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The Skills Needed for the 21st Century

This chapter introduces the Survey of Adult Skills (PIAAC). It first gives a brief overview of how and why the demand for skills has been changing over the past decades, focusing particularly on the advent and widespread adoption of information and communication technologies and on structural changes in the economy. It then describes how the survey – the first international survey of adult skills to directly measure skills in literacy, numeracy and problem solving in technology-rich environments – can assist policy makers in responding to the challenges of a rapidly changing global labour market.



The technological revolution that began in the last decades of the 20th century has affected nearly every aspect of life in the 21st: from how we “talk” with our family and friends, to how we shop, to how and where we work. Quicker and more efficient transportation and communication services have made it easier for people, goods, services and capital to move around the world, leading to the globalisation of economies. New means of communication and types of services have changed the way individuals interact with governments, service suppliers and each other. These social and economic transformations have, in turn, changed the demand for skills as well. While there are many factors responsible for these changes, this chapter focuses on technological developments, particularly information and communications technologies, because they have profoundly altered what are considered to be the “key information-processing skills” that individuals need as economies and societies evolve in the 21st century.

With manufacturing and other low-skill tasks in the services sector becoming increasingly automated, the need for routine cognitive and craft skills is declining, while the demand for information-processing skills and other high-level cognitive and interpersonal skills is growing. In addition to mastering occupation-specific skills, workers in the 21st century must also have a stock of information-processing skills, including literacy, numeracy and problem solving, and “generic” skills, such as interpersonal communication, self-management, and the ability to learn, to help them weather the uncertainties of a rapidly changing labour market.

Improving the supply of skills is only half the story: skills shortages co-exist with high unemployment; and better use can be made of existing skills. There is growing interest among policy makers not only in creating the right incentives for firms and individuals to invest in developing skills, but also in ensuring that economies fully use the skills available to them. To that end, the OECD Skills Strategy emphasised three pillars: developing relevant skills, activating skills supply, and putting skills to effective use (OECD, 2012a).

The Survey of Adult Skills (a product of the Programme for the International Assessment of Adult Competencies, or PIAAC) was designed to provide insights into the availability of some of the key skills in society and how they are used at work and at home. A major component of the survey was the direct assessment of a select number of skills that are considered to be “key information-processing skills”, namely literacy, numeracy and problem solving in the context of technology-rich environments. This chapter describes the social and economic context in which the Survey of Adult Skills was conceived and conducted. Subsequent chapters focus on specific aspects of skills supply and demand across participating countries that can inform related policy making.

MAJOR TRENDS INFLUENCING THE DEVELOPMENT AND USE OF SKILLS

Access to computers and ICTs is widespread and growing

Access to, and use of, computers both at home and at work is now widespread in OECD countries. Between 1999 and 2009, the number of Internet subscriptions in OECD countries nearly tripled, and the number of mobile phone subscriptions more than tripled (see Table B1.1 in Annex B). In over two-thirds of OECD countries, over 70% of households have access to computers and the Internet in their homes (Figure 1.1). Internet access is also pervasive in the workplace. In most OECD countries, workers in over 95% of large businesses and those in over 85% of medium-sized businesses have access to and use the Internet as part of their jobs (see Table B1.2 in Annex B), and workers in at least 65% of small businesses connect to the Internet for work.

ICTs are changing how services are provided and consumed

Computers and ICTs are changing the ways in which public and other services are provided and consumed. Familiarity with and use of ICTs has become almost a prerequisite for accessing basic public services and exercising the rights and duties of citizenship. Many governments are delivering public services, including taxation and health and other welfare services, via the Internet and this trend is likely to continue. The proportion of citizens and businesses using the Internet to interact with public authorities grew rapidly in many OECD countries between 2005 and 2010: an average of 40% of citizens and 80% of businesses in OECD countries interacted with public authorities via the Internet in 2010 (Figure 1.2).

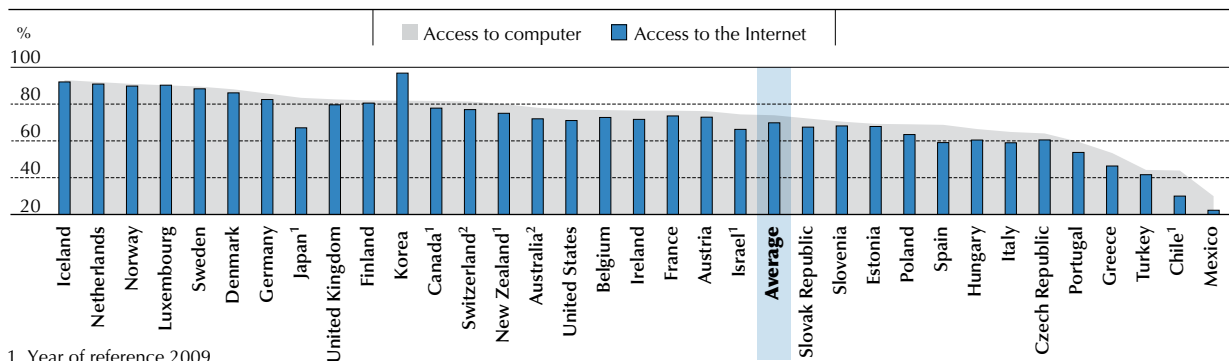
E-commerce accounts for less than 5% of retail trade in many countries (OECD, 2009). However, the proportion of adults who purchase goods or services on line continues to grow (see Table B1.3 in Annex B). In Korea, e-commerce grew seven-fold between 2001 and 2010, while in Australia, the volume of e-commerce in 2008 was over eight times the level in 2001.



■ Figure 1.1 ■

Access to computers and the Internet at home

Percentage of households with access, 2010 or latest available year



1. Year of reference 2009.

2. Year of reference 2008.

Note: The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

Countries are ranked in descending order of the percentage of households having access to a computer.

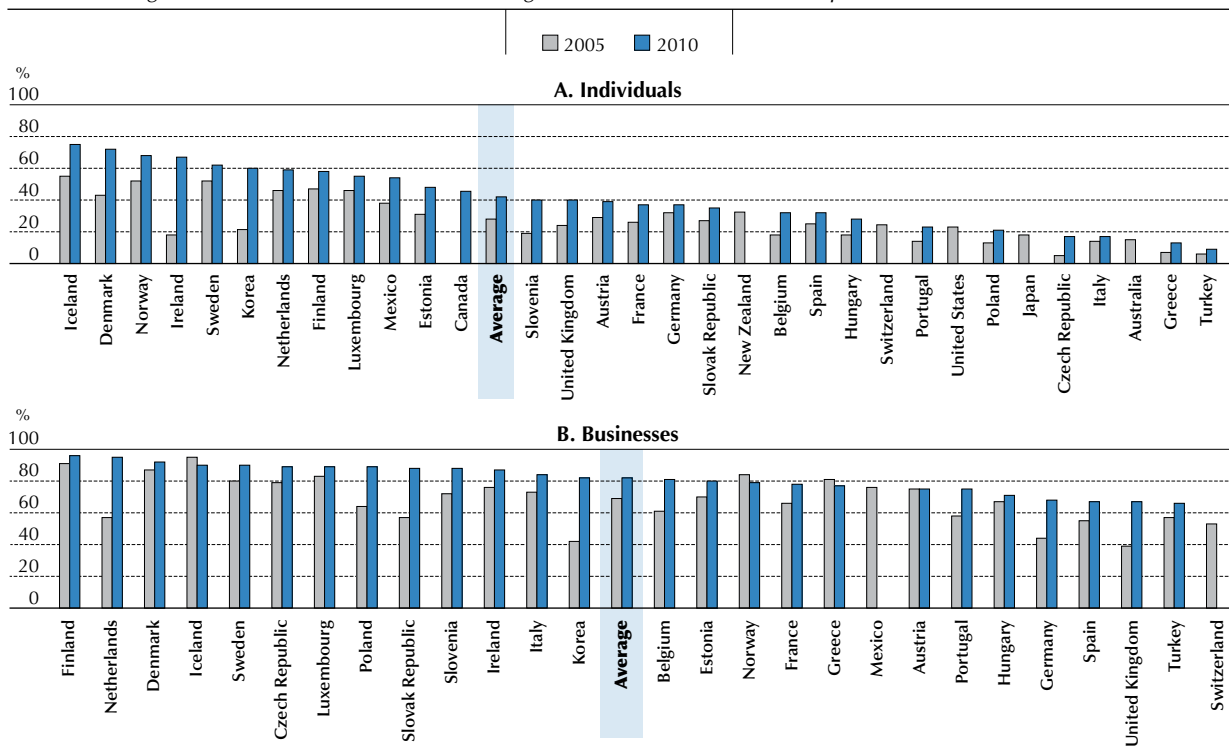
Source: OECD, ICT Database and Eurostat, Community Survey on ICT usage in households and by individuals, November 2011. See Table A1.1 in Annex A.

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■ Figure 1.2 ■

The growth of e-government

Percentage of individuals and businesses using the Internet to interact with public authorities, 2005 and 2010



Notes: For Australia, Japan and the United States, 2005 data refer to 2003. For Switzerland, 2005 data refer to 2004. For Denmark, France, Germany, New Zealand and Spain, 2005 data refer to 2006. For Canada and Mexico, 2010 data refer to 2007. For Iceland, 2010 data refer to 2009.

In Panel A, 2005 data are missing for Canada and 2010 data are missing for Australia, Japan, New Zealand and the United States. In Panel B, 2005 data are missing for Australia, Canada, Japan, New Zealand and the United States and 2010 data are missing for Australia, Canada, Japan, Mexico, New Zealand, Switzerland and the United States. Countries with missing data for both years in the same panel have been removed.

Countries are ranked in descending order of the percentage of individuals and businesses using the Internet to interact with public authorities in 2010 (data for 2005 are used for countries in which there is no data available in 2010).

Source: Eurostat Information Society Database, OECD, ICT Database and Korean Survey by Ministry of Public Administration and Security on ICT usage. See Table A1.2 in Annex A.

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Employment in services and high-skilled occupations is growing

The introduction of ICTs into the workplace has not just changed the kinds and levels of skills required of workers; in many cases, it has changed the very structure of how work is organised. A shift towards more highly skilled jobs is observed in most countries. The trend regarding low- and medium-skilled jobs is less evident.

Change in employment by industry sector

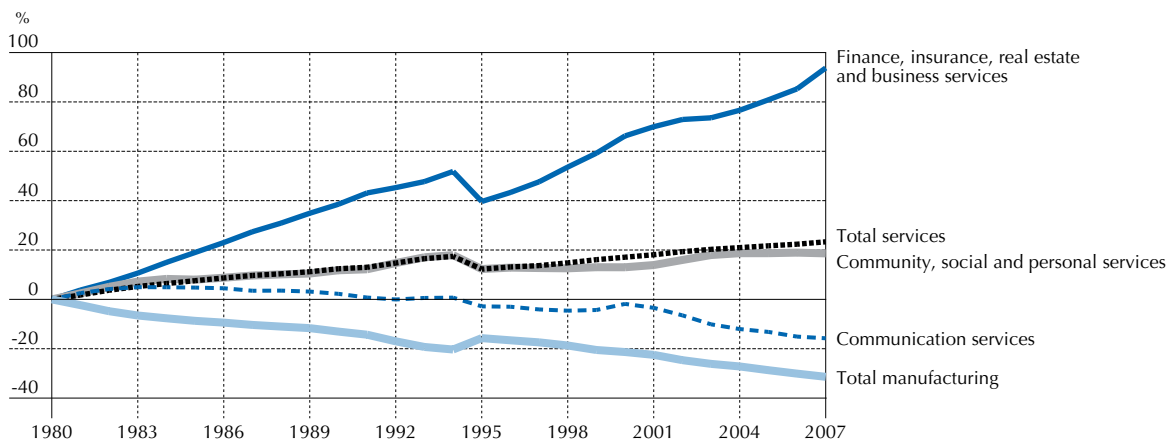
Over the past four decades, the decline in manufacturing sector employment has been offset by growth in the service sector (Figure 1.3). Services requiring the highest levels of skills, such as finance, real estate, insurance and business services, are growing fastest. These services are based on the analysis and transformation of information and, as such, are highly dependent on computers and ICTs. Despite the relative decline in manufacturing activity, the share of employment in high-technology manufacturing continues to increase (see Table A1.3 in Annex A).

In over half of all OECD countries, at least one-third of economic activity is concentrated in high-tech manufacturing, communications, finance, real estate and insurance (see Table B1.4 in Annex B). This is likely to underestimate the impact of new technologies on the economy since many traditionally low-skilled sectors, such as primary production and extractive industries, are also using advanced technologies. Agriculture, for example, is being transformed by bio-technology and computerisation (e.g. GPS technology and the use of IT to manage sales and monitor markets).

■ Figure 1.3 ■


Change in the share of employment, by industrial sectors

Percentage change in share of employment relative to 1980, OECD average



Notes: Only the OECD countries available in the 1980 STAN Database are included for the period 1980-90. Similarly, only the OECD countries available in the 1991 STAN Database are included for the period 1991-94, and only the OECD countries available in the 1995 STAN Database are included for the period 1995-2007.

Source: OECD (2010), "STAN Indicators 2009", STAN: OECD Structural Analysis Statistics (database). <http://dx.doi.org/10.1787/data-00031-en> (Accessed January 2013). See Table A1.3 in Annex A.

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Changes in the occupational structure

In most OECD countries, more than a quarter of all workers are professionals, associate professionals or skilled technicians. Between 1998 and 2008 the number of people employed in these categories increased more rapidly than did overall employment rates in most OECD countries (OECD, 2011 and see Table B1.5 in Annex B).

The evolution of employment shares for occupations with mostly low- and medium-educated workers is more complex. Trends over the period 1998-2008 in the share of employment for three types of occupational groups – in which workers have, on average, high, medium and low levels of education – are shown in Figure 1.4. On average, the share of occupations with highly educated workers has grown, while the share of occupations with both medium- and low-educated workers has declined.



There is some evidence of job polarisation, or a “hollowing out” of the skills content of occupations in certain OECD economies (Goos, Manning and Salomons, 2009, Oesch and Menes, 2010 and Fernandez-Macias, 2012), although this is by no means the case in all countries. In half the OECD countries for which data are available, the loss of jobs associated with a medium level of education was greater than the loss of jobs associated with a low level of education (see Table B1.6 in Annex B). In the remaining countries, the share of jobs that require a medium level of education grew (four countries) or declined to a lesser extent than the share of jobs requiring a low level of education.

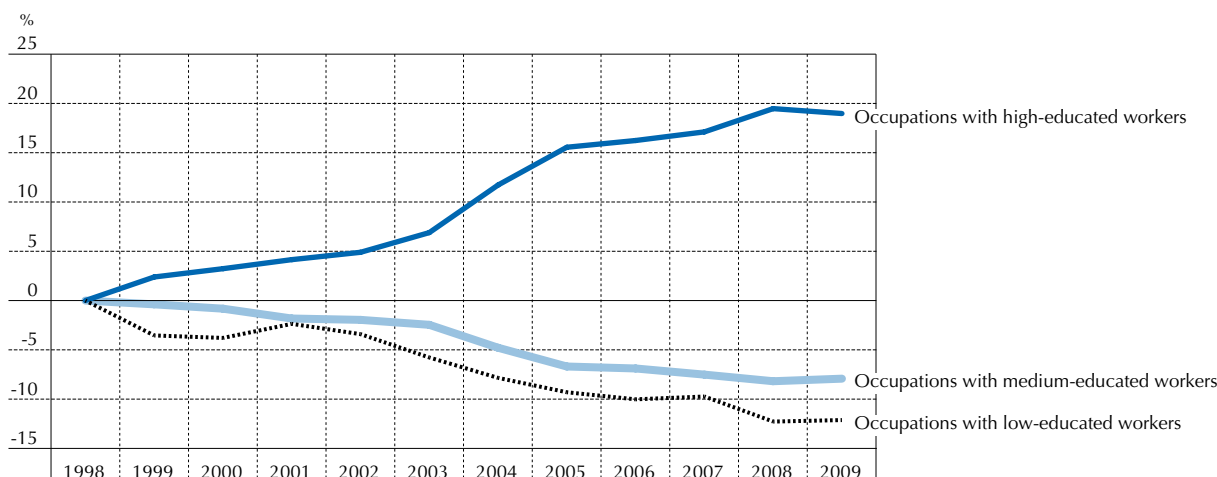
Another way of looking at the evolution of demand for skills is provided by Autor, Levy and Murnane (2003), who classify jobs into routine and non-routine tasks. They argue that the share of non-routine analytic and interactive job tasks (tasks that involve expert thinking and complex communication skills) performed by American workers has increased steadily since 1960 (Figure 1.5). The share of routine cognitive and manual tasks began to decline in the early 1970s and 1980s, respectively – coinciding with the introduction of computers and computerised production processes. These are tasks that are more readily automated and put into formal algorithms. The share of non-routine manual tasks also declined, but stabilised in the 1990s, possibly due to the fact that they cannot be easily computerised or outsourced.

Additional information provided by the Survey of Adult Skills can be used to examine the growth in share of employment for occupations associated with different average levels of information-processing skills (Figure 1.6). Strong growth is evident in the share of employment in occupations associated with the highest average levels of key information-processing skills. Employment in occupations corresponding to the lowest average levels of information-processing skills has been rather stable. In between, the results are more mixed. Occupations corresponding to the next-highest average levels of literacy and numeracy have been stable, but those corresponding to the next-lowest average levels have experienced a sharp decline in employment share between 1998 and 2008. The country-by-country patterns (see Table B1.7 in Annex B), in most cases, are similar to the overall trend.

■ Figure 1.4 ■

Evolution of employment in occupational groups defined by level of education

Percentage change in the share of employment relative to 1998, by occupational groups defined by workers' average level of education



Notes: Only the 24 OECD countries available in the 1998 LFS Database are included in the analysis. High level of education refers to tertiary level or more than 15 years of schooling; medium level of education refers to no tertiary but at least upper secondary education or around 12 years of schooling; low level of education refers to less than upper secondary education or 11 years of schooling. Occupations with high-educated workers: legislators and senior officials; corporate managers; physical, mathematical and engineering science professionals; life science and health professionals; teaching professionals; other professionals; physical and engineering science associate professionals; life science and health associate professionals; teaching associate professionals; and other associate professionals. Occupations with medium-educated workers: managers of small enterprises; office clerks; customer services clerks; personal and protective services workers; models, salespersons and demonstrators; extraction and building trades workers; metal, machinery and related trades workers; precision, handicraft, craft printing and related trades workers; stationary plant and related operators; and drivers and mobile plant operators. Occupations with low-educated workers: other craft and related trades workers; machine operators and assemblers; sales and services elementary occupations; and labourers in mining, construction, manufacturing and transport.

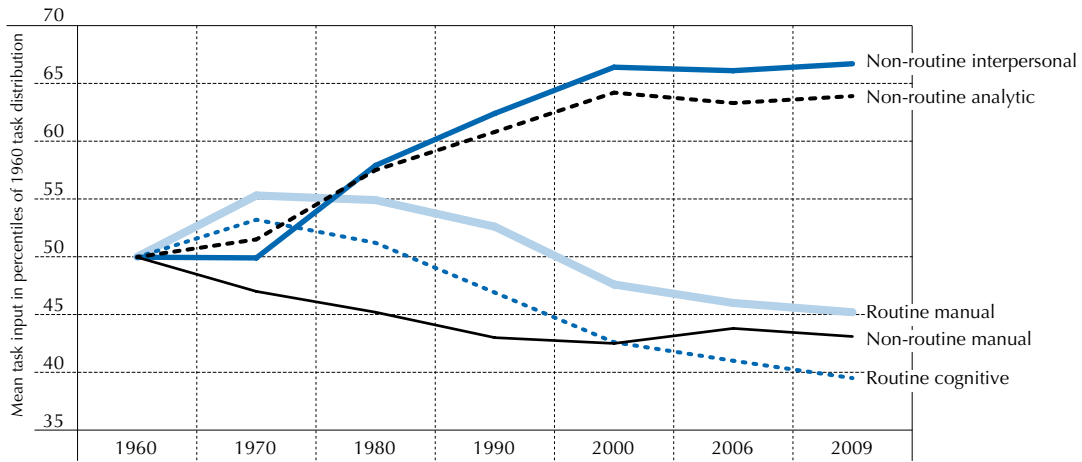
Source: Eurostat, LFS Database. See Table A1.4 in Annex A.

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■ Figure 1.5 ■

Change in the demand for skills

Trends in routine and non-routine tasks in occupations, United States, 1960 to 2009

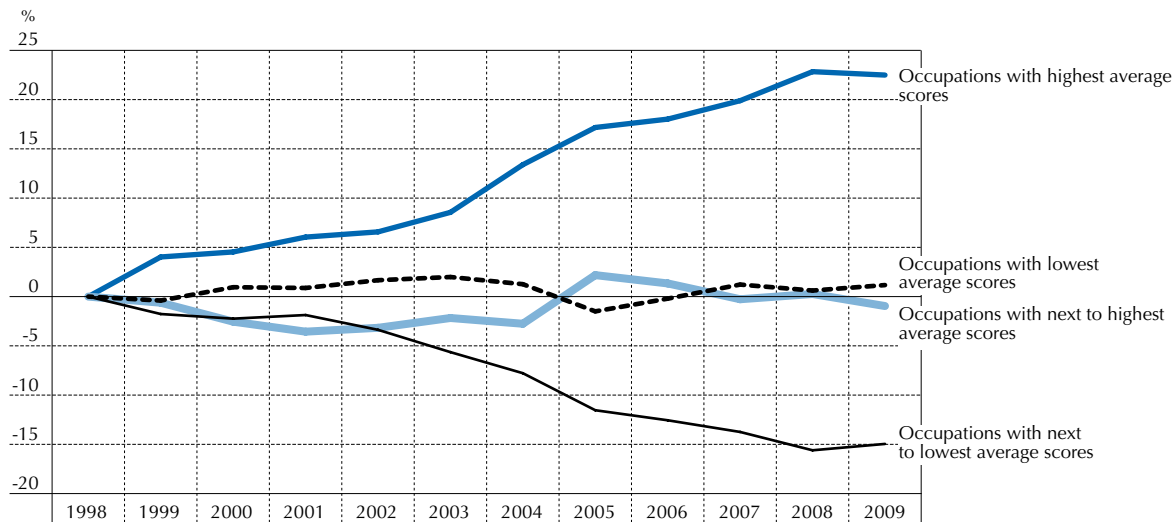


Source: Autor, D.H. and B.M. Price (2013), see Table A1.5 in Annex A.
 StatLink <http://dx.doi.org/10.1787/888932900308>

■ Figure 1.6 ■

Evolution of employment in occupational groups defined by level of skills proficiency

Percentage change in the share of employment relative to 1998, by occupational groups defined by workers' average level of proficiency in literacy and numeracy



Notes: The Survey of Adult Skills (PIAAC) is used to identify occupations associated with high and low literacy and numeracy scores, and then time series data available from the Labour Force Survey (LFS) Database are used to track changes in those occupations over time. See Chapter 2 of this volume and *The Survey of Adult Skills: Reader's Companion* (OECD, 2013) for an extended discussion describing the literacy and numeracy scales. Only the 24 OECD countries available in the 1998 LFS Database are included in the analysis. Highest average scores are in or near the upper half of Level 3 for literacy and numeracy; next to highest average scores are in or near the lower half of Level 3 for literacy and numeracy; lowest average scores are in or near the upper half of Level 2 for literacy and numeracy; next to lowest average scores are in or near the lower half of Level 2 for literacy and numeracy.

Source: Eurostat, LFS Database; Survey of Adults Skills (PIAAC) (2012). See Table A1.6 in Annex A.

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The effect of globalisation

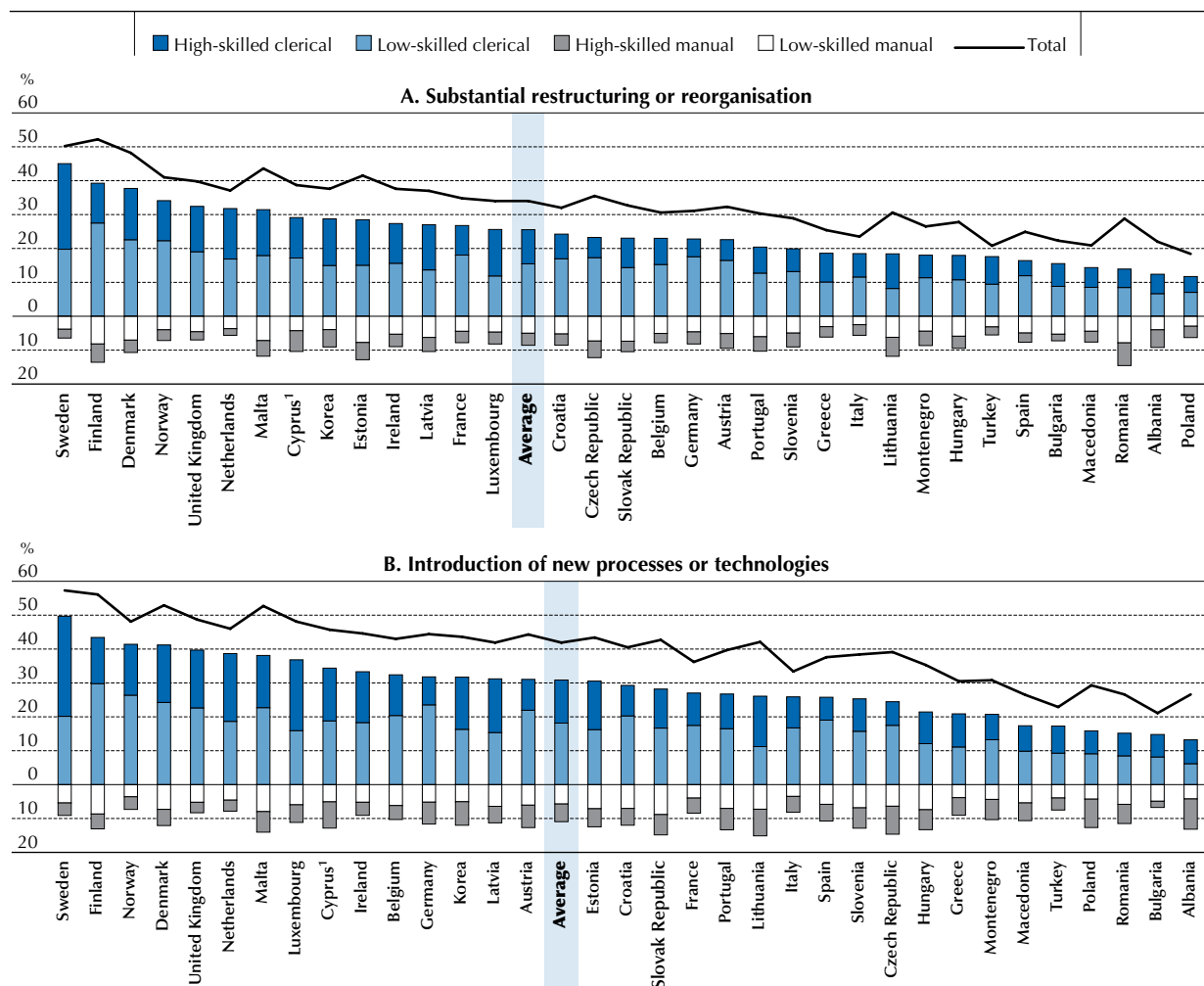
Technology has played a central role in enabling the globalisation of markets primarily by increasing the reach and speed of communication and helping to reduce costs, both of which have eased the flow of goods, capital, people and information across borders. In turn, globalisation has had a strong impact on job opportunities and the demand for skills in local labour markets. On balance, trade can play an important role in creating better jobs, increasing wages in both rich and poor countries, and improving working conditions; but these potential benefits do not accrue automatically. Policies that complement more open trade, including skills-related policies, are needed if the full positive effects on growth and employment are to be realised (OECD, 2012b).

Globalisation has also led to the outsourcing of production. Low-skilled jobs are increasingly seen as being “offshore-able” – i.e. being relocated from high wage or high cost locations to low wage and low cost locations in less developed countries. Offshoring is increasingly spreading from manufacturing to technology-intensive industries, including services. While offshoring accounts for only a small percentage of aggregate job losses on balance, the offshoring of jobs to countries with workforces that are moderately educated but earn comparatively lower wages has been cited as a possible reason for the decline in mid-level jobs in more advanced economies (Autor, 2010).

■ Figure 1.7 ■

Organisational change and new technologies

Percentage of workers who reported changes in their current workplace during the previous three years that affected their work environment



1. See notes at the end of this chapter.

Countries are ranked in descending order of the percentage of workers with low and high clerical related skills who report changes.

Source: European Working Conditions Survey, 2010. See Tables A1.7a and A1.7b in Annex A.

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The role of organisational change

Competitive pressures and technological change mean that the modern workplace is in a state of constant change. Work is regularly re-organised either to support the introduction of technology or to reduce costs or improve productivity. A substantial proportion of workers are in workplaces that have introduced new technologies and/or undergone significant restructuring (see Figure 1.7, Panels A and B). Irrespective of their origin, changes to the way work is organised contribute to a changing demand for skills and require that individuals adapt and learn new things (e.g. Green, 2012; Caroli and van Reenen, 2001).

Imbalances between the supply of, and demand for, skills in labour markets are widespread

In the 1990s, responses to structural change emphasised the supply of skills. Most of the policy discussion centred on the need for training and upgrading; much less thought was given to skill imbalances, and how a lack of use and low levels of demand for skills can be linked to low-skill traps and skills atrophy.

More recently, countries have developed a more comprehensive account of the demand for, and use of, skills, including how work and organisational practices can either perpetuate or eliminate skills imbalances (e.g. Bevan and Cowling, 2007) and low-skills traps (OECD 2012a). While certain countries focus on the imbalances between education levels and requirements (Green, 2013), a concern for all is to ensure that changes in work and organisational practices result in a more effective use of the skills of highly educated workers, which, in turn, will limit skills atrophy and wasted opportunities to increase productivity.

Another challenge is the coexistence of high levels of unemployment with skills shortages and other skills imbalances, such as shortages and so-called skill gaps or mismatches. Skill mismatches manifest themselves in situations where workers with low levels of skills are found to be employed in jobs that require relatively high levels of skills (underskilling); or where highly qualified workers underuse their skills (overskilling). Chapter 4 elaborates on the extent and distribution of mismatch by analysing the measures of skills mismatch collected by the Survey of Adult Skills.

WHAT THE SURVEY OF ADULT SKILLS CAN TELL US

The level of skills proficiency among adults

The Survey of Adult Skills directly assesses skills that are considered to be key information-processing skills: literacy, numeracy and problem solving in technology-rich environments. It is thought that these skills provide a foundation for effective and successful participation in the social and economic life of advanced economies. Understanding the level and distribution of these skills among adult populations in participating countries is thus important for policy makers in a range of social and economic policy areas. To this end, **Chapter 2** provides a descriptive, comparative analysis of the distribution of skills within the adult population.

Which groups in the population have low, medium and high levels of key information-processing skills

Given the centrality of written information in all areas of life, individuals must be able to understand and respond to textual information and communicate in written form in order to fulfil their roles in society, whether as citizen, consumer, parent or employee. Many jobs now require the use of numerical tools and models, and in many countries individuals are being required to assume more responsibility for such matters as retirement planning. The presence of ICTs in the workplace and elsewhere, and related changes in the delivery of many services (e.g. online banking, e-government, electronic shopping), may well have made mastery of literacy and numeracy skills even more important for full participation in modern life. In addition, a certain level of proficiency in literacy and numeracy appears to be a pre-condition for success in undertaking more complex problem-solving tasks – for which, in turn, demand is growing as a consequence of ongoing structural changes. To this end, **Chapter 3** addresses the question of who in the adult population has low, medium or high proficiency in literacy, numeracy and problem solving in the context of technology-rich environments.

The supply of, and demand for, key information-processing and generic skills in labour markets

Concerns about the adequacy of the supply of the skills needed to meet changing labour market requirements are now balanced by views that there are many highly educated and skilled adults who do not necessarily supply their skills to the workforce, or fully use their skills in their jobs. Based on the belief that skills requirements are rapidly evolving, the



Survey of Adult Skills collected considerably more information on the use of skills in the workplace than did previous surveys. **Chapter 4** goes beyond providing an overview of the skills available in labour markets to providing a more comprehensive account of the extent and distribution of skills use and skills mismatch.

How key information-processing skills are developed and maintained over a lifetime

Proficiency in skills such as literacy, numeracy and problem solving is not fixed once and for all on leaving formal education. What an individual does at work, the activities he or she engages in outside of work, the opportunities available for ongoing learning as well as the processes of biological ageing all affect whether proficiency increases or declines over time and at what rate. Ensuring that adults can develop and maintain their skills and positively adapt to changes in the economy and society is especially relevant in ageing societies. Gaining insight into how key skills are developed and maintained over a lifetime is thus a key issue for policy makers. **Chapter 5** examines various factors that are believed to be important for acquiring and maintaining skills.

How key information-processing skills translate into better economic and social outcomes

To what extent does proficiency in literacy, numeracy and problem solving translate into better outcomes for individuals and for nations? Are adults with higher levels of proficiency in literacy, for example, more likely than others to be employed, to have higher wages and to have better health? This information is important for policy makers deciding where to invest scarce resources. **Chapter 6** presents evidence on the potential links between adult skills and economic and social outcomes and discusses how skills and these outcomes may be linked.

Notes regarding Cyprus

Note by Turkey: The information in this document with reference to “Cyprus” relates to the southern part of the Island. There is no single authority representing both Turkish and Greek Cypriot people on the Island. Turkey recognises the Turkish Republic of Northern Cyprus (TRNC). Until a lasting and equitable solution is found within the context of the United Nations, Turkey shall preserve its position concerning the “Cyprus issue”.

Note by all the European Union Member States of the OECD and the European Union: The Republic of Cyprus is recognised by all members of the United Nations with the exception of Turkey. The information in this document relates to the area under the effective control of the Government of the Republic of Cyprus.

A note regarding Israel

The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

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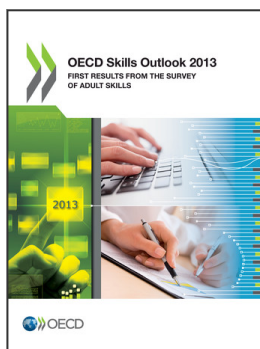
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