

Executive summary

Countries are seeking to learn more about the skills needed for innovative activity

Innovation depends on people who are able to generate and apply knowledge and ideas in the workplace and in society at large. OECD countries have long recognised the need to develop skilled people through education and training. But as they strive to find new sources of growth to underpin a strong and sustainable future, they increasingly try to understand the types of skills needed for innovation and the best ways to build them.

It is difficult to make explicit links between specific skills and innovation. The broad definitions of skills and innovation, the difficulty of measuring human capital and innovation outputs and outcomes, and the relative scarcity of innovation-specific empirical studies all serve to limit the identification of such relationships and thus the precision of policy messages. This book seeks to provide an overview of the literature, the data and the evidence in order to clarify to some extent the links between skills and innovation. It aims to increase understanding of the desired skills base for innovation and the policies that might enhance the development of such skills, and to point to areas for further analysis.

A broad range of skills contributes to innovation and “soft skills” may be increasingly important

Understanding the skills and attributes that can help people contribute to innovation is an important first step in the policy-making process. However, the wide range of skills identified in the literature as contributing to innovation does not provide much guidance for establishing policy targets. They include basic skills such as reading and writing, academic skills, technical skills, generic skills such as problem solving and “soft” skills such as multicultural openness and leadership. Managerial and entrepreneurial skills are also mentioned, as are creativity and design. People also need the skills that enable them and

their workplace to “learn”. This can encompass competencies ranging from technical to interaction skills. There is also growing interest in consumer skills for coping with new technologies and contributing new ideas.

Though many skills may be needed for innovation, individuals, firms and industries may draw on different skill mixes at different times. Some factors likely to influence the required skill sets are the stage of innovation, the type of innovation and industry structure. At the country level, adoption and adaptation skills will be more crucial for some countries: in many firms innovation means the introduction of “new to the firm” products and processes rather than radical inventions. Business strategies also drive demand for skills, as they provide a framework for decisions about investment, research and development (R&D) and human capital. As a result of these factors, while there will be differences in the specific skills needed for innovation, in practice, many skills will be relevant across the innovation spectrum.

As the demand for knowledge sharing and learning increases, “soft” skills such as communication and teamwork may gain in importance. Nevertheless, technical skills will remain an essential part of many types of work. Continuing globalisation may lead to greater emphasis on adaptability and skills that facilitate collaboration across firms and countries. The ability to work in multidisciplinary teams may also rise in importance. The growing interest in environmental and sustainability issues is another trend that will have an impact on the set of skills for innovation and research. Definitions of a “green economy” and “green jobs” are not yet settled, but there may be a need for broader skills in existing jobs as well as some new occupations.

Educational attainment has risen and some industries have experienced important increases in skilled workers

Educational attainment, as one broad indicator of the skills available in countries, has risen steadily in OECD member countries, and around one-third of 25-34 year-olds now have a tertiary education. Graduation at the doctoral level has also expanded. Compared to older cohorts, young people increasingly graduate in the social sciences, business and law, and there has been a relative decline in the share of science and engineering (S&E) graduates in a number of countries. Wage premiums and returns to education show that further study yields positive benefits. Differences

in returns to particular fields of study are one likely factor in the shift in shares of graduates over time. The general rise in attainment is also reflected in employment data; employment of tertiary graduates has risen, skilled occupational categories have grown relative to semi-skilled, and skilled occupations in the category “human resources for science and technology” (HRST) have outpaced overall employment growth in most countries. At the same time, persistent issues regarding “inactive” youths, tertiary drop-outs and poor literacy levels suggest that OECD countries still have work to do to raise educational attainment.

The services sector has a greater share of HRST occupations in total employment than the manufacturing sector. An analysis of specific medium-high- and high-technology industries and knowledge-intensive business services reveals some strong increases in highly skilled workers, especially in business services. Patterns differ across countries, however, and in some cases general employment growth outpaced that of highly skilled workers. The business enterprise sector employs more than half of the researcher population in the OECD area. Doctorate holders are mostly employed in the public sector and in higher education institutions.

There is a clear need for more empirical work linking measures of skills to innovation indicators

Empirical studies linking data on stocks and flows of skills at the country and industry level to innovation indicators would provide valuable evidence to complement more theoretical discussions of skills for innovation. However, there is a clear need for further work to improve the data, better identify relationships and explore their strength and direction. Initial investigations of the data to find simple relationships yielded mixed results. At the country level, for example, no obvious strong relationships were apparent between initial shares of R&D personnel and researchers in employment and subsequent growth in total factor productivity (TFP) or triadic patents. At the industry level, the relationships were slightly stronger; in the manufacturing sector, initial levels of business enterprise R&D personnel were positively correlated with subsequent in-house product innovation. Nevertheless, this cautions against simple “more-is-better” policy prescriptions. More disaggregated data may reveal stronger relationships, and linking firm and employee data could provide valuable insights. These data exist in many countries, although it would be necessary to overcome privacy

issues, among other constraints, in order to use them. Existing firm-level analysis is limited but appears to identify both technical and business/management skills as relevant for innovation.

Policy for skills for innovation should focus on enabling skills acquisition and optimal use of skills at work

Many OECD countries are concerned to ensure that the supply of highly skilled people keeps pace with the demands of knowledge-based economic activity. Various country-level studies have pointed to shortages of skilled workers, or of particular skills and competencies, which have at times hampered innovation. However, interpreting results regarding shortages remains a matter of judgement; the threshold at which they become a concern may differ among firms and industries, and the drivers of shortages may be more complex than simply numbers of skilled staff. For the future, the picture is mixed, with both low- and high-skilled jobs likely to experience relative growth. In consequence, policy to encourage skills for innovation may need to be broad, since many skills appear relevant and more robust evidence is needed on the relationships between specific skill groups and innovation. The most important policy approaches may thus involve the creation of an environment that enables individuals to choose and acquire appropriate skills and supports the optimal use of these skills at work.

Strengthening market signals about the merits of different education and training options is essential

Strengthening market signals so that tertiary education institutions are well attuned to the demands of the labour market is a key area for policy attention. Areas to consider include co-ordination of education and labour market policies at ministerial level, improving data on and analysis of labour market outcomes, and encouraging flexible provision and lifelong learning options at tertiary institutions. Vocational education and training (VET) systems can be made more responsive through increased involvement of the business sector and unions in curriculum development and staff exchanges. Sharing the costs of education and training among students, employers and the government in accordance with the benefits helps to signal the merits of different options.

Other aspects of skills development that may merit policy attention include knowledge about and views on scientific careers and the flexibility of academic research careers. Many countries also promote the participation of women in science, in view of the low level of their involvement in certain fields and at higher levels of seniority. More broadly, countries must ensure that improvements in educational attainment also encompass current underachievers. Basic skills and a minimum level of schooling are essential in order to participate in society and cope with the changes brought about by innovation. In recognition of the benefits of the international mobility of highly skilled people, policy should also seek to support knowledge flows and the creation of linkages, including through immigration policy for the short-term movement of skilled people.

Policies on workplace training could look to improving information and lowering costs for firms

Beyond the initial learning gained through school and tertiary study, people must now increasingly upgrade their skills throughout their adult lives. Training at work plays a key role, as it builds work-related competencies and helps workers cope with change. It also contributes to the technological capabilities of firms and is positively related to innovation. The incidence of training varies across countries and thus raises the question of whether enough training is provided and taken up by employees. A way may need to be found for increasing incentives to train or be trained without lowering the necessary motivation. Possible policy avenues to explore include improving information and lowering training costs for firms.

Policy should enable firms to adopt forms of work organisation that support innovation

Making the most of available skills for innovation depends in part on workplace organisation. Concepts such as employee engagement, high-performance working and learning organisations are being more widely studied; they include features such as job flexibility, delegation of authority and incentives for innovation. The evidence shows a link between management of human resources and innovation, although causality may run in both directions. While many decisions about human

resources are the subject of internal firm policies, governments may have some scope to shape these decisions. Labour market policies that allow mobility and enable organisational change, while also supporting training, may help firms to adopt forms of work organisation that support innovation.

Wider policy settings must provide a supportive environment in which innovation skills can be used

More broadly, given the wide variety of influences on innovation, getting policy right on skills is necessary but not sufficient to support innovative activity. Policy must be coherent and provide a supportive overall environment for innovation in which people can use their skills to their best ability.