Skilled labour

Access to skilled labour is key for innovation in firms: skilled labour can contribute to innovation and growth by generating new knowledge, developing incremental innovations, supporting firms in the identification of business opportunities, helping companies adapt to changing environments, generating spillovers (transfer of knowledge to co-workers) within the organization and adding to social capital. Although educational attainment has risen steadily in OECD countries in past decades, innovating firms still suffer from a shortage of skilled labour, inhibiting their capacity to innovate. The question of skilled labour is related to broader questions of access to labour. Innovative businesses require specific skills and experience. The costs of hiring and firing are critical in shaping how innovative businesses tap into skilled labour. Public policy could improve innovative firms' access to skilled labour by strengthening education about innovation, promoting an innovation culture, raising public interest in S&T, attracting young people to pursue higher education in S&T disciplines and encouraging lifelong learning to allow people to upgrade their skills throughout their adult lives.

What is skilled labour?

Skilled labour refers to **highly educated individuals having graduated at the tertiary level of education and experienced individuals employed in an occupation for which a high qualification is normally required.** In many studies, skills and skill levels are defined by some **combination of education, training and experience** (Machin and Van Reenan, 1998; Tether et al., 2005; Pro Inno Europe, 2007). The skills identified in the literature as contributing to innovation include basic skills (e.g. reading and writing), academic skills, technical skills, generic skills (e.g. problem solving) and "soft" skills (e.g. multicultural openness and leadership).

The specific skills and competencies of innovative entrepreneurs and how they influence innovative entrepreneurship are covered in the node "Business and entrepreneurship skills and experience [1]".

How does skilled labour affect innovation in firms?

Skilled labour can contribute to innovation and growth in firms by:

- **Generating new knowledge** that can be used to create and introduce innovations. This also includes **adopting and adapting existing ideas to develop incremental innovations** based on modifications and improvements to **existing products or services. Highly skilled labour has greater absorptive capacities** (the capacity to incorporate new technology or knowledge into their work processes), as well as a greater ability to understand how things work and how ideas or technologies can be improved or applied to other areas.

- **Helping firms in the identification of business opportunities.** Skilled labour can efficiently capture, process and synthesize disparate information, playing a key role in identifying new business opportunities.

- **Helping organizations adapt to changing environments through a capacity to learn.** Skilled workers have a greater ability to learn new skills and adapt to changing circumstances. This ability can be particularly beneficial to innovative companies, which typically face rapid changes in technologies and competition.

- **Generating spillovers within the company.** Skilled workers diffuse their knowledge throughout the workplace. Through their explicit or implicit actions as role models, they can spur innovation by spreading ideas and raising the competencies of co-workers. Also, by interacting with other aspects of the innovation process, such as capital investment, highly skilled workers can spur innovation and contribute significantly to competitiveness and expansion in firms.

- **Adding to social capital.** Higher skill levels within a company may contribute to building trust with potential partners, such as venture capital firms, business angels and customers. Such skill levels can signal the quality of a business project, an important consideration when innovative products or services are still under development. Improved levels of trust can, in turn, promote venture capital financing of risky projects (Akçomak and ter Weel, 2009).

Evidence of the importance of skilled labour

Impact of skilled labour on innovation and productivity

Evidence shows that a concentration of skilled human resources in a region can have a positive impact on innovation and entrepreneurship. For example, a study of seven international regions shows that their success in entrepreneurship and innovation largely stems from strong concentrations of skilled human resources, resulting in greater capacities for the generation, diffusion and absorption of knowledge (Potter and Miranda, 2009). Carlino and Hunt (2009) find that the percentage of college-educated people is a decisive factor in the innovative capacities of American cities. Data on Spanish regions find a positive relationship between levels of human capital and the number of patent applications (Gumbau-Albert and Maudos, 2009).

The years of higher education attained, as well as the quality of employees' technical and research skills, also significantly influence the productivity of innovative firms. Further evidence for the link between human capital and productivity comes from studies showing a strong correlation between human capital and earnings (Goldin and Katz, 2007). Additional studies have documented a strong correlation between workforce educational attainment and per capita GDP, and between educational attainment and capital per worker.

Lack of skilled labour as an obstacle to innovative firms' success

Evidence shows that innovating firms typically suffer from a shortage of skilled labour, restraining their capacity to innovate. In Australia, over one quarter (27.2%) of innovative firms stated that a lack of skilled staff, either within the firm or externally in the wider market, was a constraint on their capacity to innovate (ABS, 2006).

Type of skilled labour required for their success

Innovation requires a wide range of skills. When asked to identify the skills and capabilities required to develop new goods and services, or to implement new operational, organizational or managerial processes, innovative firms mention general business skills (22.6% of responding firms), information technology skills (18.2%) and marketing skills (16.7%). Only 2.2% of innovating firms recruited scientific personnel for innovation (ABS, 2006). However, the type of skills required for innovation varies widely across industries, firm size and ownership structure (Toner, 2011).

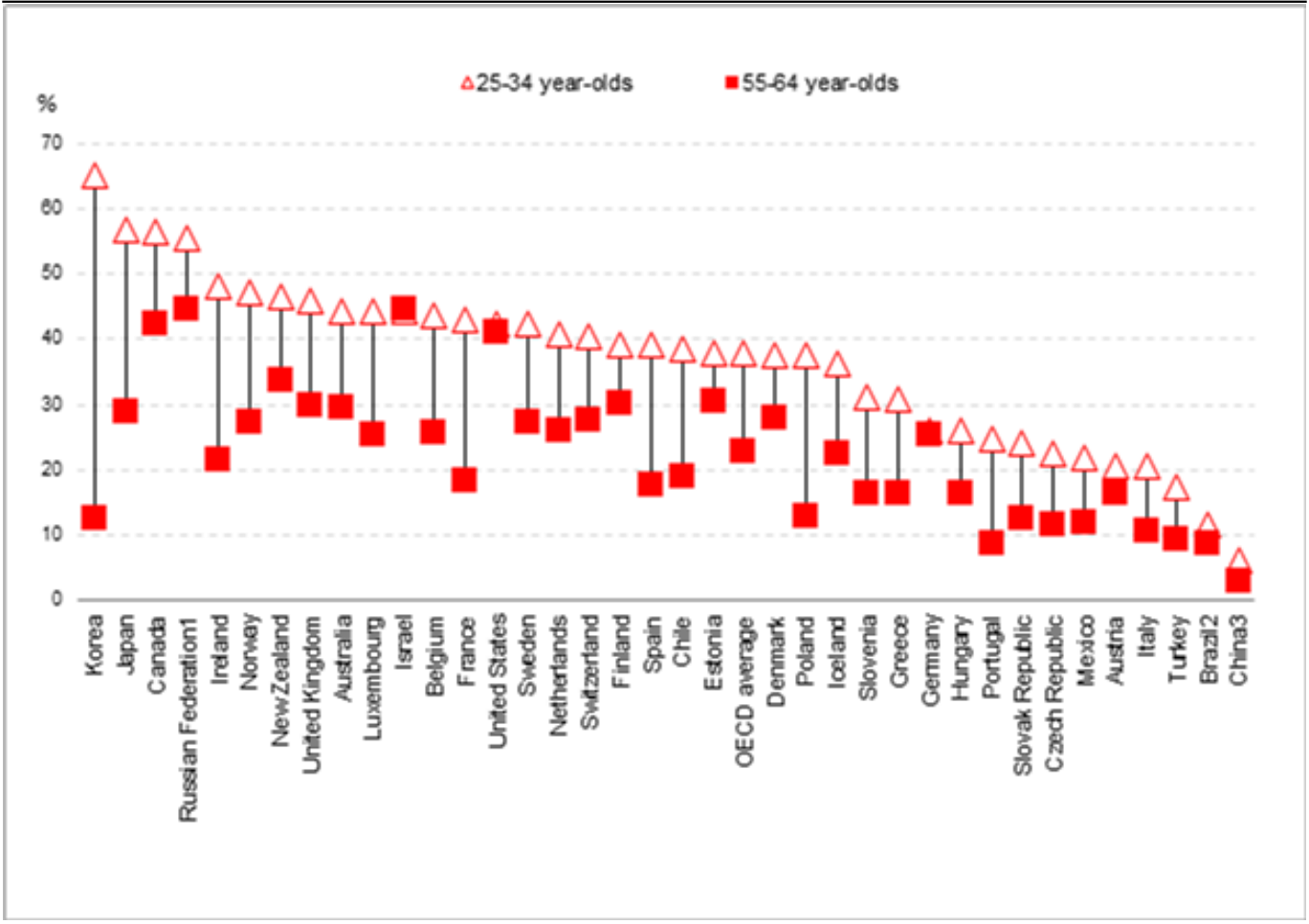
What is the evidence on the availability of skilled labour for innovation in firms?

Evidence on people with tertiary education and PhDs

High education levels can be considered one indicator of skill levels, although not in all cases, since required skills may differ among businesses and involve a different mix of tertiary educated people than what the education system provides. Moreover, depending on the type of innovative business, technically skilled professionals might be more essential than workers with high educational attainment.

Regarding the evidence on educational attainment, **educational attainment has risen steadily in OECD member countries.** In 2010, around one third of the 25-34 age group now has a tertiary education (Figure 1 [2]). **However, graduation rates at the tertiary level vary significantly between countries.** In Mexico and Turkey, only 25% or fewer of young people attain a university-level education; in contrast, the proportion is 50% or more in Australia, Denmark, Iceland, Poland and the United Kingdom. **Disparities in graduation rates also exist between genders.** On average in OECD countries, significantly more women (47%) are expected to obtain university-level qualifications than men (32%), based on current graduation rates. The gender gap in favour of women is at least 25 percentage points in Iceland, Poland, the Slovak Republic and Slovenia. In Germany, Mexico and Switzerland, graduation rates between sexes are quite balanced. In contrast, more men attain a university-level education in Japan and Turkey.

Figure 1. Percentage of population attaining tertiary education, by age group (2010)

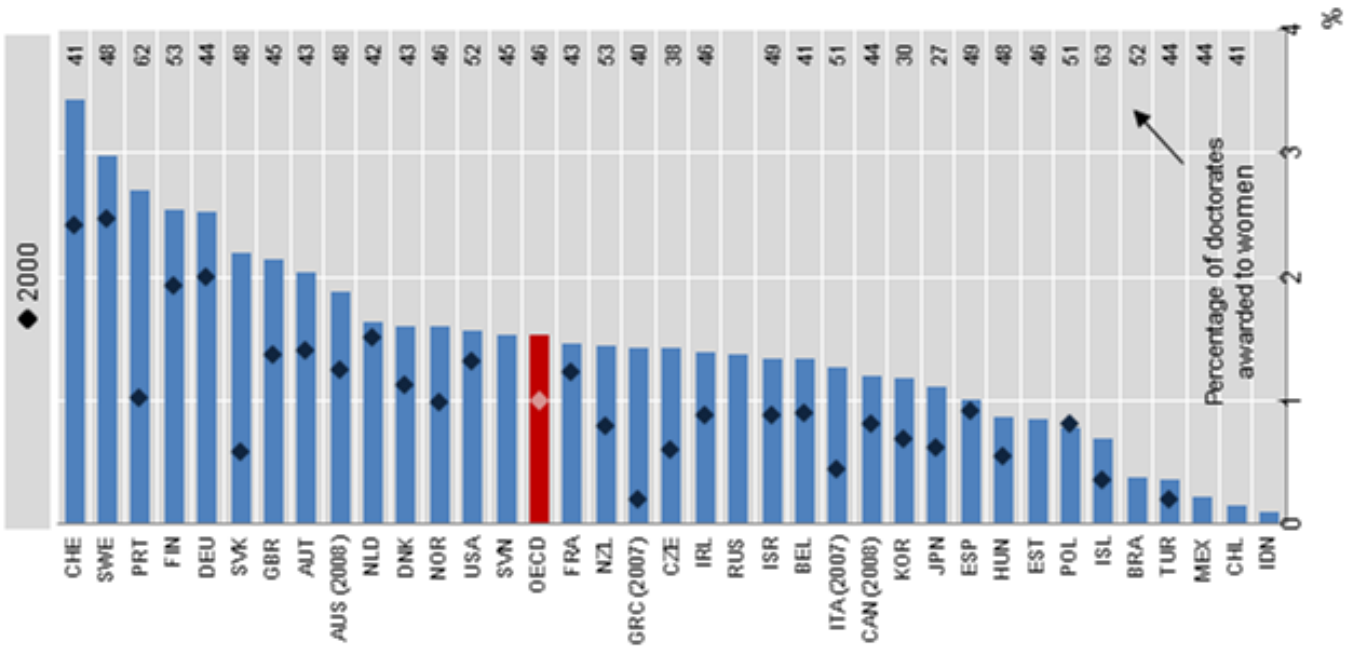


1. Year of reference 2002.
2. Year of reference 2009.
3. Year of reference 2000.

Countries are ranked in descending order of the percentage of 25-34 year-olds who have attained tertiary education.
Source: OECD (2012),Table A1.3a. Population that has attained tertiary education (2010), in Education at a Glance 2012, OECD Publishing. http://dx.doi.org/10.1787/eag-2012-table8-en [3]

Graduation at the doctoral level has also expanded over the past decade (Figure 2) [4]. The increase in doctorates is partly explained by the increasing presence of women in doctoral programmes. In 2009, women received 46% of total doctorate degrees awarded in OECD countries. However, they remain underrepresented in science and engineering (S&E), accounting for only 34% of all degrees in these fields.

Figure 2. Graduation rates at doctorate level, 2000 and 2009
As a percentage of population in reference age cohort



Source: OECD (2011), Education at a Glance 2011: OECD Indicators and Education at a Glance (2009): OECD Indicators, OECD, Paris.
StatLink http://dx.doi.org/10.1787/888932485728 [5]

The largest share of new doctorate degrees is in science and engineering. Nearly 39% of doctoral graduates in OECD countries obtained their degrees in science and engineering fields in 2009; in Chile, France and China, the figure is 55%. However, while absolute numbers of science and engineering doctorates have increased significantly since 2000, their relative share has been declining in a majority of OECD countries. Compared to older cohorts, young people increasingly graduate in the social sciences, business and law. The United States is the largest single contributor of new doctorates in science and engineering, with more than a quarter of the nearly 89,000 OECD total in 2009, followed by Germany, the United Kingdom and France. The 20 EU countries combined account for more than half of the total number of OECD doctoral degrees in science and engineering.

What other topics relate to skilled labour and innovation in firms?

Costs of hiring and firing [6] . The ability of innovative firms to tap into skilled labour will depend on the context of their labour market.

Migration. [7] Immigrants can address skilled labour shortages by bringing new skills to host countries.

R&D and other investment in innovation [8]. The contributions of skilled labour to business innovation will depend on corresponding investments in capital. The cost of skilled labour often constitutes a substantial share of total R&D spending.

Interface with universities and public research institutes. [9]Innovative firms can draw on co-operation with universities to obtain access to scientists and experts, and to undertake innovation activities. This can be particularly helpful, since innovative firms typically lack the assets and resources to invest in formal R&D.

Access to labour for innovative entrepreneurship [10]. Innovative entrepreneurs face specific challenges to access to labour which may call for targeted policy.

Business and entrepreneurship skills and experience [1]. Business and entrepreneurship skills and competencies allow innovative entrepreneurs to better identify and pursue business

opportunities. In doing so, entrepreneurship skills improve the ability of innovative entrepreneurs to manage risk and best utilize their resources, including skilled labour.

What policies relate to skilled labour and innovative businesses?

Public policy can influence skilled labour within the context of innovative businesses by:

Strengthening education for innovation. Education policies can increase national innovation capacities by equipping more people with required skills and by inspiring talented young people to enter innovation-related occupations. By raising attainment levels and the general quality of education, education policies can meet the need for diverse and complex skills. Introducing innovative learning practices into traditional disciplines may also be a way to foster a capacity in all students to contribute to innovation, by enhancing creativity, curiosity and collaboration, as well as entrepreneurial attitudes.

Strengthening an innovation culture and raising public interest in S&T in order to attract young people into pursuing S&T disciplines in higher education. Public interventions could include large public communication campaigns (e.g. high-visibility international events or outdoor events promoting science) and joint research projects involving youth and senior scientists.

Identifying future skill needs and ensuring delivery of the right mix of skills through education, in order to more effectively link supply and demand for skilled labour at both sector and regional levels.

Encouraging lifelong learning to enable workers to upgrade their skills throughout their adult lives. To encourage lifelong learning, schools need to adopt practices that increase students' capacity and motivation for independent learning. All forms of learning, including non-formal learning (e.g. workshops, short courses and conferences) need to be recognized and made available on the basis of their content, quality and outcomes. Education systems also need to promote and be responsive to lifelong education and training systems. With the number of stakeholders involved in lifelong learning extending beyond those covered by education authorities, co-ordination in policy development and implementation will be essential.

Facilitating the mobility of the highly skilled workforce in order to optimize the use of human resources, to facilitate the cross-fertilization of ideas and learning, and to address structural mismatches in supply and demand for skilled workers. Policies for increasing the mobility of human resources for science, technology and innovation (HRSTI) include measures to facilitate mobility across sectors within the economy, notably between academic research and industry, as well as international mobility for HRSTI. Measures to increase domestic mobility can reduce regulatory barriers in labour markets (e.g. transferable pension rights), and provide advice and training programmes for people who have strong technological knowledge but lack market and commercial expertise.

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Links
[1] https://www.innovationpolicyplatform.org/content/business-and-entrepreneurship-skills-and-experience?topic-filters=12032
[2] https://www.innovationpolicyplatform.org/#fig1
[3] http://dx.doi.org/10.1787/eag-2012-table8-en
[4] https://www.innovationpolicyplatform.org/#fig2
[5] http://dx.doi.org/10.1787/888932485728

[6] https://www.innovationpolicyplatform.org/content/costs-hiring-and-firing?topic-filters=12028
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