the staff in firms that implement new work practices.

46. True, it could be argued that those firms which adopt new work practices will get a larger share of the market, to the detriment of other firms – *i.e.* the size of the cake would in fact be constant. This is particularly the case when organisational changes improve the extent to which production matches demand requirements – *e.g.* by bringing the nature of products closer to consumer preoccupations.[19] Though there is probably an element of truth in this assertion, few researchers believe that organisational innovations do not bring any real gains at all. In addition, evidence carried out for this study shows that new work practices do have a macroeconomic impact, an issue addressed now.

17. Cappelli and Neumark (1999) find weak support for this relationship, based on a data set covering the period 1977-1996. However, Black and Lynch (2000) find a positive and significant relationship for 1993-1996, based on a similar data set.

18 . One major problem with many of these studies is that they are usually based on the employers' subjective evaluation of the performance of their firm – some studies for the United States, however, use objective performance indicators.

19. Even in this case, however, it could be argued that the quality of output increases, thus raising welfare.

(b) Empirical evidence

New work practices are associated with a greater use of ICT

Box 5. Selected empirical studies on the impact of new work practices on firm performance

	Main findings
Evidence for the United States	
Ichniowski (1990)	"High-commitment" systems (encompassing flexible job design, formal training programs, formal communication systems and internal promotion) enhance firm productivity and Tobin's q.
Huselid & Beker (1996)	In firms with employee skill development schemes and performance pay systems, Tobin's q and gross rates of return are high.
Kelly (1996)	Plants with strong employee involvement enjoy relatively high hourly labour productivity, especially among those plants using computer-controlled machines.
Black & Lynch (1997)	Higher-than-average performance in unionised firms with new work practices. Greater employee voice in decision-making is what seems to matter most for productivity – rather than Total Quality Management *per se*. Labour productivity in unionised firms which adopt new work practices and use computers is estimated to be 20% higher than in the baseline case (non-unionised firms which have few new practices and do not use computers intensively). In unionised workplaces without employee involvement schemes, labour productivity is 15% lower than in the baseline case.
Ichniowski *et al.* (1997)	A study of steel finishing lines shows that, compared with "traditional" systems (with no innovative practice), lines adopting new work practices yield higher output levels (measured by actual output as a percent of potential output) and better product quality. The output differential between the lines with a complete set of new work practices and those with no new workplace practice is estimated to range from 7 to 11 percentage points.
Bresnahan *et al.* (1999)	New work practices are positively correlated with firm performance only when they are combined with heavy investments on either human capital or ICT. For instance, productivity of firms with a high intensity of both ICT and new work practices is 7% higher than in competing firms. The productivity effect is practically nil when either new workplaces or ICT are weakly used.
Bryson (1999)	Employee Involvement schemes enhance productivity only when combined with other new work practices.
Cappelli & Neumark (1999)	A weak correlation is found between sales per worker and new work practices, whereas establishments using new work practices offer relatively high wages.

Askenazy and Gianella (2000)	Re-organisation and computerisation have a positive and significant impact on multi-factor productivity growth when they are combined. On the contrary, the two factors have a negative impact on muti-factor productivity growth when each of them is introduced separately.
Black & Lynch (2000)	Positive correlation between new practices (regular meetings, re-engineering and profit sharing schemes) and labour productivity. Positive and significant correlation between new practices and wage rates.
Evidence for others countries	
Greenan (1996*a*, 1996*b*) (France)	Based on a classification of firms according to the degree of decentralisation of decision-making and communication structure, the study finds no correlation between different organisational systems and productivity.
Caroli and Van Reenen (1999) (France)	Although changes in work organisation, as a whole, influence positively plant-level multi-factor productivity, the effect is strongest when the incidence of skilled labour is high.
Coutrot (2000*a*) (France)	Establishments that use computers and are "innovative" in terms of changes in work organisation tend to report a strong expansion in their activities, relative to establishments that are "less innovative".
Addison *et al.* (2000) (United Kingdom, Germany)	Among non-union establishments in the United Kingdom, changes in employee involvement are positively and significantly correlated with changes in labour productivity and employment. In the case of unionised establishments, the correlation is often negative. In the German case, a positive and significant correlation is found between works councils and labour productivity among establishments with more than 100 employees.
Ramsey *et al.* (2000) (UK)	"High Performance Workplaces" (HPW) are identified based on an analysis of 24 human resource practices. HPW are associated with a relatively high performance in terms of labour productivity, financial results, product/service quality, and labour costs. HPW are also associated with a low job turnover rate.
Crockett (2000) (Australia)	Workplaces having undergone workplace reforms have recorded a rise in relative labour productivity according to both the 1995 Cross-section survey and the 1990-95 Panel survey. The index of workplace reforms includes formal training, semi-autonomous groups, income-bonus scheme, quality circles or team building, staff appraisal, Total Quality Management, Computer-Integrated Management, Skills audit and Just-in-time.
Antila and Ylöstalo (1999) (Finland)	Strong positive correlation between "functional flexibility" and value added per employee.
NUTEK (1999) (Denmark, Sweden and Finland)	Positive and marginally significant correlation between new work practices and productivity for Denmark. In the case of Swedish manufacturing industries, the correlation is positive and significant. In Finland, firms which have adopted new work practices have, on average, higher productivity levels than other firms.

47. There is considerable evidence that new work practices are introduced hand-in-hand with new technologies, notably ICT. To the extent that ICT is an engine of economic growth, this evidence would suggest that organisational change is also a major factor at work behind the recent growth performance. First, in all countries for which data are available, the incidence of ICT-use in the firms that implement new work practices is much larger than is the case in the firms that do not implement these practices. Thus, in the United States, 58 percent of non-supervisory workers of firms that implement new work practices use computers, that is 9 percentage point higher than in the case of firms that do not implement new work practices (Table 2). Similarly, the average difference in ICT-use among firms that use and do not use new work practices is 15 percentage points according to a survey conducted for the European Union and 10 percent points in both Australia and Finland.

Table 2. **Implementation of new work practices and use of ICT**[a]

Percentage of firms which use ICT[b]

	Among firms that implement new practices	Among firms that do *not* implement new practices
Australia (1995)	**24**	**14**
European Union (EPOC survey, 1994-96)	**49**	**34**
Denmark	*50*	*45*
France	*42*	*27*
Germany	*41*	*26*
Ireland	*59*	*46*
Italy	*54*	*43*
Netherlands	*25*	*16*
Portugal	*42*	*30*
Spain	*45*	*33*
Sweden	*55*	*41*
United Kingdom	*63*	*46*
Finland (1996)	**62**	**52**
France (REPONSE survey 1998)	**46**	**29**
United States (1996)	**58**	**49**

a) Figures correspond to averages of estimates carried out for each individual work practice (see Annex D for details on these calculations). Data are not comparable between surveys.

b) Figures for the United States refer to the percentage of non-supervisory workers using computers.

Source: Secretariat estimates based on various surveys.

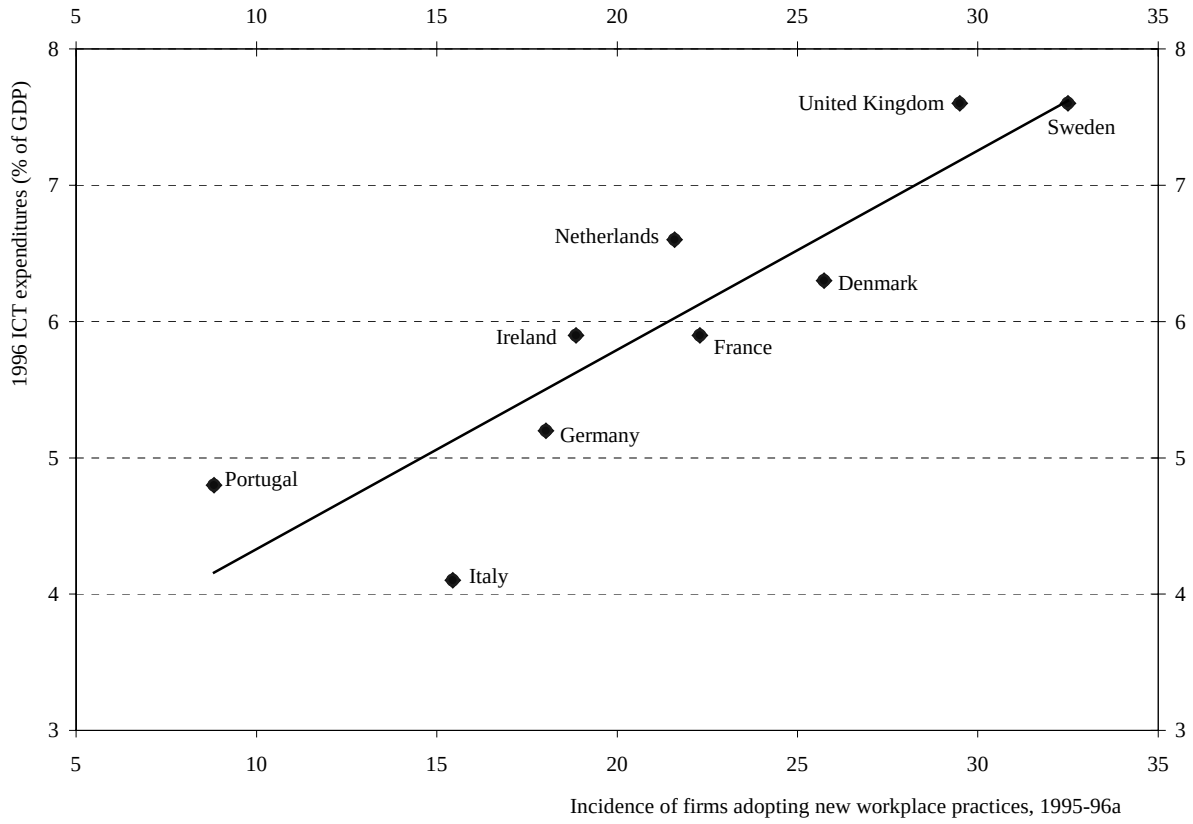
48. Second, looking at individual practices, it appears that most of them are associated with a high incidence of ICT-use (see figures of Table D.4 in Annex D):

- in all countries for which data are available, *employee involvement* schemes are strongly associated with ICT-use. This relationship reflects the fact that ICT facilitates information flows among staff (notably between management and front-line workers), and employee involvement schemes are one way of exploiting this possibility;

- *team-working* is also associated with a relatively intensive use of ICT. This result suggests that team-working and ICT complement each other. ICT facilitates the creation of networks, both formal and informal, while conversely the presence of well-functioning teams provides a justification for introducing ICT;

- similarly, the incidence of ICT-use is higher in firms that implement *new production systems* than is the case of firms that do not implement such systems. The rationale behind this result is that changes in production systems are often associated with the introduction of team-working and employee

Chart 12**. New work practices and ICT investment**



a) This is calculated as a simple average of five new work practice indicators for 9 European countries (see Annex D for details). Spain is excluded because of the absence of information about one of the indicators (flattening of managerial levels). ICT expenditures include expenditures on hardware, information technology services and software and telecommunications for the year 1996.

Sources: Secretariat estimates based on the *Survey of Employee Direct Participation in Organisational Change*; OECD, *Science, Technology and Industry Scoreboard 1999 - Benchmarking Knowledge-based economies*, 1999.

involvement schemes –which, as just discussed, are strongly related with ICT. There is evidence that firms which have modified their production system, without at the same time introducing team-working or employee involvement schemes, tend to be relatively weak users of ICT;[20] and

- the link between job rotation schemes and ICT-use is somewhat weaker than is the case of the other practices reported (especially in the case of the United States).

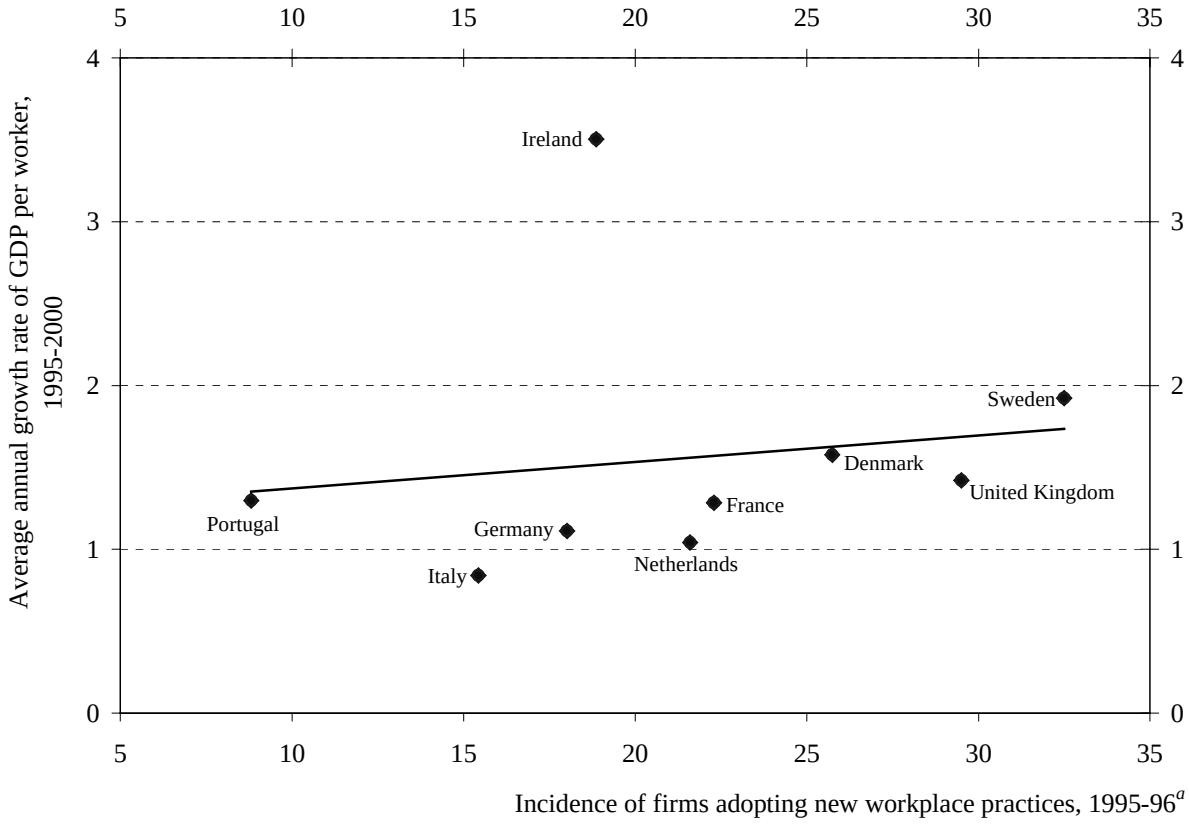
20. This finding is based on the EPOC survey. For example, when there is no group delegation of responsibility, ICT adoption among firms that flatten managerial structures is no higher than is the case among firms that do not flatten managerial structures. But, in the presence of group delegation of responsibility, 43% of firms that flatten managerial structures have adopted new ICT against 36% for firms that do not flatten managerial structures. A similar pattern is found in the case of "back to the core business".

49. Finally, a cross-country link between new work practices and ICT can be established by examining evidence for European countries for which comparable data on organisational change exist (Chart 12). The incidence of new work practices is proxied by the average rate of diffusion of a range of indicators, and appears to be strongly correlated with ICT expenditure as a share of GDP. This proxy is subject to a degree of arbitrariness. However, the correlation is suggestive and consistent with earlier evidence.

Direct evidence on the productivity impact

50. Besides the association which has just been established between new work practices and ICT, a more direct impact on productivity growth can be discerned. As shown in Chart 13, the diffusion of new work practices is correlated with labour productivity growth, even though the case of Ireland departs from this relationship.

Chart 13. **New work practices and labour productivity**



a) This is calculated as a simple average of the five new work practice indicators for 9 European countries (see Annex D for details). Spain is excluded because of the absence of information about one of the indicators (flattening of managerial levels). ICT expenditures include expenditures on hardware, information technology services and software and telecommunications for the year 1996.

Sources: Secretariat estimates based on the *Survey of Employee Direct Participation in Organisational Change* and *OECD Economic Outlook*, No.68, December 2000.

51. Productivity gains are particularly large when new work practices are implemented together with ICT. As shown in Table 3, labour productivity growth during 1992-1998 was much faster than average in US manufacturing industries that combined a high incidence of new work practices with a high incidence of ICT-use. However, the productivity performance of firms which use ICT and do not adopt new work practices is rather poor. Studies based on subjective evaluations of productivity lead to a similar finding. Employers in firms characterised by an intensive use of both new work practices and ICT tend to report that their productivity is higher than that of competitors. In other firms, employers are not particularly optimistic about their firm's productivity. Likewise, among the Fortune 1000 firms, productivity is expected to rise only in those which use intensively both ICT and new work practices. Otherwise, the individual productivity effect of either new work practices or ICT seems to be very small (Bresnahan *et al.*, 1999).

Table 3. **The mutually-reinforcing relationship between new workplace practices and ICT, United States**

Average annual growth rate of labour productivity, US manufacturing 1992-98, in percentages

	Industries with *high* ICT intensity	Industries with *low* ICT intensity
Industries with *high* incidence of new workplace practices	7.8	1.4
Industries with *low* incidence of new workplace practices	0.5	2.2

Sources: Secretariat estimates from Education Quality of Workforce -- National Employer Survey 1997 and Gross Product by Industry (BEA).

An association with performance-pay systems, non-standard forms of employment and stress at work

52. Though there is evidence that new work practices are positively associated with productivity performance, concern has been expressed about the possible impact of these practices on wage inequalities and job precariousness – whose impact on growth over the medium-to-longer run is ambiguous.

53. Firms adopting new work practices are prone to use performance-pay schemes such as profit-sharing and stock options, with potential productivity (and growth) effects (Table 4). For example, in the United States, 49 percent of firms that implement new work practices provide stock options or profit-sharing schemes to their staff – the figure is 37 percent in the case of firms that do not implement the new work practices. In the case of the European Union, performance-pay systems such as "pay on the basis of team output", profit-sharing and ownership schemes are systematically more prevalent among firms that implement the new work practices than among other firms. Similar results are obtained according to the special surveys conducted for Australia, Finland and the United Kingdom.

54. Performance-pay systems can be expected to raise productivity. These systems can be regarded as an important organisational arrangement enabling firms to attract skilled labour, motivate workers, and hence achieve a better economic performance (Lawler, 2000). In particular, when responsibilities in decision-making are delegated to workers or teams, performance-pay systems are likely to enhance team motivation, outweighing the potential risks entailed by weaker management monitoring. However, on the other hand, the increased recourse to performance-pay systems is likely to widen wage inequality between workers. At a macroeconomic level, wider wage inequalities can affect income distribution, thus possibly reducing social support for growth-enhancing policies (see OECD, 2001*b*).

55. It is sometimes claimed that new work practices tend to be associated with a relatively intensive use of outsourcing and non-standard forms of employment. Table 5 provides some support for this assertion: in firms which use new work practices, the incidence of outsourcing arrangements, part-time work and fixed-term contracts tends to be somewhat higher than in firms that do not implement the new practices. While job turnover of skilled workers may be an enriching experience, this is usually not the case when unskilled workers change jobs – these workers tend to lose skills (since their human capital is often firm- or industry-specific), thereby depressing their actual productivity. Also, there is ample evidence that employees with short-term contracts and other non-standard forms of employment are less likely to

Table 4. **New work practices and selected performance-pay systems**[a]

Percentage of firms which use performance-pay systems

	Among firms that implement new practices	Among firms that do *not* implement new practices
Australia (1995)		
Any performance-based payment	37	31
Profit sharing	7	4
Stock options	18	15
European Union (EPOC survey 1994-96)		
Pay on the basis of team output	22	17
Profit sharing	25	18
Ownership schemes	10	6
Finland (1996)		
Pay for the result of team or unit	53	43
France (REPONSE survey 1998)		
Individualisation of wage increase	76	66
Individual bonus	54	51
United Kingdom (WERS survey 1998)		
Any incentive payment scheme	47	41
United States (1996)		
Profit-sharing or stock options	49	37

a) Figures correspond to averages of estimates carried out for each individual work practice (see Annex D for details on these calculations). Data are not comparable between surveys.

Source: Secretariat estimates based on various surveys.

receive training than their permanent-contract counterparts.

56. Finally, there is some evidence that new practices are associated with greater stress at work. Employees are more autonomous, and in this sense they may be more satisfied at work, but they are made directly responsible for their performance which in many circumstances will intensify stress. This is why some argue that new production models boil down to "management by stress" (Parker and Slaughter, 1988). Worryingly, in recent years, the incidence of stress and accidents at work has reportedly increased

in many OECD countries.[21] According to some studies, this trend is in part attributable to firm re-organisation (Askenazy, 1999; Fairris and Brenner, 2001).

Table 5. **New work practices and selected atypical forms of employment**[a]

Percentage of firms which have recourse to atypical forms of employment

	Among firms that implement new practices	Among firms that do *not* implement new practices
Australia (1995)		
Contractors, outworkers and agency employees	**72**	**65**
Fixed-term contracts	**40**	**31**
European Union (EPOC survey 1994-96)		
Part-time workers	**27**	**23**
Denmark	*15*	*15*
France	*42*	*29*
Germany	*22*	*23*
Ireland	*35*	*26*
Italy	*6*	*9*
Netherlands	*34*	*28*
Portugal	*3*	*9*
Spain	*12*	*13*
Sweden	*59*	*59*
United Kingdom	*39*	*33*
United Kingdom (WERS survey 1998)		
Temporary agency employees	**25**	**17**
United States (1996)		
Workers from outside the firm	**56**	**36**

a) Figures correspond to averages of estimates carried out for each individual work practice (see Annex D for details on these calculations). Data are not comparable between surveys.

Source: Secretariat estimates based on various surveys.

2. Links between skills and economic growth

57. As mentioned earlier, over the past few years, the issue of the links between human capital and economic growth has received considerable attention among researchers. Human capital plays a central role in "new growth" theories, which make economic growth dependent on the rate of accumulation of physical and human capital. Another strand of the literature examines the issue of knowledge spill-over.

21. In the United States, illness due to work pressure has jumped from 18 per cent of all occupational illnesses in 1980 to 65 per cent in 1998 (U.S. Department of Labor, 1999*b*). Similarly, the International Labour Office recently reported that the incidence of mental health problems and the costs related to them have risen during the past decade in the five countries under study, namely Finland, Germany, Poland, the United Kingdom and the United States (Gabriel and Liimatainen, 2000).

Such theories treat knowledge as a public good: once knowledge has been generated by one individual, it becomes accessible to other individuals.

58. However, an issue which is often ignored in the literature is *how* human capital affects economic growth. In the present context, it can be argued that certain skills are of particular importance for the effective implementation of new technologies. Indeed, certain skills are indispendable complements to new technology.

59. In order to test the validity of this view, an econometric analysis of recent growth patterns in several OECD countries has been conducted (see Annex C for the detailed estimation results). Physical capital and skilled labour emerge as complements, while both these factors and unskilled labour are substitutes. It follows that an insufficient supply of skilled labour will constrain economic growth. Analysis of factor proportions in the United States illustrates this result: as shown in Chart 14, physical capital and knowledge-intensive employment have followed similar patterns, even though the relative return to knowledge-intensive employment has increased substantially.[22] By contrast, unskilled employment has fallen relative to the other two factors, despite the reduction in the relative wage of this type of employment. These findings confirm evidence from other studies which show that the cross-country difference in the diffusion of computers crucially depends on differences in human capital (Caselli and Coleman, 2001).

Box 6. Knowledge as a privately produced public good

Recent research on the economic properties of knowledge may lead to important policy implications. The "public good" nature of knowledge is well-established --in other words, unlike private services which imply exclusion or rivalry, access to knowledge can be given to all. The policy implication is clear: market forces in and of their own are likely to lead to under-provision of knowledge. This would justify government intervention in this area to ensure an adequate provision of the public good.

Much less explored is the fact that knowledge is a special public good, in that it is produced by individuals (i.e. it is a privately-produced public good, see Chichilnisky (2000)). In this case, distributional issues become essential: knowledge opportunities have to be distributed in a way which ensures efficiency. Indeed, unlike the case of typical public goods, distribution cannot be separated from efficiency considerations in the case of knowledge. This reinforces the importance of improving access to quality education and access to new technologies for all.

60. There are several reasons why knowledge may exert a greater influence on economic growth today. First, facilitated by the increased use of ICT, knowledge is diffused more rapidly and widely than ever. The result is that the economic externalities associated with knowledge may have increased. Second, today's economy is dominated by services where intangibles play an important role, knowledge being one of these key intangibles. More generally, the production of goods and services embodies an increasing element of knowledge (e.g. design and consumer services). Ideas and knowledge are the pillars of the so-called "knowledge-based" economy.

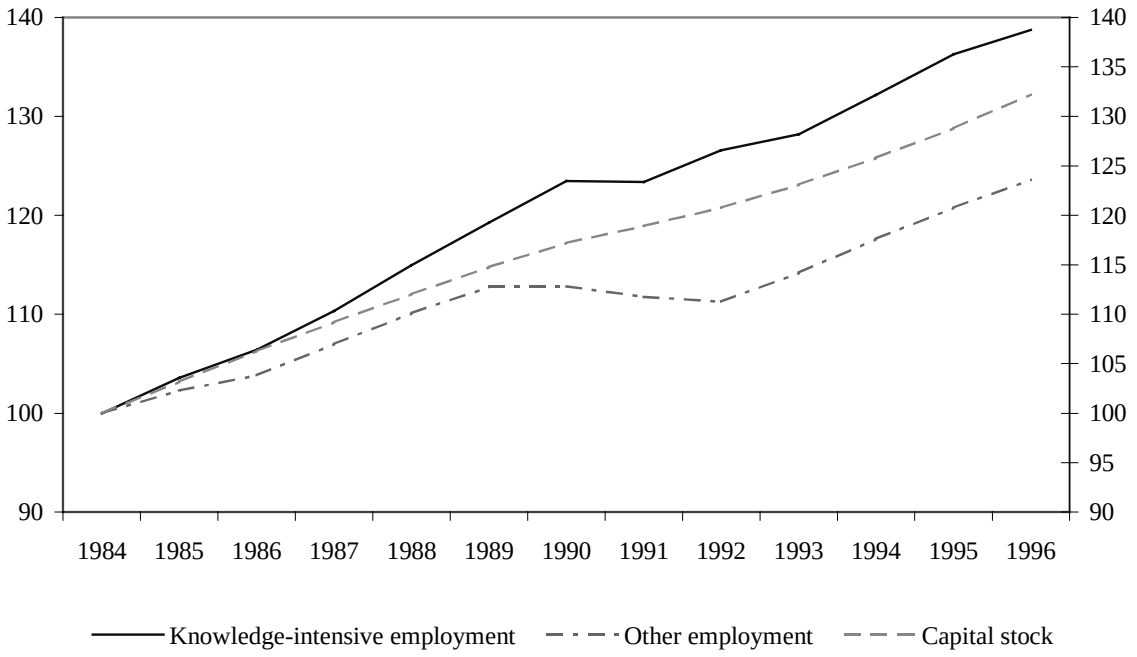
61. While human capital investment is so critical in today's "knowledge-based" economy, the social returns from these investments tend to be higher than their private returns. The problem may have been compounded by the fact that a rising number of unskilled workers face relatively unstable employment conditions, so that firms employing them have little incentive in investment in their human capital. The issue of how policies can address this thorny public good question is treated below.

22. Unfortunately, reflecting data constraints, it is not possible to replicate this chart for other OECD countries.

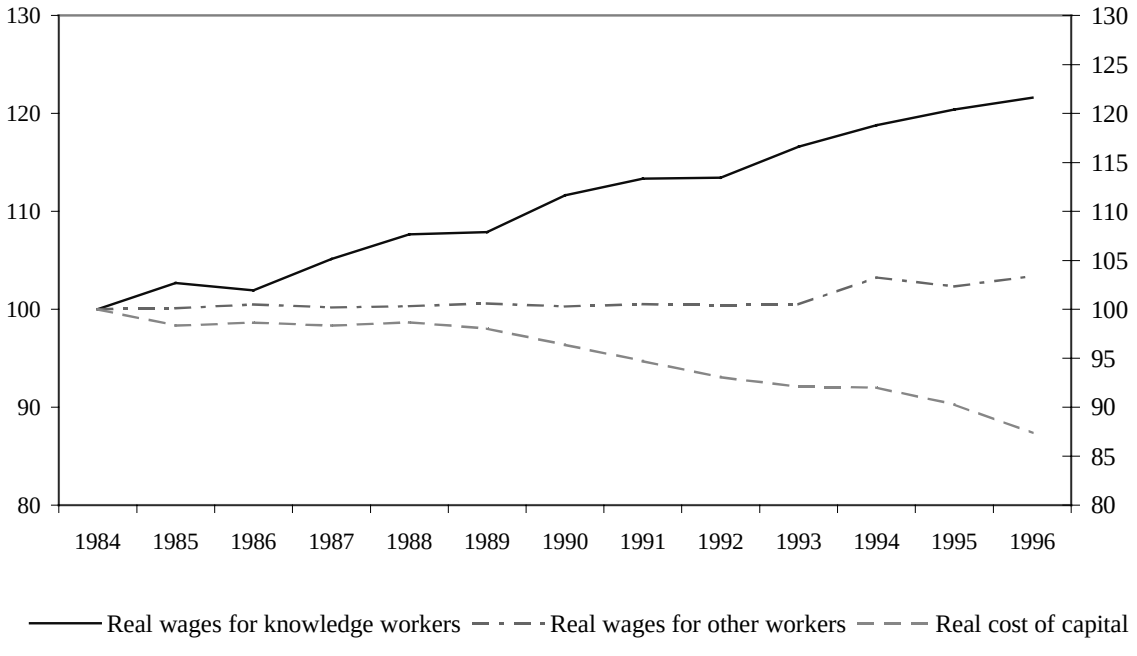
Chart 14. **Complementarity between physical capital and knowledge-intensive employment,**[a] **United States**

Indexes, 1984 = 1000

Panel A - **Trends in factor proportions**



Panel B - **Trends in factor remuneration**[b]



a) For a definition of "knowledge-intensive employment", see Section B.2.

b) Real factor remuneration is measured as the ratio of nominal factor remuneration to the value-added deflator.

Sources: Secretariat estimates based on BLS, Current Population Survey; and OECD, International Sectorial Database.

D. POLICY ISSUES

62. It could be argued that decisions regarding work organisation are typically a firm prerogative, one in which policy makers have no direct role to play. Moreover, given that work practices apparently help improve firm performance, it is legitimate to ask why these practices are not embraced more widely (and therefore why there is a need for discussing policies at all). One possible explanation is that introducing these practices involves a reorganisation of the enterprise, which is time-consuming, costly and necessitates an investment effort (notably in the area of training). Thus, the decision depends on a cost-benefit analysis of the practices, as well as on whether there is any pressure to change. In addition, certain categories of workers and managers may feel insecure about the new practices — this is especially the case when they lead to downsizing, or when layers of management are suppressed. Even though these perceptions are not always justified, insecure workers and certain managers will tend to oppose change. Governments may thus have an indirect role to play here, mainly by making sure that firms and workers are provided with the appropriate skills and that regulatory frameworks do not overly distort decisions.

63. More generally, policies are needed to exploit the growth and job opportunities associated with the new economic environment characterised by the rapid diffusion of new technology. First, to seize these opportunities, there is a need for ensuring that workers participate in the labour market actively. Second, governments have to create an environment conducive to the acquisition of skills and competencies that are needed. Third, the issue of whether (and how) labour-management institutions will adapt to the changing economic situation needs to be addressed.

1. Mobilising labour supply

64. Discussions about the new economic context should not divert attention from the fact that many OECD countries continue to suffer low rates of labour utilisation. While the employment/population ratio exceeds 70 per cent in the United States and most Nordic economies, the figure is less than 60 per cent in many other OECD countries (Table 6). Especially low are the employment/population ratios of women (notably in Southern Europe).

65. Achieving a greater mobilisation of labour supply would also go hand-in-hand with higher productivity gains (thereby economic growth). Indeed, there is evidence that in many of the countries most successful in creating employment, multi-factor productivity has grown fast, thereby confirming that there is no trade-off between productivity gains and job creation, but a mutually-reinforcing relationship (OECD 2000*b*). It can even be hypothesised that multi-factor productivity will tend to accelerate all the faster when spare capacity has been fully utilised – recent developments would lend support to this hypothesis.

66. Policies that encourage the labour market participation of would-be workers, such as making work pay systems and effective active labour market programmes, should therefore continue to rank high in the policy agenda. In countries where labour shortages have emerged, it is particularly urgent to reinforce the activation elements of labour market programmes – in this regard, the coexistence in certain countries of labour shortages with relatively high unemployment rates is a matter of considerable policy concern. Also, evidence shown in Section B that employee tenure is somewhat lower in countries where multi-factor productivity has accelerated suggests that labour needs to be mobile to exploit the growth potential of new technology. Features of employment regulations that unduly inhibit labour mobility need to be reconsidered. More generally, the labour market policy framework continues to be relevant in the "New Economy", even though certain elements of the framework can be posed in different terms and priorities may have to be rethought.

Table 6. **Employment/population ratios by gender, for persons aged 15-64 years,[a] 1999**

Percentages

	Both sexes	Men	Women
Australia	67.7	76.1	59.3
Austria	68.2	76.7	59.7
Belgium	58.9	67.5	50.2
Canada	70.1	75.5	64.7
Czech Republic	65.9	74.3	57.4
Denmark	76.5	81.2	71.6
Finland	66.0	68.4	63.5
France	59.8	66.8	52.9
Germany	64.9	73.1	56.5
Greece[b]	55.6	71.6	40.3
Hungary	55.7	62.6	49.0
Iceland[c, d]	84.2	88.2	80.2
Ireland	62.3	73.4	51.3
Italy	52.5	67.1	38.1
Japan	68.9	81.0	56.7
Korea	59.7	71.5	48.1
Luxembourg	61.6	74.4	48.5
Mexico	61.2	84.8	39.6
Netherlands	70.9	80.3	61.3
New Zealand	70.0	77.3	63.0
Norway[c]	78.0	82.1	73.8
Poland	57.5	63.6	51.6
Portugal	67.3	75.5	59.4
Spain[c]	53.8	69.6	38.3
Sweden[c]	72.9	74.8	70.9
Switzerland	79.7	87.2	71.8
Turkey	51.9	71.7	32.0
United Kingdom[c]	71.7	78.4	64.9
United States[c]	73.9	80.5	67.6
European Union[d]	**62.4**	**72.0**	**52.7**
OECD Europe[d]	**61.4**	**72.3**	**50.5**
Total OECD[d]	**65.5**	**76.1**	**55.1**

a) Ratios refer to persons aged 15 to 64 years who are in employment or in the labour force divided by the working-age population, or in unemployment divided by the labour force.

b) The year 1999 refers to 1998.

c) Age group 15 to 64 refers to 16 to 64.

d) Unweighted average for above countries using 1998 figures for Greece in the 1999 average calculated for the areas.

Source: OECD, *Labour Force Statistics, 1979-1999,* 2000, Part III. For Austria, Belgium, Denmark, Greece, Italy, Luxembourg and the Netherlands data are from the European Labour Force Survey.

2. Equipping workers with the appropriate skills

67. The success of technological and organisational innovation depends to a large extent on the ability of individuals to absorb change. It goes without saying that education and a well-functioning training system are of paramount importance in this respect. There is some evidence from a small sample of European Union countries that the rate of adoption of new work practices is positively associated with the level of educational attainment (Chart 15). In addition, a number of studies have found that enterprises that are prone to train their workers have a relatively high incidence of new work practices (Pil and Macduffie, 1996; Gittleman *et al*,. 1998; OECD, 1999). Table 7 illustrates this relationship. A consistent finding is that the incidence of training is higher in firms that adopt new work practices than is the case in other firms.[23] This can be interpreted as evidence that training facilitates the adoption of new work practices. More generally, education and training are important not only for economic growth, but also for equity and social cohesion purposes.[24]

Table 7. **New work practices and training**[a]

Percentage of firms which provide training

	Among firms that implement new practices	Among firms that do *not* implement new practices
Australia (1995)	**76**	**61**
European Union (EPOC survey 1994-96)	**39**	**27**
Denmark	*44*	*37*
France	*29*	*18*
Germany	*39*	*28*
Ireland	*47*	*27*
Italy	*30*	*28*
Netherlands	*42*	*27*
Portugal	*27*	*24*
Spain	*30*	*27*
Sweden	*33*	*24*
United Kingdom	*53*	*37*
Finland (1996)	**77**	**66**
France (REPONSE survey 1998)	**29**	**20**
United Kingdom (WERS survey 1998)	**15**	**10**
United States (1996)	**82**	**68**

a) Figures correspond to averages of estimates carried out for each individual work practice (see Annex D for details on these calculations). Data are not comparable between surveys.

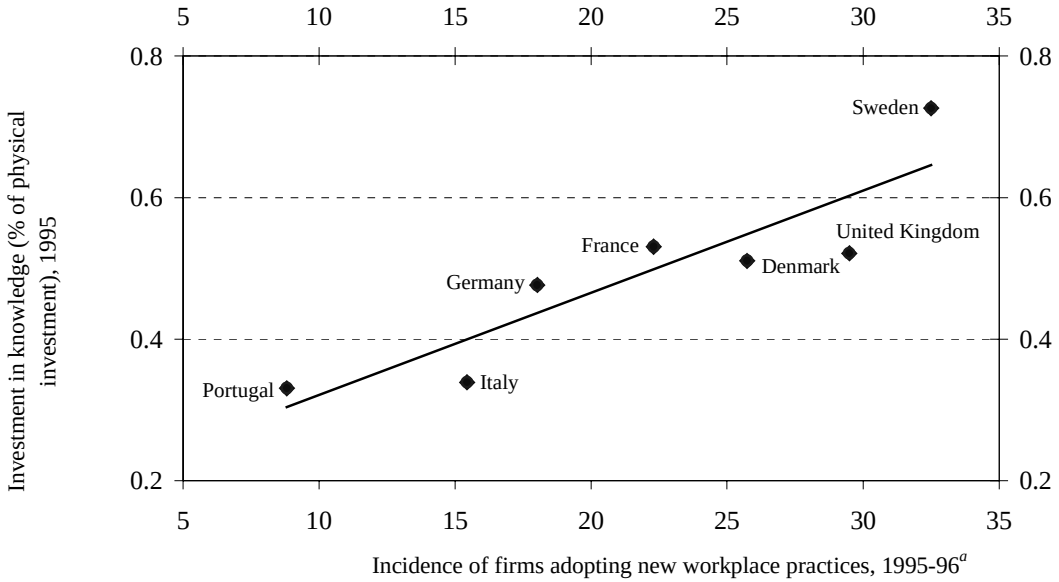
Source: Secretariat estimates based on various surveys.

23. Remarkably, there is only one exception to this general pattern, namely the case of "delegation of responsibility to the individual workers" in Finland – though the link does exist in the case of "team delegation of responsibility".

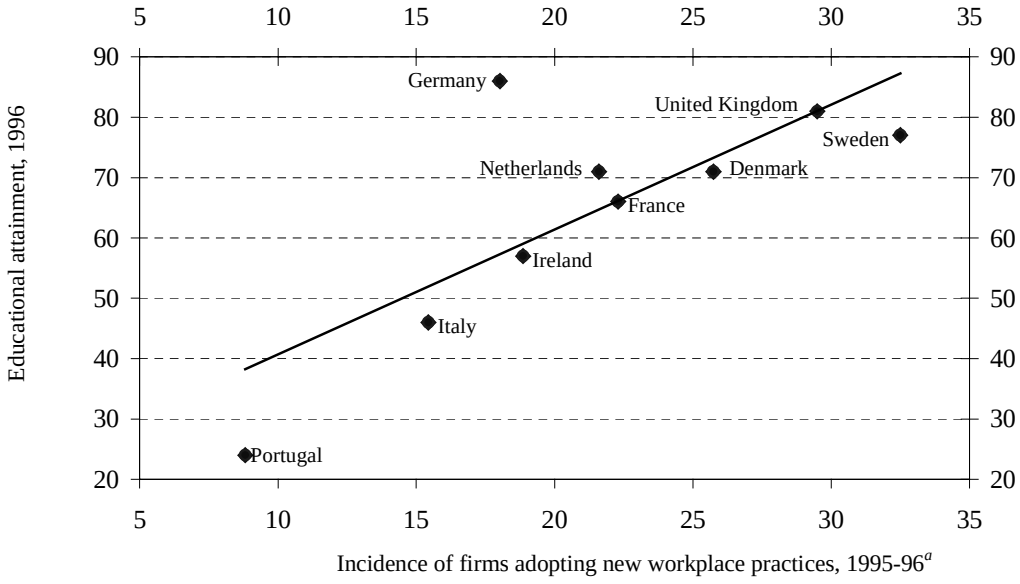
24. As stated in OECD (2001*c*), adults with a high level of educational attainment have better-than-average employment and wage prospects, while they also enjoy a relatively good health and life expectancy and a lower-than-average probability of being involved in crime than low-educated individuals.

Chart 15. **New work practices and education**

Panel A - **New work practices and investment in knowledge relative to investment in physical capital**



Panel B - **New work practices and educational attainment**



a) This is calculated as a simple average of the five new work practice indicators for 9 European countries (see Annex D for details). Spain is excluded because of the absence of information about one of the indicators (flattening managerial levels). "Investment in knowledge" includes public spending on education, expenditures on Software and R&D expenditures for the year 1995 and is given as a share of gross fixed capital formation. "Educational attainment" is the number of workers aged 25-64 who attained at least upper-secondary education, as a percentage of the total labour force (aged 25-64).

Sources: Secretariat estimates based on the *Survey of Employee Direct Participation in Organisational Change*; OECD, *Science, Technology and Industry Scoreboard 1999 - Benchmarking Knowledge-based economies*, 1999; and OECD, *Education at a glance* - OECD Indicators 1998, 1998.

68. In the present circumstances, policies need to tackle the emerging shortage for certain occupations and skills. In the short term, migration policies can help (see below), but more emphasis on policies that enhance human capital is clearly indispensable. Thus, some authors have stressed the need for enhanced coherence between technology policies (which tend to raise the demand for occupations such as scientists) and education policies (which shape the supply-side) – otherwise skill shortages will intensify (Romer, 2000).

(a) Education in new technology

69. The fact that new technology tends to be skill-biased implies that efforts to upgrade the basic skills and competencies of the youth should be intensified. In addition, there is a need for improving ICT literacy.

70. Societies cannot afford to exclude a large part of their population from access to high-quality education and learning. This is why governments recognise the need for bridging the digital divide caused by an unequal access to new technologies. The problem of access, which is often presented as the main solution to bridge the digital divide, is not the only one which education polices have to solve. Measures to improve the ability of teachers to use ICT effectively in the classroom are also needed. More fundamentally, between one tenth and one third of each youth cohort, depending on the country, does not complete secondary education, which is worrisome in view of the fact that our societies are increasingly knowledge-based. Policies should intensify the efforts to reduce secondary school dropout rates.

71. Going forward that premise, the content of education policies needs to reflect the changing requirements of the economy. People with insufficient general skills and low ICT literacy will become socially excluded not only from the labour market but also from services and leisure activities. This is why, within recent efforts undertaken by OECD governments to upgrade educational attainment, many OECD countries have launched programmes to create a new culture giving priority to new technologies and making the Internet accessible to all since primary schools. The issue arises whether these efforts will match the requirements of the information society in a short period of time.

(b) Vocational and on the-job training

72. Vocational and on-the-job training are especially important for economic growth in the current context. Indeed, much of the productivity gains will occur within firms through re-organisation, a process which is facilitated by training. Also, as shown previously, the demand for certain high-skilled jobs is growing. Many knowledge workers have acquired their competencies through training. And the need for greater labour mobility requires an ability to adapt to different jobs, often in different sectors, and training can play a role in this respect.

73. Despite the importance of training, it is unclear whether the incentives to engage in further learning are strong enough, from the point of view of both firms and workers (OECD, 1998). Reflecting the well-known “poaching-externality problem”, firms have a weak incentive to invest in vocational training because once trained, the employee can leave the firm and get a better wage (Hocquet, 2000). The result is that firms tend to under-invest in the training of their employees. Instead of upgrading the skills of the existing workforce they will tend to pursue a “buying strategy”.

74. If firms are reluctant to train their workers because of the risk associated to the “poaching problem”, much will then depend on the motivation and the capacity of individuals to invest in their human capital. When deciding to improve their employability, individuals face problems of time and resource availability. In addition, qualifications obtained from formal and informal learning are not always

recognised, which reduces workers' incentive to engage in training. It is therefore increasingly important that public authorities develop a coherent strategy to co-ordinate the different phases of primary and secondary education with on-the-job training, both in terms of curricula and recognition or certification of formal and non-formal learning. The development of the Computer Driving Licence introduced by Finland as a way to certify ICT computer knowledge provides an interesting case in point.[25]

75. Evidence also shows that some categories of workers have less opportunities to be trained than others (OECD, 1999). In general, the less-educated, employees of small firms and older and atypical workers are less motivated to invest in their own training and are also likely to be offered relatively few training opportunities. These categories of workers are also those that are most likely to suffer from the organisational changes. It is therefore essential to develop policy measures to improve the distribution of vocational training opportunities.

76. To improve the incentives of both firms and workers in the area of training, it is important to review financing arrangements. One possible approach to encourage human capital investment is to place individuals at the core of the decision to learn, while at the same time reducing the risks associated with the "poaching problem". This can be achieved by sharing the costs of training between the different actors (government, the firm, the individual and educational institutions). Thus, during the 1990s, different demand-side financing mechanisms for education and/or lifelong learning, such as voucher schemes, generated great interest and were implemented in some OECD countries. Even though few systematic evaluations of the effects of vouchers have been conducted (apart from the mixed results in terms of student achievement shown by experiments done in the United States (Patrinos, 1999)), this system still attracts much interest. Other innovative funding strategies, such as Individual Learning Accounts (ILAs), have been developed and recently implemented in some OECD countries. The aim of the ILAs is to encourage learning by adults and increase the effectiveness of the system. Like voucher schemes, ILAs are based on the principle that (a) individuals are best placed to choose what they need to learn and how they want to improve their skills; and (b) costs should be shared by all the actors concerned. As stated in OECD (2000*d*), ILAs can provide training opportunities to groups which do not generally participate in such activities. The idea of ILAs is to raise the overall commitment to training among the less well-trained workers and among those firms which train less – mainly smaller companies (see Box 7).

77. In addition to funding issues, institutional aspects of training should be reviewed. The involvement of the social partners in vocational training and life-long learning is essential. Public authorities must target less-favoured groups (older workers, the less-educated, atypical workers, ethnic minorities, immigrants etc.) to minimise the risks of unemployment and social exclusion. It is necessary to adapt adequately the methods of learning to take into account the capacities and motivations of each group, as well as their specific needs.

78. These innovative systems to promote learning are part of a new approach to welfare policies which, instead of supporting income, try to promote human capital and improve individuals' employability. Nevertheless, it must be said that ILAs are only one example of a range of innovative schemes. In addition, since no evaluations exist as yet, it is not possible to assess the extent to which ILAs have contributed to solve problem of under-investment in training, especially of low-skilled workers.

25 . The Computer Driving Licence was introduced by Finland in 1995 and has since then been generalised to other European countries through the European Computer Driving Licence Foundation. This system permits to certify that the holder of the licence has acquired the basic concepts of ICT and is able to use a personal computer at a basic level of competence. To get the licence, an examination has to be passed in one of the accredited test centres.

Box 7. An innovative initiative: Individual Learning Accounts (ILAs)

The aim of Individual Learning Accounts (ILAs) is to make training more accessible to all by improving learning opportunities and increasing the amount of learning funded directly by individuals themselves, at a reduced cost. The system is intended to provide greater choice regarding the content of training. Individuals should benefit in the form of higher productivity and earnings, reducing also the risk of unemployment whereas the firm benefits from a reduction of the training costs, increasing at the same time workers' productivity and acquiring a reputation for being a "good" employer. For the government, the cost depends on the level of the subsidy.

In the United Kingdom, ILAs were introduced in April 2000 as a key part of the government strategy on lifelong learning. They consist of a special account with government to help individuals plan and pay for their learning. In the first year of operation of the system, the individual must provide a small contribution to the account (25 GBP) and the government adds 150 GBP.[26] Employers can also make contributions, which can be tax-deductible if used for agreed learning and if contributions go to low-paid workers. To be eligible for the scheme, individuals have to be over 19 years old, and they must be in the labour force and not in full education or on training schemes already publicly supported. After the initial 150 GBP has been spent, ILA holders can be entitled to a series of discounts on courses such as computer literacy.

In Sweden, ILAs are currently being piloted and refined and will probably be in place in January 2002. The last proposal of the government is that approximately one million individuals will receive a basic contribution of 2500 SEK to be supplemented with at least equal contributions by individuals and/or employers. The amount of the account is subject to tax relief on earned income and employers wishing to participate will receive a reduction in payroll tax of 10% of the amount contributed. To be eligible, individuals must be between 30-55 years old and must have an annual income in 2000 ranging from 50000 SEK to 216000 SEK.

A similar system of ILAs has been in place in the United States for some time now, the so-called Individual Development Accounts. These are saving accounts, mainly offered to low and medium-income households, which can be used, among other purposes, to fund education and training (they can also be used for starting a small business). Other countries like the Netherlands and Australia are considering similar systems of ILAs.

(c) Looking at migration in a new light

79. In some OECD countries, shortages of knowledge workers are being partly addressed by having recourse to foreign labour. For example in the United States, the Federal Government raised in 1998 its visa programme (H-1B) to admit 115,000 foreign skilled workers each year.[27] This ceiling was already reached in March 2000 and employers have asked for 50,000 additional H-1B visas. The ceiling has been raised to 195,000 for the next three years. Similarly, the German government launched in August 2000 a programme allowing 20.000 permanent visas to be issued to computer specialists, whereas Ireland is proposing to allow in 32,000 foreign ICT workers up to 2005. In 1997-1998, Australia granted 3,200 temporary visas to foreign ICT professionals and Japan hopes to attract about 30,000 foreign ICT high skilled technicians and researchers until 2005.

80. More generally, in the majority of OECD countries, the educational attainment of foreign workers has increased over the last few years (Table 8). This is mainly attributable to a reduction in the incidence of foreign workers with lower secondary education or less. Indeed, the proportion of foreign

26. The government has committed itself to support in that way the first million accounts.

27. It has been estimated that during the period 1996-1998, the H-1B programme has filled over 70.000 ICT jobs, equivalent to 28% of the average annual demand for IT workers having at least a bachelor's degree.

workers with tertiary education has not increased in most OECD countries, and remains relatively low for the OECD area as a whole.

Table 8. **Foreign adult population classified by level of education,[a] 1992-1998**

	Lower secondary		Upper secondary		Third level	
	1992	**1998**	**1992**	**1998**	**1992**	**1998**
Austria[b]	49.5	45.0	39.9	44.4	10.6	10.6
Belgium	67.2	52.9	18.4	27.1	14.4	20.0
Denmark[b]	33.2	32.7	34.8	37.9	32.0	29.4
Germany[c]	67.2	46.0	7.1	35.2	12.6	13.1
France	79.3	62.9	9.2	22.3	11.4	14.8
Greece	34.2	41.7	39.1	38.2	26.7	20.1
Ireland[c]	33.2	28.8	25.3	23.8	40.5	47.0
Italy	58.5	35.4	29.0	45.9	12.5	11.4
Luxembourg[c]	72.8	56.8	9.2	19.0	15.8	24.2
Netherlands	73.2	46.7	10.2	30.2	15.3	22.0
Portugal	51.3	53.7	13.6	24.8	35.1	16.6
Spain	53.4	46.7	20.6	23.2	26.0	30.1
Sweden[b]	27.1	26.2	39.8	38.6	28.0	27.8
United Kingdom	58.6	65.9	8.7	13.7	21.5	20.4
United States[b]	35.3	34.5	40.0	40.9	24.6	24.6

a) The educational attainment classification is defined as follows: lower secondary refers to pre-primary education or none, primary or lower secondary; upper secondary refers to upper secondary education or post-secondary non tertiary education; third level refers to tertiary education.

b) Data for 1992 refers to 1995.

c) Data for 1998 refers to 1997.

Sources: European Labour Force Survey for European countries; and US Census Bureau for the United States.

81. Different opinions have been expressed regarding these new migration practices. Some consider that migration of highly skilled personnel provides an important channel to fill in specific skill shortages related to ICT and knowledge-intensive occupations. This may ease constraints on economic growth, but at the same time there is also a risk of "brain drain" to the detriment of developing countries. Also some claim that recourse to foreign labour entails a risk of "social dumping".[28]

3. Enhancing employment adjustment: the role of collective bargaining and government regulation

82. For new technology to lead to higher productivity growth, work needs to be reorganised and the right skills must be available. There is a key role for social partners and governments in this area, going beyond the human capital aspects just discussed. First, the presence of well-functioning labour-management institutions is likely to enhance the effectiveness of work reorganisation. Second, however, some of the existing labour-management institutions such as collective bargaining need to take into account the changing nature of work. Third, certain government regulations are challenged by the

28. According to a study for the United States, foreign workers under the H-1B programme receive lower wages than their American counterparts (Matloff, 2000).

emergence of new forms of employment and the need for making wages and working conditions more responsive to the changing workplace.

Table 9. **Employee representation, new work practices and training, European Union (1994-96)**

Panel A - **Average number of new work practices**

	Among firms with employee representation	Among firms *without* employee representation
Type of representation recognised for the purpose of consultation/negotiation/joint decision making:		
Union representation	1.32	0.97
Works council	1.09	1.05
Advisory committee	1.33	1.03

Panel B - **Percent of firms providing training to support decision-making activities**

	Among firms with employee representation	Among firms *without* employee representation
Type of representation recognised for the purpose of consultation/negotiation/joint decision making:		
Union representation	35	29
Works council	29	32
Advisory committee	37	30

a) Owing to lack of data, Spain is excluded from the calculations.

Source: Secretariat estimates based on the Survey of Employee Direct Participation in Organisational Change.

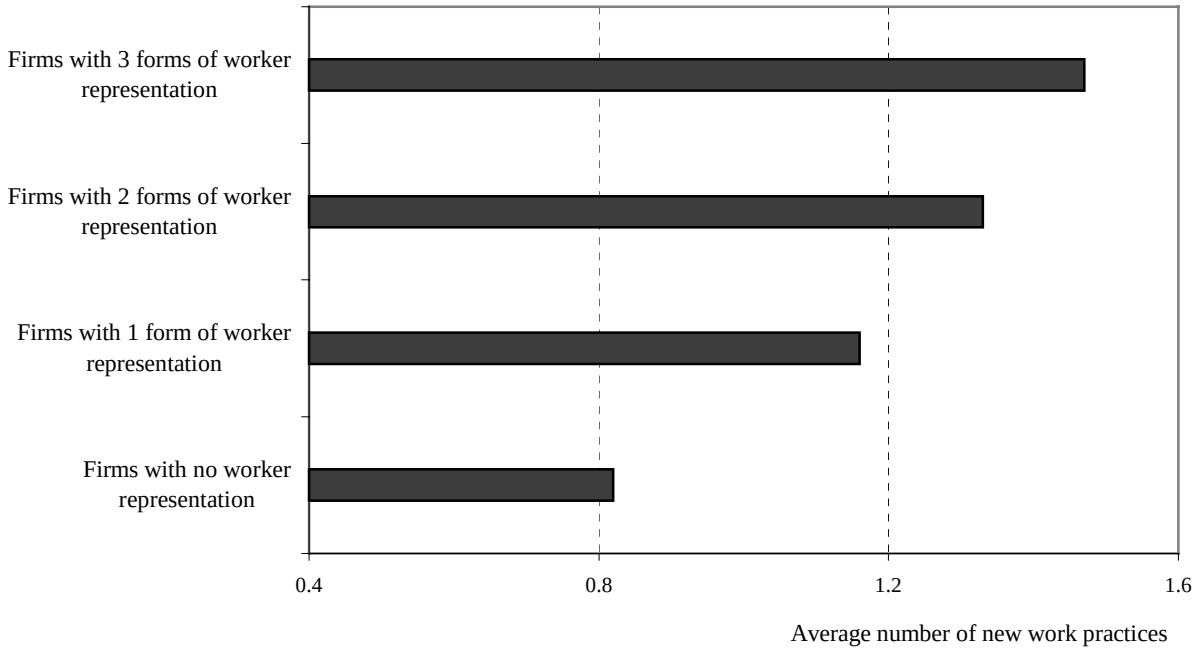
83. Institutions which allow a closer contact between management and employees (such as works' councils) can help build a high-skill, high-trust enterprise climate (see ILO (2001) for a recent excellent survey on this issue). Though this is not new, the wave of workplace changes has triggered renewed interest on such institutions. In the European Union, firms allowing worker representatives to be involved in the process of consultation, negotiation and/or decision making adopt more intensively new work practices than is the case of firms without institutions of worker participation (Table 9).[29] They are also more likely to provide training to their workers. What is more, the greater the number of institutions of worker representation, the greater the numbers of new work practices adopted by firms (Chart 16 and Box 8).[30] Other studies find that new work practices are likely to be more effective (and successful) when they are implemented through a collective agreement than is the case in the absence of a collective agreement (see, for example, European Commission, 1997). In a way, these results are not surprising. The potential of labour-management institutions for taking advantage of new technology is manifold. Labour-management institutions at the firm-level facilitate the adoption of employee involvement schemes and improve the flow of information among staff, while they enhance employee involvement in training matters either to increase the overall intensity of training or to distribute training opportunities more evenly among different categories of workers. Unions and other forms of worker representation can usefully address a variety of "public good" issues such as access to training, health care, pension rights and the establishment of support

29 . See Table D.8 in Annex D for the details.

30 . A previous study (OECD, 1999) also finds that new work practices are more prevalent among unionised firms than among non-unionised ones. Similarly, the existence of works' councils is positively correlated with the adoption of new work practices. The study estimates that the existence of a collective agreement raises the probability of firms to adopt team-working by about five percentage points.

mechanisms to workers' mobility. National governments and international organisations can help the process by identifying and facilitating the diffusion of successful cases of new forms of work (*e.g.* the

Chart 16. **Greater workers' voice facilitates the adoption of new work practices**



Note : Owing lack of data, Spain is excluded from the calculation.

Source : Secretariat estimates based on the Survey of Employee Direct Participation in Organisational Change.

current initiative by the European Union on the "pacts on employment and competitiveness").

84. However, changes in work practices also raise a number of challenges to traditional labour market institutions and government regulation:

- the growing role of performance-related remuneration reduces the importance of collectively agreed basic wages;

- the tendency to reduce layers of management and to enhance the multi-task nature of jobs (which is an important aspect of team work) calls into question existing systems of job classification;

- the emergence of telework also raises challenges to collective bargaining, since, in most countries, there is no national legislation on telework. In some countries, such as France, Germany, Ireland and the United Kingdom, wages and working conditions of teleworkers are mainly established through collective bargaining, while in others (Belgium, Finland, Greece, Luxembourg, the Netherlands and Portugal) telework is practically not addressed in collective bargaining. Instead, in these countries the individual contract seems to be the norm (Box 9). Some countries have established consultation procedures among social partners to promote a new legislative framework for telework (Portugal and Greece) while others (like Denmark and Ireland) have already issued guidelines on telework after consulting with the social partners. Still others (the Netherlands) have decided that the protection of

teleworkers should be identical to that of their regular counterparts. In any case, some principles should be respected and clearly regulated in collective agreements: the voluntary nature of telework; the principle of reversibility; the principle of equality of treatment and of non-discrimination between on-site workers and teleworkers. In addition, telework raises a range of issues regarding safety, data protection and "privacy" of the home;

- on a more general level, working-time regulations should include or enhance hours' flexibility arrangements so as to reduce obstacles to team work and other new work practices; and

- the proliferation of different forms of employment has blurred the traditional distinction between management and employees – which forms the back bone of collective bargaining institutions.

Box 8. Worker representation and new work practices

Existing case studies show that greater workers' voice facilitates the adoption of new work practices (see for example European Commission, 1997). This positive contribution has two aspects: (*i*) workers' voice is associated with a greater adoption of new work practices; and (*ii*) it makes the adoption of new work practices more successful.

The first point can be empirically verified from the EPOC survey used in this study. The survey includes some questions about whether there is any worker representative (from the largest occupational group) recognised for the purposes of consultation/negotiation and/or joint decision making at the workplace. The survey considers three forms of worker representation: trade union representatives (UR), representatives elected to a works council (WC) and representatives to an advisory committee established by management (AC). The results in the Table below show that the probability of new work practice adoption is greater when the firm recognises diverse forms of worker representation.

Correlation coefficients between institutions of employee representation and new work practices

	Flattening managerial levels	*Back to the core business*	*Employee Involvement*	*Team-working*	*Job rotation*	*At least one practice*	*Number of practices*
UR	0.66**	0.50**	0.15	0.15	0.51**	0.40**	0.44**
	(4.20)	(2.75)	(1.10)	(1.05)	(2.74)	(2.66)	(3.46)
WC	0.22	0.11	0.43**	0.10	0.47*	0.34*	0.37**
	(1.55)	(0.67)	(3.03)	(0.65)	(2.52)	(2.44)	(2.85)
AC	0.09	-0.38^{+}	0.41*	0.18	0.46^{+}	0.35^{+}	0.28^{+}
	(0.48)	(-1.74)	(2.38)	(0.90)	(1.71)	(1.94)	(1.80)
Obs.	4829	5267	5267	5267	5267	4829	4829

Note: A standard logit model is used for the estimations except for the last column where ordered logit model is used. All regressions include dummies that control for industry, firm size, country, private sector, profit sector and existence of foreign competition. **, *, and $^{+}$ indicate significance at 1%, 5% and 10% levels respectively. Numbers between parentheses refer to *t*-values.

The second point is more difficult to verify empirically for a wide range of firms. However, a study for the United States shows that the labour productivity improvement resulting from the adoption of new work practices is particularly strong when the firm is unionised (Black and Lynch, 1997).

Box 9. Some examples of collective bargaining on telework

Country	Sector of activity or firm	Beneficiaries	Characteristics of the agreement
Austria	ICT sector IBM and Hewlett-Packard among others.	Employees combining telework with in-the-firm work	• Telework is voluntary and teleworkers' involvement in the firm must be guaranteed. • The agreement specifies the distribution of working time between home and firm. • The firm pays the cost for the equipment (data transmission and telephone). • The home workstation must respect health and safety regulations.
Denmark	Financial sector	60,000 employees on an experimental basis (expired in May 1999)	The agreement specifies the issues that have to be regulated at sectoral and firm levels and individually between the firm and the worker. The sectoral one defines telework as: • Voluntary and reversible at 4 weeks' notice. • Telework must not exceed 50 per cent of the working time over a 13-week period. • The employer is responsible of the equipment and its maintenance. • The teleworker is covered by regulations on health and safety at work.
France	Financial sector Banques Populaires (1996)	Disabled people	Telework appears as a possibility to work at home on a voluntary basis.
Germany	ICT sector Deutsche Telekom (1995) and IBM (1991)		• Telework is voluntary and reversible. • The employer is responsible for the equipment and its maintenance as well as for additional expenses. • The distribution of working time between home and the firm is agreed on an individual basis.
Italy	Manufacturing Electrolux-Zanussi	Pregnant women or those with small children Two-year programme on an experimental basis	The aim is to help combining work with family responsibilities. Even if directed to women on a voluntary basis, men can also participate in line with Italian parental leave legislation.
Norway	ICT sector Vesta		• The workplace (a room at home or rented) must only be used for work. • The worker loses his right to occupy his job in the firm while the agreement lasts. • The employer is responsible for the equipment and its maintenance, and must pay for insurance and domestic expenses. • The worker must take care of the equipment, and must respect professional confidentiality. • The teleworker has the right to receive an unspecified wage bonus. • The conditions for the termination of the telework agreement must be specified.
Spain	DHC International	New recruited staff	The firm must define the jobs appropriate for recruiting staff as teleworkers, considering also disabled people.
Sweden	Trade, commerce and services sector	80,000 employees	• Telework must be voluntary and reversible. • Teleworkers' attendance to meetings should be facilitated. • Teleworkers should have the same rights to information, consultation and professional development as other employees. • The equipment must meet health and safety regulations that can be controlled by employers.
United Kingdom	ICT sector. British Telecom	Managers and professionals	• Telework is voluntary and teleworkers are paid a salary and covered by collective bargaining for all purposes. • The employer pays for equipment and domestic expenses and is responsible for health and safety. • Teleworkers are guaranteed information and communication with the firm and can attend regular meetings.

Source: Secretariat elaboration based on Caprile and Llorens (1998).

E. CONCLUDING REMARKS

85. The paper shows that, to take advantage of the new economic environment, work needs to be reorganised. In addition, it appears that low-tenure countries have enjoyed faster productivity gains than high-tenure countries – suggesting that an element of "external" flexibility may be important as well. In this respect, providing greater training opportunities and enhancing workers' voice in the process of change stand out as two important policy requirements. But, the study also raises some important analytical and policy-related questions which require further scrutiny.

86. From the analytical point of view, there is increasing concern that the traditional long-term relationship between employers and employees may be weakening. This study finds no clear trend for aggregate tenure in the OECD area. However, the study identifies some interesting underlying changes. First, relatively low-skilled workers are disadvantaged by the current changes in employee tenure. Second, the industrial structure is moving towards industries with low employee tenure in almost all the countries considered.

87. Another question arises regarding the traditional distinction between "internal" and "external" flexibility. The diffusion of new work practices suggests that firms are increasingly relying on "internal" flexibility in order to adapt to the changing environment. On the other hand, the study shows that the increasing adoption of these practices does not directly translate into a longer employee tenure in the economy as a whole. Whether new work practices and "external" flexibility are substitutes or complements is not clear, and further work is needed to identify how both types of flexibility interact.

88. On the policy side, there is consensus that training is of paramount importance for raising the benefits of the new economic environment. In particular, vocational training constitutes an important pillar of human capital. However, most of the available analyses focus exclusively on formal education, while relatively less attention has been paid to firm training. In this respect, it is important to assess to what extent firm training improves workers' employability and productivity, and thus how much it contributes to macroeconomic growth. One of the new approaches to enhance training incentives, namely Individual Learning Accounts, is examined in this study, but the cost-effectiveness of both this and other innovative systems requires further scrutiny.

89. Finally, the study suggests that greater voice should be given to workers in the process of change. However, the links between institutions of worker representation and firm performance remain controversial and require deeper examination.

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ANNEXES

Annex A. New work practices — conceptual models and examples

Several conceptual models are available to managers who are looking for an effective way of restructuring the firm in face of increasingly fierce competition and technological change. Each model contains a system of practices which, according to some, is fully efficient only as a whole. The following are important examples (see Lawler et al. (1998) for more details).

- Employee Involvement (EI) emphasises greater worker participation and a willingness to share information with employees. This model has ethical and economic motivations. Conceptually, the pattern of involvement can be classified into three categories: Suggestion Involvement, Job Involvement and Business Involvement. *Suggestion Involvement* entails the power to make suggestions for change but not necessarily the power to make decisions. *Job Involvement* offers employees more control over the day-to-day decisions that are relevant to their jobs. *Business Involvement* encompasses the first two types of involvement, but also offers employees a greater opportunity to participate in the management of the business. Therefore, EI follows a bottom-up approach.

- Total Quality Management (TQM) emphasises continuous quality improvement and cost reduction. Note that the term of quality is used in a very broad way in this model. Quality is often equated with customer satisfaction, including a prompt delivery of products. This model has an element of information feedback, based on the philosophy that employees have good ideas on how improve quality. Just-In-Time (JIT) systems are also part of the model. JIT serves not only to improve clients' satisfaction by shortening waiting time, but also to reduce the cost of production by eliminating unnecessary stocks.

- Business Process Re-engineering (BPR) stresses the possibility of reducing costs by improving the organisational structure. According to the advocates of this model, the impact of ICT crucially depends on whether the firm is organised in a way which facilitates information flows.

Despite their different origins and rationale, all three models tend to emphasise the need for increasing the responsibility of employees at lower managerial levels, horizontal communication between employees and team working. Furthermore, the active involvement of employees often requires flatter management structures.

There are, however, some differences between the three models. In EI, the main focus is on workers' motivation and job enrichment so that it strongly favours small business units. Under the TQM, the autonomy of employees is more limited than under EI, the main focus being employees' problem-solving capability over their jobs. EI and TQM address the issue of too much hierarchy, functional specialisation and overhead, but they rarely recommend dramatic downsizing and the elimination of layers of management and consider them only as long-term results. On the contrary, BPR favours 'fundamental', 'radical' and 'dramatic' restructuring of the organisation. In practice, BPR is sometimes used as a justification for rapid cost reduction. Finally, advocates of EI believe that the implementation itself should be highly participative, whereas TQM and BPR have been implemented in a much more top-down manner.

Annex B. Data sources and definitions

The purpose of this Annex is to document the main sources of data on new work practices and occupational classification of workers.

1. Data on new work practices

1. USA

- *Education Quality of the Workforce – National Employer Survey* (EQW-NES) is conducted by the US Bureau of the Census for the National Center on the Educational Quality of the Workforce. The survey is composed of two waves of interviews of representative samples of U.S. manufacturing and non-manufacturing establishments in 1994 and 1997, which provide information about establishment performance and characteristics for 1993 and 1996. The 1994 Survey includes over 1600 manufacturing establishments and the 1997 Survey included over 2500 establishments in manufacturing and services. Establishments with less than 20 employees are excluded. The survey questionnaire includes questions about benchmarking, TQM (1994 only), re-engineering (1997 only), self-managed teams, regular meetings about work-related issues and job-rotation. Some of the data and relevant documentation can be downloaded from http://www.irhe.upenn.edu/centers/ctrs-prog3.html. The indicators used in this study are calculated by the Secretariat based on the public-use data files. Weights are applied to all calculations using standard procedures.

Regarding Table 3, the 10 US manufacturing industries are classified into four groups as follows. The workplaces that use intensively new work practices are those satisfying at least 3 among the following 4 criteria: *(a)* they use benchmarking; *(b)* they implement re-engineering; *(c)* the proportion of non-supervisory workers involved in self-managed teams is higher than average (>15.54%); and *(d)* the proportion of non-supervisory workers involved in regular meetings to discuss work-related issues is higher than average (>55.46%). Workplaces with high ICT-intensity are those where the proportion of non-supervisory workers using computers is higher than average (> 52.07%). The outcome of the classification is presented in the following table. Numbers between parentheses refer to the 1987 SIC code.

	Industries with high ICT intensity	**Industries with low ICT intensity**
Industries with high incidence of new work practices	Chemicals & Petrolium (28, 29), Machinery & Instruments (35, 36, 38), Transportation equipment (37)	Food & Tabaco (20, 21), Primary metals (33)
Industries with low incidence of new work practices	Printing & Publishing (27), Other and miscellaneous manufactured products (25, 30, 31, 32)	Textile & Apparel (22, 23), Lumber & Pater (26), Fabricated metals (34)

- *Survey of Employer-Provided Training* (SEPT) is conducted by the US Bureau of Labor Statistics for the Employment and Training Administration of the US Department of Labor. The first wave of the survey was conducted in 1993 over the private non-agricultural establishments regardless of size. Some 7895 establishments responded usable data. The

second wave, conducted in 1995, included only establishments with fifty or more employees with 1062 usable respondents.

2. Canada

- *Workplace and Employment Survey* (WES) is being undertaken by the Statistics Canada. In 1996, a pilot survey was made. The survey questionnaire can be found at http://www.statcan.ca/english/concepts/wes.htm. See also Statistics Canada (1998).

3. Australia

- *Australian Workplace Industrial Relations Survey* (AWIRS) is conducted by the Department of Workplace Relations and Small Business. Until now, two large-scale surveys have been undertaken, in 1990 and in 1995. AWIRS 90 is composed of two separate surveys respectively for establishments with 20 or more employees (Main Survey) and for 5 to 19 employees (Small Business Survey). In AWIRS 95, two major additions are made: Employee Survey and Panel Survey. Most of the data used in this study come from the Main Survey, which contains information for 2004 and 2001 workplaces, respectively, for 1990 and 1995. The results are reported in Morehead *et al*. (1997) for AWIRS 95 and in Callus *et al*. (1991) for AWIRS 90. The calculations were provided by Bill Harley, Department of Management, The University of Melbourne. Weights are applied in all the calculations following standard procedure.

4. European Union Survey

- *Survey of Employee Direct Participation in Organisational Change* (EPOC) was conducted by the European Foundation for the Improvement of Living and Working Conditions in 1996. The sample was done for workplaces with 20 or more employees for the smaller and medium countries (Denmark, Ireland, the Netherlands, Portugal and Sweden), and for those with 50 or more workplaces for the larger countries (France, Germany, Italy, Spain and the UK). This is the only existing survey that allows an international comparison among a sample of countries. However, the response rate was quite low ranging from 9.4 percent (Spain) to 38.8 percent (Ireland). Some precaution should be made in the utilisation of the data from EPOC Survey. First, in the question 9, the initiatives taken by workplaces "during the last three years" was mistranslated into Italian as those "during the last three *months*". Second, "flattening managerial levels" was translated incorrectly in Spanish. Weights are applied in all the calculations in this study. Related documents and reports can be found in http://www.eurofound.ie/publications/participation/subject7.htm.

5. United Kingdom

- *Workplace Employee Relations Survey* (WERS, formerly *Workplace Industrial Relations Survey*) is conducted under the responsibility of the Department of Trade and Industry (formerly Department of Employment). There have been in total 4 waves of surveys in 1980, 1984, 1990 and 1998. The WERS 98 is composed of 4 components: Management Survey, Work Representative Survey, Employee Survey and Panel Survey. This study relies mainly on the 1998 cross-section Management Survey, which includes establishments with 10 or

more employees, whereas the threshold was 25 employees for the previous surveys. In total, 2191 establishments are included in the survey. Major results are reported in Cully *et al*. (1999). See http://www.niesr.ac.uk/niesr/wers98/Index.htm for relevant documentation and questionnaires.

In Annexe Tables, workplaces using "autonomous teams" are defined as those that responded that *(a)* more than 60% of employees in the largest occupational group work in formally designated teams *and (b)* the teams have at least 3 of the following four characteristics: (i) Team-working depends on team members working together; (ii) Team members are able to appoint their own team leaders, (iii) Team members jointly decide how the work is to be done; (iv) Teams are given responsibility for specific products or services. All calculations in this study are weighted following standard procedure.

6. France

- *Enquête sur les Relations Professionelles et Négociations d'Entreprise* (REPONSE) has been conducted by BVA l'Institut d'Etude de Marché et d'Opinion for the Direction de l'Animation de la Recherche des Etudes et des Statistiques (DARES) of the Ministère de l'Emploi et de la Solidarité. Two waves of survey were carried out, in 1993 for establishments with 50 and more employees and in 1999 for establishments with 20 and more employees excluding agricultural and administrative sectors. The main results are reported in Coutrot (2000*a*; 2000*b*). The calculations used in this study have been provided by Thomas Coutrot, DARES, Minstère de l'Emploi et de la Solidarité.

- *Enquête sur les Changements Organisationnels et l'Informatisation* (COI) was conducted at the end of 1997 jointly by the Service des Statistiques Industrielles (SESSI), DARES, the SCEES, l'INSEE and the Centre d'Etudes et de l'Emploi. The sampling was done for 1462 employers and 2049 employees of manufacturing firms with 20 or more employees. The first findings are reported in Favre *et al*. (1998).

7. Nordic countries

- *Nordflex Project* was co-ordinated by NUTEK (Swedish National Board for Industrial and Technical Development). The project has been conducted on the basis of separate national surveys for Denmark, Finland, Norway and Sweden for establishments with 50 or more employees. The main results can be found in NUTEK (1999). However, the original sampling for the individual countries was done on establishments with 10 or more employees (except Sweden). The data for Finland used in this study are based on the original Finnish survey from the project "Flexible Enterprise". Juha Antila of the Finnish Minstry of Labour provided the data. See http://www.nutek.se/analys/struktur/svflex2e.htm.

2. Occupational classification of workers

Classification of occupations

Type of workers	US classification	ISCO-88(COM) classification (3-digit level)
1. Knowledge workers	Engineer, architects and surveyors (43-63)	Physical, mathematical and engineering science professionals (211, 212, 214)
a) Engineers and applied and social scientists	Natural scientists (69-83)	Life science and health professionals (221, 222, 223)
	Health diagnosing occupations (84-89)	Teaching professionals (231)
	Health assessment and testing occupations (95-106)	Other professionals (241, 242, 244, 247),
	Technicians and related support occupations(203-235, not 213, 229, 233)	Physical and engineering science associate professionals (311, 313, 314, 315)
	Social scientists and urban planners (166-173)	Life science and health associate professionals (321, 322, 323)
	Lawyers and judges (178-179)	Other associate professionals (341, 342)
	Teachers post-secondary (113-154)	
b) Computers specialists	Mathematical and computer specialists (64-68)	Computing professionals (213)
	Computer technicians (213, 229 and 233)	Computer associate professionals (312)
	Computer equipment operator (308-309)	
2. Management workers	Executive, administrative and managerial occupations (3-37)	Legislators and senior officials (111, 114)
		Corporate managers (121, 122, 123)
		Managers of small enterprises (131)
3. Data workers	Teachers except post-secondary (155-159)	Teaching professionals (232, 233, 234, 235)
	Counsellors, educational and vocational (163)	Other professionals (243)
	Librarians, archivists and curators (164-165)	Teaching associate professionals (331, 332, 333, 334)
	Administrative support occupations, including clerical (303-389), except Computer equipment operators (308-309)	Other associate professionals (343, 344)
		Office clerks (411, 412, 413, 414, 419)
		Customer service clerks (421, 422)
4. Services workers	Sales occupations (243-285)	Other professionals (245, 246)
	Service occupations (403-469)	Other associate professionals (345, 346, 347, 348)
	Social recreation and religious workers (174-177)	Personal and protective services workers (511, 512, 513, 514, 515, 516)
	Writers and artists (183-199)	Models, sales persons and demonstrators (521, 522)
		Sales and services elementary occupations (911, 912, 913, 914, 915, 916)
5. Goods-producing workers	Farming, forestry and fishing occupations (473-499)	Skilled agricultural and fishery workers (611, 612, 613, 614, 615)
	Precision production, craft and repair occupations (503-699)	Extraction and building trade workers (711, 712, 713, 714)
	Operators, fabricators and laborers (703-889)	Metal machinery and related trades workers (721, 722, 723, 724)
		Precision, handicraft, printing and related trades workers (731, 732, 733, 734)
		Other craft and related trades workers (741, 742, 743, 744)
		Stationary-plant and related operators (811, 812, 813, 814, 815, 816, 817)
		Machine operators and assemblers (821, 822, 823, 824, 825, 826, 827, 828, 829)
		Drivers and mobile plant operators (831, 832, 833, 834)
		Agricultural, fishery and related labourers (921)
		Labourers in mining, construction, manufacturing and transport (931, 932, 933)

Source: Secretariat elaboration based on Lavoie M. and Roy R. (1998).

Annex C. Complementarity between knowledge-intensive employment and physical capital : econometric evidence

The main body of the text documents a trend rise in the incidence of knowledge workers, which seems to go hand-in-hand with lower relative prices of information and communications technologies. This parallelism can be interpreted in different ways, possibly reflecting supply and demand changes. One of the possible interpretations is that, for new technologies to be effectively implemented (and lead eventually to higher economic growth), a sufficient number of specialists and other knowledge workers are needed. In other words, physical capital and knowledge workers may be complementary factors of production. The purpose of this Annex is to test this hypothesis.

Estimation results

To achieve this, detailed data for different types of labour and physical capital over a sufficiently long time period are needed. Unfortunately, this is possible only for the United States and even in this case the time period is 1984-1996 – *i.e.* only 13 years, and excludes the most recent years. In order to be able to test the factor-complementarity hypothesis, it is therefore necessary to include sectoral data, so that the number of observations reaches a critical mass for the test to be meaningful. The results, therefore, should be interpreted with caution.

Notwithstanding these caveats, econometric results based on these data lend support to the factor-complementarity hypothesis. This finding comes from the estimation of a translog production function, comprising physical capital, knowledge workers and other workers as separate production factors, with fixed effects for the sectoral variation and a time-trend – as a proxy for dis-embodied technical progress. The equation takes the following form:

$$\text{Ln } Q = A + \alpha \text{Ln } K + \beta \text{ Ln } N_k + \delta \text{ Ln } N_o + 0.5\gamma_{kk} (\text{Ln } K)^2 + 0.5.\gamma_{nknk}(\text{Ln } N_k)^2 + 0.5.\ \gamma_{\ nono}(\text{Ln } N_o)^2$$

$$+ \gamma_{knk}.\text{Ln } K.\text{Ln } N_k + \gamma_{kno}.\text{LnK.LnN}_o + \gamma_{nkno}.\text{LnN}_k.\text{LnN}_o + \tau\ T + \Sigma_I\ \theta_I\ S_i$$

With the terms of the equation designating the following variables:

Term	*Meaning*	*Source*
Q	Value added at market prices, at 1990 prices	International Sectoral Data Base
K	Net Capital Stock, at 1990 prices and 1990 PPPs (US dollars)	International Sectoral Data Base
N_k	Knowledge workers (based on number of employees and estimated share of knowledge workers)	International Sectoral Data Base and Secretariat estimates
N_o	Other workers	International Sectoral Data Base and Secretariat estimates

T	Time trend
Si	Fixed effect for sector i (20 sectors in total)

Constant returns to scale have been imposed, meaning that:

$\alpha + \beta + \delta + \text{Ln K} (\gamma_{kk} + \gamma_{knk} + \gamma_{kno}) + \text{Ln Nk} (\gamma_{nknk} + \gamma_{knk} + \gamma_{nkno})$

$+ \text{Ln No}(\gamma_{nono} + \gamma_{kno}. + \gamma_{nkno}) = 1$

i.e. the output-elasticities of the three production factors must add up to one.

Based on a pooling of the data for the 20 sectors, the following results come out.

Name of the variable	**Estimated coefficient**	**t-Student**	**Significance probability**	**Comment**
Intercept	-16.102851	-6.783817	0.0001	
LnK	1.803889	8.341838	0.0001	
Ln Nk	-2.297054	-47.447825	0.0001	
Ln No	2.697866	22.070411	0.0001	
Ln K²	0.034060	3.747435	0.0002	
Ln No²	0.204969	41.682648	0.0001	
Ln Nk²	-0.035957	-19.199744	0.0001	
Ln K * Ln Nk	0.122273	66.569480	0.0001	K and Nk are complements
Ln Nk * Ln No	-0.004184	-2.000730	0.0465	Nk and No are substitutes
Ln K * Ln No	-0.229730	-75.131034	0.0001	K and No are substitutes
T	0.011036	18.687065	0.0001	

The number of observations is 260 (20 sectors times 13 years) and R^2 is 0.99. The estimated output elasticities are: a) with respect to capital, 0.27; b) with respect to knowledge labour, 0.23; and c) with respect to other labour, 0.5.

Importantly, knowledge workers and physical capital are complements (as shown by the negative inter-action terms between these two factors). By contrast, non-knowledge labour is a substitute vis-à-vis both physical capital and knowledge labour.

Interpretation of the empirical findings

The results imply that a decline in the price of capital goods (as has happened as a result of cheaper computers and communication technologies) will raise the demand for capital goods and also that for knowledge workers. There may be various reasons to this complementarity. First, it could be that knowledge workers are needed in order to implement new technologies effectively. For instance, when buying new technologies, firms may also have to recruit computer specialists. Second, and perhaps more importantly, the use of new technologies will facilitate knowledge spill-overs, thereby raising the return to knowledge and the demand for workers that generate knowledge. Conversely, lower prices of capital goods will exert downward pressures on the demand for non-knowledge labour.

These empirical results are therefore consistent with observed patterns in the relative earnings of high-skilled *versus* low-skilled labour, despite the increase in the supply of skilled labour which should have pushed relative earnings in the opposite direction. In sum, this work lends support to the view that the new wave of technological change is biased towards the use of knowledge workers.

Annex D. Supplementary Tables

Table D.1. **The trend-rise in the adoption of new work practices**

Percentage of firms reporting existence of practices

Panel A - **Australia**[a]

	1990	1995
Quality circles[b]	13	13
Joint consultative committees	14	23
Task forces or *ad hoc* joint committee	25	30
Employee representatives on board of management/directors	7	16
Suggestion schemes	27	29

a) All workplaces with 20 or more employees are surveyed.

b) The 1995 questionnaire asks about "Quality circles" only whereas the 1990 questionnaire refers to either "Quality circles" or "productivity improvement groups".

Sources: Morehead *et al.* (1997), based on the 1990; and 1995 Australian Workplace Industrial Relations Surveys.

Panel B - **France**

	1992	1998
Quality circle	42	54
Service meeting	76	77
Direct expression group	33	22
Project group	39	63
Autonomous production team	12[c]	35
Just-in-time	29	35
ISO	12	34
Flattening hierarchical level	30	30

Note: Only establishments belonging to enterprises with more than 50 employees are considered here.

c) Numbers cannot be compared directly between the two years because of the different formulation of the question.

Source: Coutrot (2000), based on the REPONSE Survey.

Table D.1. **The trend-rise in the adoption of new work practices** (*Cont*.)

Percentage of firms reporting existence of practices

Panel C - **United Kingdom**[d]

	1984	1990	1998
A. Methods other than consultative committees used by management to communicate or consult with employees			
Systematic use of the management chain	62	60	60
Regular newsletters distributed to all employees	34	41	52
Regular meetings between management and workforce	34	41	48[e]
Suggestion scheme	25	28	33
B. Provision of information by management to employees or their representatives			
Information about			
Financial position of workplace[f]	55	60	66
Financial position of organisation	60	61	63
Investment plans	27[g]	41[g]	53
Staffing/manpower plans	67[g]	60	61

d) The base is all workplaces with 25 or more employees.

e) Imputed from panel data.

f) Part of wider organisation only.

g) Question wording includes the additional phrase '… before the implementation of any changes.'

Source: Cully *et al.* (1999), based on Workplace Employee Relations Survey (formerly Workplace Industrial Relations Survey).

Panel D - **United States**

	1987	1990	1993	1996
Quality circle (QC)	61	66	65	60
Employee participation group other than QC	70	86	91	94
Union-management Quality-of-Work-Life Committees	30	35	35	36
Survey feedback	68	77	85	91
Suggestion systems	83	86	85	89
Job enrichment or redesign	60	75	82	87
Self-managing work teams	28	47	68	78
Minibusiness Units	25	28	44	60
Employee committees concerned with policy and/or strategy	-	-	65	74

Coverage: Fortune 1000 firms.

Source: Lawler *et al.* (1998).

Table D.2. **Incidence of telework, 1999**

	Regular teleworkers[a]	Occasional teleworkers[b]	Total number of teleworkers	
	Thousands	Thousands	Thousands	Percentage of total employment
Austria	..	..	67	2.0
Belgium[c]	..	..	250	6.2
Denmark	180	100	280	10.5
Finland	230	130	360	16.8
France	500	140	640	2.9
Germany	1 560	570	2 130	6.0
Greece	..	..	50	1.3
Ireland	40	30	70	4.4
Italy	580	140	720	3.6
Japan	..	..	2 090	7.9
Netherlands	590	450	1 040	14.5
Portugal	..	..	100	2.2
Spain	260	100	360	2.8
Sweden	310	280	590	15.2
United Kingdom	1 270	750	2 020	7.6
United States	..	..	15 700	12.9

..: Data not available.

a) Regular teleworkers include home-based teleworkers, self-employed people working in "small offices and home offices" and mobile telework done on a regular basis.

b) Occasional teleworkers include those working less than one full-day per week at home.

c) Data for Belgium include also those for Luxembourg.

Sources: Data for Austria, Belgium, Greece and Portugal come from the European Telework Development's National Co-ordinator Network (estimates are based on different quantitative and qualitative surveys). For the other European countries, data come from the ECaTT project "Benchmarking Progress on Electronic Commerce and New Methods of work". For the United States, data come from Cyber Dialogue. For Japan, the source is Wendy Spinks.

Table D.3. **Nominal and real earnings by occupation in the United States, 1985-1998**

US dollars per hour

	Nominal earnings			Real earnings[a]		
	1985	1995	1998	1985	1995	1998
Knowledge workers	10.0	15.6	16.9	14.1	15.9	16.4
Engineers and applied and social scientists	*10.2*	*15.7*	*16.9*	*14.4*	*16.0*	*16.5*
Computers	*9.0*	*14.9*	*16.9*	*12.7*	*15.2*	*16.4*
Management workers	8.7	12.5	13.8	12.2	12.7	13.4
Data workers	6.7	9.6	10.4	9.5	9.7	10.1
Services workers	5.0	7.2	8.1	7.0	7.3	7.9
Goods-producing workers	8.0	10.3	11.3	11.3	10.5	11.0
	Standard deviations within each group of occupations					
Knowledge workers	2.7	4.4	4.8	3.8	4.5	4.6
Data workers	1.1	2.0	2.0	1.6	2.0	2.0
Services workers	1.7	2.9	3.0	2.5	3.0	3.0
Goods-producing workers	2.3	2.8	3.1	3.3	2.9	3.0

a) Real hourly earnings are calculated as nominal hourly earnings deflated by the private consumption defator.
Source: Secretariat estimates based on BLS, Current Population Survey.

Table D.4. **Implementation of new work practices and use of ICT**

Panel A - **Percentage of firms that use computer-integrated management systems, Australia (1995)**

	Among workplaces that implemented the new practice	Among workplaces that have *not* implemented the new practice
Type of practice:		
Semi-autonomous work groups	23	15
Quality circles	32	15
Team building	23	12
Total quality management	25	13
Just-in-time	31	16
Job re-design programs	21	14
Suggestion schemes	20	17
Management/employees regular formal meetings	20	7
Average	**24**	**14**

Source: Secretariat estimates based on the 1995 Australian Workplace Industrial Relations Survey.

Panel B - **Percentage of firms that have adopted ICT, European Union (1994-96)**

	Among firms that implement the new practice	Among firms that do *not* implement the new practice
Type of practice:		
Flattening of managerial levels[a]	42	35
Back to core business	43	36
Employee involvement	53	30
Team-based organisation	54	32
Job rotation	52	35
Average	**49**	**34**

a) Owing to lack of data, Spain is excluded from the calculations.

Source: Secretariat estimates based on the Survey of Employee Direct Participation in Organisational Change.

Panel C - **Percentage of firms that have introduced new ICT, Finland (1996)**

	Among firms that implement the new practice	Among firms that do *not* implement the new practice
Type of practice:		
Job rotation[b]	59	49
Quality circle[b]	62	50
Work groups with individual responsibility[b]	67	44
Work teams with joint responsibility[b]	62	44
Individual autonomy		
Daily planning of work	53	58
Weekly planning of work	53	57
Quality control	57	55
Team autonomy		
Daily planning of work	68	53
Weekly planning of work	67	54
Quality control	69	54
Average	**62**	**52**

b) Practices applying to permanent staff only.

Source: Secretariat estimates based on the Flexible Enterprise Project, Ministry of Labour, Finland.

Table D.4. **Implementation of new work practices and use of ICT (*Cont*.)**

Panel D - **Percentage of firms that use a Computer-assisted System, France (1998)**

	Among firms that implement the new practice	Among firms that do *not* implement the new practice
Quality circle	43	28
Direct expression group	38	35
Project group	44	24
Autonomous production team	48	28
Just-in-time	44	31
ISO	52	29
Flattening hierarchical levels	52	29
Average	**46**	**29**

Source: Secretariat estimates based on the survey of *Relations Professionnelles et Négociations d'Entreprise 1998*.

Panel E - **Non-supervisory workers using computers, United States (1996)**

Percentage of total non-supervisory workers

	Firms that implement the new practice	Firms that do *not* implement the new practice
Type of practice:		
Benchmarking	64	49
Re-engineering	59	48
Autonomous teams	64	48
Regular meetings about work-related issues	56	46
Job rotation	48	54
Average	**58**	**49**

Source: Secretariat estimates based on Education Quality of Workforce -- National Employer Survey 1997.

Table D.5. **New work pratices and selected performance-pay systems**

Panel A - **Percentage of workplaces that use performance-pay schemes, Australia (1995)**

	Among workplaces that implemented the new practice	Among workplaces that have *not* implemented the new practice
Type of practice:		
Any performance-based payment		
Semi-autonomous work groups	38	31
Quality circles	41	31
Team building	31	34
Total quality management	39	29
Just-in-time	42	32
Job re-design programs	36	29
Suggestion schemes	32	33
Management/employees regular formal meetings	33	30
Average	**37**	**31**
Profit-sharing		
Semi-autonomous work groups	8	4
Quality circles	10	4
Team building	5	5
Total quality management	6	4
Just-in-time	10	5
Job re-design programs	6	4
Suggestion schemes	7	4
Management/employees regular formal meetings	6	3
Average	**7**	**4**
Stock options		
Semi-autonomous work groups	15	16
Quality circles	21	15
Team building	19	13
Total quality management	19	14
Just-in-time	18	16
Job re-design programs	14	17
Suggestion schemes	18	15
Management/employees regular formal meetings	16	14
Average	**18**	**15**

Source: Secretariat estimates based on the 1995 Australian Workplace Industrial Relations Survey.

Panel B - **Percentage of workplaces that use performance-pay schemes,[a] European Union (1994-96)**

	Among firms that implement the new practice	Among firms that do *not* implement the new practice
Type of practice:		
Pay on the basis of team output		
Flattening of managerial levels[b]	20	18
Back to core business	24	18
Employee involvement	22	17
Team-based organisation	24	17
Job rotation	22	18
Average	**22**	**17**
Profit-sharing		
Flattening of managerial levels[b]	28	18
Back to core business	24	19
Employee involvement	30	15
Team-based organisation	23	18
Job rotation	22	19
Average	**25**	**18**
Ownership schemes		
Flattening of managerial levels[b]	12	5
Back to core business	8	7
Employee involvement	12	5
Team-based organisation	10	6
Job rotation	8	7
Average	**10**	**6**

a) All schemes refer to the largest occupational group.

b) Owing to lack of data, Spain is excluded from the calculations.

Source: Secretariat estimates based on the Survey of Employee Direct Participation in Organisational Change.

Table D.5. **New work practices and selected performance-pay systems** *(Cont.)*

Panel C - **Percentage of firms that pay for the result of team or unit, Finland (1996)**

	Among firms that implement the new practice	Among firms that do *not* implement the new practice
Type of practice:		
Job rotation[c]	50	45
Quality circle[c]	55	43
Work groups with individual responsibility[c]	52	45
Work teams with joint responsibility[c]	54	36
Individual autonomy		
Daily planning of work	49	45
Weekly planning of work	48	46
Quality control	56	40
Team autonomy		
Daily planning of work	58	44
Weekly planning of work	51	46
Quality control	56	40
Average	**53**	**43**

c) Practices applying to permanent staff only.

Source: Secretariat estimates based on the Flexible Enterprise Project, Ministry of Labour, Finland.

Panel D - **Percentage of workplaces using certain incentive pay schemes, France (1998)**

	Among firms that implement the new practice	Among firms that do *not* implement the new practice
Type of practice:		
Individualisation of wage increase		
Quality circle	77	64
Direct expression group	67	71
Project group	74	65
Autonomous production team	80	64
Just-in-time	76	67
ISO	82	65
Flattening hierarchical levels	79	66
Average	**76**	**66**
Individual bonus		
Quality circle	57	48
Direct expression group	43	55
Project group	52	53
Autonomous production team	56	50
Just-in-time	56	50
ISO	57	51
Flattening hierarchical levels	56	51
Average	**54**	**51**

Source: Secretariat estimates based on the survey of *Relations Professionnelles et Négociations d'Entreprise 1998* .

Panel E - **Percentage of workplaces using any incentive pay scheme,[d] United Kingdom (1998)**

	Among firms that implement the new practice	Among firms that do *not* implement the new practice
Type of practice:		
Autonomous teams	36	47
Use of management cahin / cascading information	48	38
Regular meetings with entire workforce present	47	41
Suggestion schemes	41	44
Problem-solving circle	43	43
Joint consultative commitees	42	44
Just-in-time	54	39
Quality control (ISO9000, BS5750)	63	43
Quality monitoring by employee himself	47	39
Benchmarking	52	36
Average	**47**	**41**

d) Workplaces using at least one of the following incentive payment schemes: *(i)* Profit-related payments or bonuses; *(ii)* Defered profit-sharing scheme; *(iii)* Employee share ownership schemes; *(iv)* Individual or group performance-related schemes.

Source: Secretariat estimates based on the 1998 Workplace Employee Relations Survey.

Table D.6. **New work practices and selected atypical forms of employment**

Panel A - **Percentage of workplaces that use atypical forms of employment, Australia (1995)**

	Among workplaces that implemented the new practice	Among workplaces that have *not* implemented the new practice
Type of practice:		
Contractors, outworkers and agency employees		
Semi-autonomous work groups	76	64
Quality circles	76	66
Team building	71	64
Total quality management	70	66
Just-in-time	74	67
Job re-design programs	71	64
Suggestion schemes	66	68
Management/employees regular formal meetings	69	59
Average	**72**	**65**
Fixed-term contracts		
Semi-autonomous work groups	44	33
Quality circles	39	35
Team building	42	30
Total quality management	42	32
Just-in-time	35	36
Job re-design programs	42	30
Suggestion schemes	36	36
Management/employees regular formal meetings	39	19
Average	**40**	**31**

Source: Secretariat estimates based on the 1995 Australian Workplace Industrial Relations Survey.

Panel B - **Percentage of firms that increased share of part-time workers, European Union (1994-96)**

	Among firms that implement the new practice	Among firms that do *not* implement the new practice
Type of practice:		
Flattening of managerial levels[a]	30	23
Back to core business	23	24
Employee involvement	27	22
Team-based organisation	28	22
Job rotation	28	23
Average	**27**	**23**

a) Owing to lack of data, Spain is excluded from the calculations.

Source: Secretariat estimates based on the Survey of Employee Direct Participation in Organisational Change.

Table D.6. **New work practices and selected atypical forms of employment (***Cont* .)

Panel C - **Percentage of workplaces that use temporary agency employees, United Kingdom (1998)**

	Among firms that implement the new practice	Among firms that do *not* implement the new practice
Type of practice:		
Autonomous teams[b]	22	19
Use of management cahin / cascading information	21	19
Regular meetings with entire workforce present	19	20
Suggestion schemes	22	19
Problem-solving circle	27	16
Joint consultative commitees	34	15
Just-in-time	24	18
Quality control (ISO9000, BS5750)	31	16
Quality monitoring by employee himself	24	15
Benchmarking	23	17
Average	**25**	**17**

b) Workplaces using autonomous teams are defined as those that responded that more than 60% of employees in the largest occupational group work in formally designated teams and that the teams have at least 3 of the following caracteristics: *(i)* Teamworking depends on team members working together, *(ii)* Team members are able to appoint their own team leaders, *(iii)* Team members jointly decide how the work is to be done, *(iv)* Teams are given responsiblility for specific products or services.

Source: Secretariat estimates based on the 1998 Workplace Employee Relations Survey.

Panel D - **Percentage of workplaces which have recourse to workers from outside the firm, United States, 1996**

	Among firms that implement the new practice	Among firms that do *not* implement the new practice
Type of practice:		
Benchmarking	56	36
Re-engineering	53	35
Autonomous teams	46	37
Regular meetings about work-related issues	42	36
Average	**49**	**36**

Source: Secretariat estimates based on Education Quality of Workforce -- National Employer Survey 1997.

Table D.7. **New work practices and training**

Panel A - **Percentage of firms that provide formal training, Australia (1995)**

	Among workplaces that have implemented the new practice	Among workplaces that have *not* implemented the new practice
Type of practice:		
Semi-autonomous work groups	81	63
Quality circles	79	66
Team building	75	62
Total quality management	78	62
Just-in-time	77	67
Job re-design programs	78	59
Suggestion schemes	71	67
Management/employees regular formal meetings	73	45
Average	**76**	**61**

Source: Secretariat estimates based on the 1995 Australian Workplace Industrial Relations Survey.

Panel B - **Percentage of firms that provide training to support decision-making activities, European Union (1994-96)**

	Among firms that implement the new practice	Among firms that do *not* implement the new practice
Type of practice:		
Flattening of managerial levels[a]	45	25
Back to core business	36	30
Employee involvement	40	26
Team-based organisation	41	26
Job rotation	36	30
Average	**39**	**27**

a) Due to lack of data, Spain is excluded from the calculation.

Source: Secretariat estimates based on the Survey of Employee Direct Participation in Organisational Change.

Panel C - **Percentage of firms which provide for on-the-job training, Finland (1996)**

	Among firms that implement the new practice	Among firms that do *not* implement the new practice
Type of new practices:		
Job rotation[b]	75	51
Quality Circle[b]	80	62
Work groups with individual responsibility[b]	80	62
Work teams with joint responsibility[b]	75	62
Individual autonomy		
Daily planning of work	71	71
Weekly planning of work	70	72
Quality control	76	68
Team autonomy		
Daily planning of work	82	69
Weekly planning of work	84	69
Quality control	78	71
Average	**77**	**66**

b) These practices refer to permanent staff only.

Source: Secretariat estimates based on the Flexible Enterprise Project, Ministry of Labour, Finland.

Table D.7. **New work practices and training** *(Cont.)*

Panel D - **Percentage of "highly-training-intensive" workplaces,[c] France (1998)**

	Among firms that implement the new practice	Among firms that do *not* implement the new practice
Quality circle	30	18
Direct expression group	32	22
Project group	31	15
Autonomous production team	26	22
Just-in-time	25	23
ISO	31	21
Flattening hierarchical levels	29	22
Average	**29**	**20**

c) "Highly-training-intensive" workplaces refer to workplaces where the expenditure on continuous vocational training exceeds 3% of the total wage bill.

Source: Secretariat estimates based on the survey of *Relations Professionnelles et Négociations d'Entreprise 1998* .

Panel E - **Percentage of "highly-training-intensive" workplaces,[d] United Kingdom (1998)**

	Among firms that implement the new practice	Among firms that do *not* implement the new practice
Type of practice:		
Autonomous teams	16	10
Use of management cahin / cascading information	16	7
Regular meetings with entire workforce present	15	10
Suggestion schemes	17	11
Problem-solving circle	17	10
Joint consultative commitees	17	11
Just-in-time	14	12
Quality control (ISO9000, BS5750)	11	11
Quality monitoring by employee himself	14	10
Benchmarking	16	9
Average	**15**	**10**

d) "Highly-training-intensive" workplaces refer to workplaces where *(i)* more than 40% of the employees in the largest occupational group have had formal off-the-job training and *(ii)* the average time spent on training is at least 5 days over the past 12 months.

Source: Secretariat estimates based on the 1998 Workplace Employee Relations Survey.

Panel F - **Percentage of firms that spend on formal vocational training, United States (1996)**

	Among firms that implement the new practice	Among firms that do *not* implement the new practice
Type of practice:		
Benchmarking	91	67
Re-engineering	75	71
Autonomous teams	82	69
Regular meetings about work-related issues	80	64
Average	**82**	**68**

Source: Secretariat estimates based on the Education Quality of Workforce -- National Employer Survey 1997.

Table D.8. **Worker representation, new work practices and training, European Union (1994-96)**

Percentage of firms that implement the new work practices and employer-sponsored training

Panel A - **Union representatives**

	Firms with union representation	Firms without union representation
Type of practice:		
Flattening of managerial levels[a]	33	25
Back to core business	14	13
Employee involvement	39	28
Team-based organisation	30	24
Job rotation	16	10
Average number of new practices	**1.32**	**0.97**
training	**35**	**29**

Panel B - **Workers Council**

	Firms with union representation	Firms without union representation
Type of practice:		
Flattening of managerial levels[a]	28	27
Back to core business	14	13
Employee involvement	31	31
Team-based organisation	26	25
Job rotation	12	11
Average number of new practices	**1.09**	**1.05**
training	**29**	**32**

Panel C - **Advisory Committee**

	Firms with union representation	Firms without union representation
Type of practice:		
Flattening of managerial levels[a]	32	26
Back to core business	11	13
Employee involvement	44	29
Team-based organisation	31	25
Job rotation	15	11
Average number of new practices	**1.33**	**1.03**
training	**37**	**30**

a) Owing to lack of data, Spain is excluded from the calculations.

Source: Secretariat estimates based on the Survey of Employee Direct Participation in Organisational Change.

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