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Notes

[1] "Third stream" is the term used in the United Kingdom to refer to the engagement function of higher education.

[2] Scientific publications are accredited in the form of publication points. In the calculation of publication points, scientific works are ranked according to form of publication, level and number of authors (Fossum-Raunehaug, 2017[127]).

[3] Scholarship of engagement refers to the need to place academic research in a larger context through the scholarship of discovering, integrating, sharing and applying knowledge. This involves creating a climate "in which academic and civic cultures communicate more continuously and more creatively with each other" (Boyer, 1996[125]; Sandmann, 2008[126]).

[4] At the time of the publication of the plan, the coalition of stakeholders included: DANS, The Young Academy, DTL, GO FAIR, National Library of the Netherlands (KB), The Royal Netherlands Academy of Arts and Sciences (KNAW), the National Coordination Point for Research Data Management (LCRDM), the Netherlands eScience Center, the Netherlands Federation of University Medical Centres (NFU), the Netherlands Organisation for Scientific Research (NWO), the PhD Candidate Network Netherlands (PNN), SURF, 4TU.Centre for Research Data, the Dutch consortium of the thirteen university libraries and the National Library of the Netherlands (UKB), the Netherlands Association of Universities of Applied Sciences (VH), the Association of Universities in the Netherlands (VSNU) and the Netherlands Organisation for Health Research and Development (ZonMw).

[5] The Sámi people traditionally inhabit a territory known as Sápmi, which traverses the northern parts of Norway, Sweden, Finland and the Russian Kola peninsula.

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Table 7.3. Selected policies from the participating jurisdictions (2017)

	Motivation	Policies
Estonia	Improving accessibility in higher education through continuing education	• Legislation determines the responsibility of higher education to provide education services to society. • The provision of continuing education is among the criteria used in institutional accreditation. • There are also goals related to the provision of continuing education in performance agreements, which are tied to funding. • Around 20% of funding is allocated based on performance, and one indicator pertains to revenues from study activities (i.e. funding coming from tuition fees and provision of continuing education).
The Flemish Community	Increasing environmental sustainability through higher education	• The government (at various levels) supports the development of programmes that promote sustainability. EcoCampus is an example of how higher education institutions can engage with society to promote sustainability, including preservation of the environment, by assisting teachers, researchers and students to develop knowledge, skills and attitudes necessary to critically examine sustainability practices. • EcoCampus provides information (publications), offers tools and the exchange of good practices, including thematic learning networks, education videos, a kit for teachers in economic lessons, dissemination of a theoretical framework for sustainable higher education through publications, etc. • Curieuzeneuzen, a collaboration project to engage citizens in scientific research and the Participatory Platform for Sustainable Energy Management (PARENT), is also an example of an engaged research project with direct impact on the environment and on the community. The programme promotes the reduction of household energy consumption in the local community.
The Netherlands	Encouraging the development of policies to increase the social impact of research and better integrate higher education locally	• In 2010, the Valorisation Programme was initiated with the aim of professionalising the knowledge transfer process. The programme created several regional consortia centred on one or more higher education institutions. The consortia brought together companies, knowledge and research institutes, civil society organisations, and local and regional governments. Co-funding of 50% was provided for valorisation plans, on the condition that plans would be carried out by a public-private consortium. Funds supported pre-entrepreneurial education; screening and scouting knowledge transfer opportunities; IP applications; pre-seed funding; proof-of-concept funding; network creation; and other activities that contribute to knowledge transfer. • Using society as a learning environment for students is part of the Strategic Agenda for Higher Education and Research 2015-25. Students formulate the relevant research questions together with researchers and partners in the field through activity such as community service, knowledge workshops, field laboratories and student housing in the learning environment itself .For example, the City Deals on Education aims to find solutions for social challenges in cities through the large-scale involvement of businesses, researchers, lecturers and students.
Norway	Fostering entrepreneurship and innovation across the higher education system, including place-based innovation systems	• The 2014 Action Plan urged higher education institutions to expand and diversify their entrepreneurship education provision. As a result, a nationally funded peer-mentoring project to support the development of entrepreneurship was piloted from 2014 to 2016, and has since been adopted by other institutions across Norway. • The newly introduced performance agreements include indicators for entrepreneurship and innovation for some institutions. • The Research Council of Norway also finances the Student Entrepreneurship (STUD-ENT) programme, which promotes a stronger entrepreneurship culture in higher education institutions. • As for better integrating higher education in place-based innovation systems, in 2007, Norway established a ten-year funding programme for regional R&D and innovation through the Research Council. The funding programme aimed to promote greater regional collaboration between trade and industry, R&D institutions and government authorities, and the establishment of closer ties with other national and global networks. • As part of the performance-based component of funding for Norwegian higher education institutions, additional funding is awarded based on reported income from regional research grants and grants from the Research Council.

Source: Adapted from information provided by the participating jurisdictions. See the reader's guide for further information.

Due to the lack of available data, the benchmarking approach to the study of engagement with the wider world focuses more heavily on policies and practices. Table 7.3 summarises key policies and practices presented in the chapter. As discussed in this chapter, some OECD countries have developed or are developing indicators to measure the social impact of engagement activity in research. These developments are still in the early stages, but have the potential to eventually contribute towards the definition of comparable indicators across OECD countries, with additional conceptual development.

Japan addresses existing social challenges, including climate change, poverty and human rights, in order to achieve sustainable development through an ESD programme (Japanese Ministry of Education, Culture, Sports, Science and Technology, 2019[123]). In 2008, the national ESD implementation plan called for the development of higher education model programmes in this area. Since then, the government supports ESD in higher education through funding, including grants for sustainable science research, and community activities, such as the provision of ESD certificates at higher education institutions and the establishment of a higher education forum on ESD (Nomura and Abe, 2010[124]).

7.5. Concluding remarks

This chapter reviewed engagement with the wider world, the third function of higher education, focusing on engagement efforts that help build human capital, contribute to innovation and support wider development. It explored relevant higher education policies with a particular focus on the four participating jurisdictions, and highlighted developments at conceptual and practical levels, pointing out gaps in the existing information base.

This concluding section focuses on summarising some of the key messages of the chapter, along with the limitations of available information, which prevent a deeper analysis. Key concluding points are:

- Most of the internationally comparable data on engagement at the system level are based on engagement between higher education and enterprises, and business contributions to higher education expenditure on R&D, enabling only a partial understanding of higher education engagement.
- Governments are playing a critical role in developing entrepreneurship in higher education in all fields of study, as well as developing and updating the skills of society through continuing education. Data on the development and diffusion of entrepreneurship across educational programmes, as well as a common definition and provision of continuing education across OECD countries would contribute to a better understanding of how and why policies are being developed. This could provide a better ground for countries to learn different ways to make their higher education systems more relevant to their societies and sustainable.
- Surveys that measure engagement between higher education and enterprises measure perceptions of university-business collaboration and factual collaboration, providing an overview to policy makers of performance and public opinion. More comprehensive data collection on collaboration could improve countries' overview of their capacity to meet society's needs.
- As governments develop legal and policy frameworks, guidelines and initiatives to encourage greater openness in science, it will be important to also develop internationally comparable indicators to measure progress across the OECD.
- Discussions about the definitions of, as well as agreement on, common indicators are becoming increasingly important as the emphasis on civic engagement and the social impact of higher education grows. Due to the lack of data to measure performance, assessments at this stage are not feasible, but countries can greatly benefit from learning about each other's good practices in these areas through policy and practice benchmarking. Efforts to define and collect data will become even more important as engagement efforts increase.

government engages social partners, including the higher education sector, on its efforts to achieve a more green and sustainable economy. The policy framework is based on three main concepts: circular economy, local engagement (social entrepreneurship), and value-added, inclusive partnerships (DuurzaamDoor, 2018[119]).

In 2016, Norway was the first OECD member country to ratify the Paris Agreement. In the Long-Term Plan for Research and Higher Education 2015–2024, the government sets the six priority areas of Norwegian higher education and research, which include two broad environmentally related areas: climate, environment and renewable energy; and seas and oceans.

Beyond the participating jurisdictions, the United States has been very active in energy and environmental education stewardship. At the federal level, environmental education is one of the services provided by the Environmental Protection Agency. Almost half of the agency's budget is allocated to grants to various organisations, including education institutions. Grants can be invested on education programmes, professional and youth recognition awards, funding opportunities, publications and more. A useful tool developed by the agency is a platform with information on all initiatives by state, including programmes delivered by higher education institutions (United States Environmental Protection Agency, 2018[120]).

In addition, states have customised approaches for the promotion of sustainable development. For example, the state of Massachusetts developed the *Leading by Example* programme to encourage state agencies and higher education institutions to adopt new practices to reduce their negative impact on the environment. In 2008, the programme created a guide on Campus Sustainability Best Practices, as well as a Greenhouse Gas Inventory Guide for Massachusetts Colleges and Universities. Both the guide and the inventory were based on studies that reviewed thousands of projects happening at the institutional level across the country and provided a list of best practices for local higher education institutions (Patrick, Murray and Bowles, 2008[121]).

In Canada, the federal and the provincial level share jurisdiction in environmental law. At the federal level, educational activities broadening public awareness of climate change are mainly based on partnerships between academics and government scientists in the area; research grants; and the recruitment of students through "co-operative education," which is the terminology used for work-based learning in Canada (Government of Canada, 2013[122]). Co-op placements are assigned with the government or private organisations focusing on environmental policy and climate change, respectively.

An important initiative at the provincial and territorial levels in Canada is the Networks of Centres of Excellence (NCE). These networks bring together academics, industry and non-profit organisations, leading multi-disciplinary research partnerships and attracting strategic investment in the area. NCEs are usually centred at university campuses, two examples are the ArcticNet (Laval University) and the Marine Environmental Observation Prediction and Response Network (Dalhousie University) (Government of Canada, 2013[122]). In addition, many higher education institutions in Canada have adopted a "whole-institution" approach as a result of the Sustainability Tracking Assessment and Reporting System of the American Association for Sustainability in Higher Education. "Whole-institution approaches involve the learners, the institution and the community working together to embed sustainability in curriculum, learning approaches, facilities, operations and community interaction" (UNECE, 2016[115]).

research, as well as curricula and learning. Some examples of networks include the Baltic University Programme (225 higher education institutions from the Baltic Sea region), the Copernicus Alliance (55 higher education institutions from 33 countries), the Global Universities Partnership on Environment and Sustainability, and the University Educators for Sustainable Development (a consortium of higher education institutions, organisations, agencies and associations situated around four regions across Europe) (UNECE, 2016[115]).

Estonia is engaged in UNESCO's ESD programme, mainly through primary and secondary education. However, the government has also provided direct funding to support initiatives in higher education (Estonian Ministry of Education and Research, 2016[116]). For example, since 2003, the Ministry of Research and Education, together with universities and the Environmental Investment Centre, has funded student science conferences on sustainable development (Kalle, 2013[117]).

In the Flemish Community, sustainable higher education embeds the ecological, economic and social principles and practices of sustainable development in its core objectives (Flemish Environment, Nature and Energy Department, 2018[118]). Ecocampus, for example, provides a space in which teachers, researchers and students can study and experiment with sustainability challenges (Box 7.10).

Box 7.10. Ecocampus: Sustainable development in Flemish higher education

The Ecocampus programme promotes sustainable development in the Flemish higher education system by aiming to:

- provide a favourable and enterprising environment so that teachers, researchers and students have the space and the opportunity to work on sustainability
- assist teachers, researchers and students in developing knowledge, skills and attitudes necessary to respond to pressing problems on climate change, energy, food security, poverty and quality of life, as well as qualities necessary to critically examine their practices in the context of sustainability.

Ecocampus aims to fulfil these goals through various means, including by providing information (e.g. publications), offering tools and exchanging good practices, including:

- thematic learning networks that serve as platforms to connect educators from higher education institutions and provide spaces for learning exchange on sustainable development teaching practices
- education videos, including "Sustainability in Research, an Answer to Wicked Problems," where four Flemish researchers and policy directors share their views on the meaning and use of sustainability in higher education research
- a kit for teachers, which shows two approaches of resource management as a sustainability issue (one from Flanders and the transition towards a circular economy, and one from Peru and its mining industry)
- dissemination of a theoretical framework for sustainable higher education through publications. These publications provide a view on several concepts, such as sustainable development, sustainable higher education, barriers, and ways forward (Flemish Environment, Nature and Energy Department, 2018[118]).

Environmental education has a long history in the Netherlands; yet it has been mainly focused on primary education. Higher education contributes through annual programmes funded by the Sustainability Framework 2017-2020. Through these programmes, the

has around 2 000 members, and is a profession-based organisation, advising the government and other stakeholders on policies (European Commission, 2018[111]).

A report commissioned by the Arts Council England and the National Museums Director's Council in 2013 showed that arts and culture create spill-over effects through tourism, support commercial creative industries, improve national productivity, and work as a catalyst for economic regeneration (Centre for Economics and Business Research Ltd., 2013[112]). The report also highlights the role arts and culture play in supporting research activities, with many respected museums having officially been recognised as research organisations and having received the right to supervise research degrees. According to the report, 599 arts organisations in the UK had a relationship with at least one higher education institution and 244 higher education institutions have established links with national museums. In Australia, the government's Excellence in Research for Australia (ERA) framework has recognised creative work of artists, dancers, filmmakers and similar professions as research (Australian Research Council, 2017[75]).

Higher education can also support and promote Indigenous cultures and languages. The Kindred Peoples Programme (1999) fosters the promotion of Estonian culture in higher education by supporting the development of language and culture of the Indigenous Uralic population. In addition, various fields of R&D, including activities related to the Estonian language, culture and language technology, are supported by government. Scholarships for higher education are also available for targeted groups (i.e. Finno-Ugric, Samoyed peoples and the Livonians) (Fenno Ugria, 2010[113]).

The Norwegian Constitution protects the Sámi people,[5] their culture and traditional livelihoods. Higher education institutions play an important role by promoting and strengthening research and education in relation to Sámi and other Indigenous people. The Sámi University of Applied Sciences is an Indigenous institution that preserves and promotes Sámi culture and language. The institution promotes a Sámi perspective in research and teaching and focuses on Sámi teacher training and journalism. The Arctic University of Norway (UiT) also has a Centre for Sámi Studies, which aims to promote and strengthen multi-disciplinary research and education related to Sámi and other Indigenous peoples.

7.4.4. *Using engagement activities to promote sustainability*

Ensuring green growth and sustainable development is one of the key challenges of modern society. A clean and healthy environment is essential for supporting economic activity and well-being in the long-term. Higher education, through its education, research and engagement functions, can support countries in achieving a sustainable and inclusive development.

The Sustainable Development Goal 4 (SDG4), one of the UN's 17 Sustainable Development Goals (SDGs) adopted in 2015, seeks to achieve education for sustainable development and global citizenship. Higher education also plays an important role in the other goals, including climate change (SDG13), which includes the target to "improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning" (UNESCO, 2015[114]).

As part of the United Nations Economic Commission for Europe (UNECE), the participating jurisdictions all promote Education for Sustainable Development (ESD) in the region through network platforms. Through these networks, higher education institutions have identified common goals and shared sustainability practices and

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Box 7.9. The Civic University

The notion of the "Civic University" recognises that the process of engagement itself has value; it is not just a means to an end, but is also an end in itself (Ehrlich, 2000[108]; Goddard et al., 2016[3]; OECD, 2007[5]). Civic universities view themselves as anchor institutions in their communities, i.e. institutions of higher learning that also cultivate their roles as centres for culture and the arts, public service and continuing education. When engagement is embedded as a core function of the institution, it facilitates greater responsiveness to societal needs through education and research.

Growing interest in pluralistic forms of evidence and participatory research in higher education has also facilitated more inclusive approaches to solving society's intractable problems (Benneworth, 2013[96]; Inman and Schuetze, 2010[109]). Service learning, for instance, is a pedagogical approach that incorporates community engagement as part of the curriculum. Using the community as a classroom or research laboratory provides a richer learning environment for students and opens up opportunities for collaborative research with community partners (Ehrlich, 2000[108]; Inman and Schuetze, 2010[109]). This also encourages the development of competences, values and attitudes that promote civic participation, social inclusion, sustainability thinking and global citizenship (Grau et al., 2017[110]).

Higher education and cultural engagement

Culture acts as an agent of development by enhancing quality of life, attracting and retaining social creativity (e.g. through arts and music), and enhancing enterprise formation, productivity and employment (OECD, 2007[5]). Higher education institutions can facilitate public cultural engagement by making their cultural infrastructure available to the public, such as libraries, auditoriums, orchestra, sports and media facilities as well as galleries and museums (since many are owners or custodians of cultural assets). They can add to the body of knowledge by producing culturally based research, and contributing to capacity building in cultural groups. Moreover, higher education institutions can be culture champions and provide policy advice as well as services to culturally enrich communities (OECD, 2007[5]).

In Estonia, the preservation of culture has been embedded in legislation. It is part of the mission of universities to support initiatives that aim to preserve, develop and promote the national culture through institutional co-operation and social engagement in the production of research and creative work (Estonian Parliament, 1995[39]). Some of the activities provided by higher education institutions open to both students and the public include: access to library services, museums, botanical gardens, sport facilities and leagues. In addition, higher education institutions offer various events to students and the public, such as open lectures, concerts, student festivals (e.g. the regional (Estonia, Latvia and Lithuania) student singing and dance festivals called Gaudeamus have taken place every four years since 1956). Furthermore, Estonia's Research Development and Innovation Strategy 2014-2020 plans to create favourable conditions for culture and the sustainable development of Estonia.

The Norwegian Ministry of Culture, with the co-operation of other ministries, is responsible for the overall framework of cultural policy in the country. The responsibilities of the Ministry of Culture are broad and include the policy areas of art, culture, copyright, church, the media, sport and the voluntary sector. More specifically, the Norwegian Federation of Arts in Education (*Fellesrådet for kunstfag i skolen*) aims to enhance art subjects in all levels of education, including higher education. The Federation

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Box 7.8. The Carnegie Community Engagement Assessment Pilot in Ireland

The Carnegie Classification™ has been the leading framework for recognising and describing higher education institutions in the United States for over 40 years.

The Carnegie Foundation's Classification for Community Engagement is a voluntary classification that was developed in 2006 by the Carnegie Foundation for the Advancement of Teaching to determine whether an institution qualifies for recognition as a community engaged institution.

Community engagement is defined as:

Community engagement describes collaboration between institutions of higher education and their larger communities (local, regional/state, national, global) for the mutually beneficial exchange of knowledge and resources in a context of partnership and reciprocity.

The purpose of community engagement is the partnership of college and university knowledge and resources with those of the public and private sectors to enrich scholarship, research, and creative activity; enhance curriculum, teaching and learning; prepare educated, engaged citizens; strengthen democratic values and civic responsibility; address critical societal issues; and contribute to the public good (Brown University, 2018[103]).

The classification involves data collection and documentation of institutional practice to be used in a process of self-assessment and quality improvement. The documentation is reviewed by a National Review Panel. The application process for the Elective Community Engagement Classification takes place on a five-year cycle and is currently administered by the Swearer Center at Brown University (Brown University, 2018[104]).

There is currently an international pilot underway to apply the community engagement classification framework outside of the United States for the first time. A pilot was conducted with 12 higher education institutions in Ireland to measure community and civic engagement. The pilot project is largely focused on research to assess the feasibility of a national measurement tool that could be created and adopted to allow higher education institutions in Ireland to measure community and civic engagement (Carnegie Community Engagement Assessment Framework Ireland, 2019[105]).

Higher education is associated with other forms of civic engagement. For example, individuals with higher education report that they participate more frequently in formal and informal volunteering than those with lower levels of education (OECD, 2015[106]). On average across OECD countries with available data, the proportion of adults reporting that they participate in volunteer activities is 10% higher for those with higher education compared to those below upper secondary education. Particularly large differences are observed in the United States, where the difference amounted to 26 percentage points in 2012. This difference represented 7-8% in Estonia and the Netherlands and 10% in Flanders and Norway (OECD, 2014[107]).

The notion of the "Civic University", as defined in Table 7.1, embraces a broad, civic role for higher education institutions and sees active engagement as an important feature of both education and research activities (Box 7.9).

outlined in the White Paper on Quality Culture in Higher Education (Norwegian Ministry of Education and Research, 2016[100]).

Some initiatives have taken a step further, aiming to measure community and civic engagement. For instance, the EU-funded project, Towards a European Framework for Community Engagement of Higher Education (TEFCE), aims to develop tools to assess the community engagement of universities in Europe. The project aligns with the EU's Renewed Agenda for Modernisation of Higher Education, which prioritises building inclusive and connected higher education systems (European Commission, 2017[101]). The project will last from 2018 to 2020 and will include leading researchers, universities, local authorities and university networks from seven EU member states. The main aim of the project is to better prepare higher education institutions in their engagement efforts in order to address pressing social issues (NESET II, 2018[102]).

Other tools have also been developed to measure community and civic engagement, For example, the Carnegie Foundation has initiated a pilot project in Ireland to implement the Classification for Community Engagement in twelve higher education institutions in the country (Box 7.8).

As policies and legal frameworks are developed to encourage greater openness in science, it will be important to also develop internationally comparable indicators to measure progress across the OECD.

7.4.3. *Creating a greater role for higher education in civic and cultural engagement*

In recent decades, higher education institutions have become increasingly entrepreneurial in many countries, with the development of on-campus business incubators, technology accelerators, science parks, and spin-offs. This has been accompanied by increased policy interest in the economic outputs of commercial activity. However, there has been some criticism that the emphasis on commercialisation and business engagement has overshadowed civic engagement (Benneworth, 2013[96]; Hazelkorn and Gibson, 2017[97]). Similarly, there have been suggestions that the emphasis on "technology transfer" implies a one-way relationship between higher education and society, favouring technological contributions to innovation and neglecting the role of the arts, humanities and social sciences (Kempton et al., 2013[98]). This has been accompanied by growing calls for greater social and public accountability in higher education (Hazelkorn and Gibson, 2017[97]).

As a result, more demand and citizen-driven approaches to innovation, regional engagement and "third mission" activities have arisen in recent years, with the objective of re-orienting higher education towards social challenges and concerns (Benneworth, 2017[1]; Pinheiro, Langa and Pausits, 2015[99]). Civic and social engagement plays an important role in the overarching mission for higher education (i.e. the legislative framework or other national policy) in all participating jurisdictions and in their funding programmes. Civic and social engagement is also included as part of the organising legislation for higher education systems in many countries, for example Estonia and Norway.

In Estonia, the concept of civic engagement is embedded in the legislation, which states objectives and learning outcomes to be achieved at the higher education level (Estonian Parliament, 1995[39]). Student engagement normally takes place through representation on relevant decision-making bodies within higher education institutions. Institutional civic engagement is also fostered through set expectations that are incorporated in the curricula. For example, in order to be awarded a bachelor's degree, a student is expected to be able to evaluate the role of discipline-specific knowledge and the consequences of his or her professional activities in society; a similar approach applies to the awarding of a master's and a doctorate degree.

In Norway, students can demonstrate their civic engagement through representation on the relevant decision-making bodies in higher education institutions. Under the Universities and University Colleges Act 2005, students have the right to organise and they must be consulted on all matters that concern them. Students are also given the opportunity to engage in public debates through student organisations at the local, institutional and national levels (Government of Norway, 2010[68]); this approach is supported through legislation and funding for student organisations.

Norwegian higher education institutions also play an important role in promoting democratic values in society. The Universities and University Colleges Act 2005 states that all higher education institutions should facilitate the participation of its staff and students in public debate (Government of Norway, 2010[68]). The responsibility of higher education institutions to participate in public debate and set the social agenda is also

Figure 7.5. Open access of scientific documents (2016)

As a percentage of a random sample of 100 000 documents published in 2016
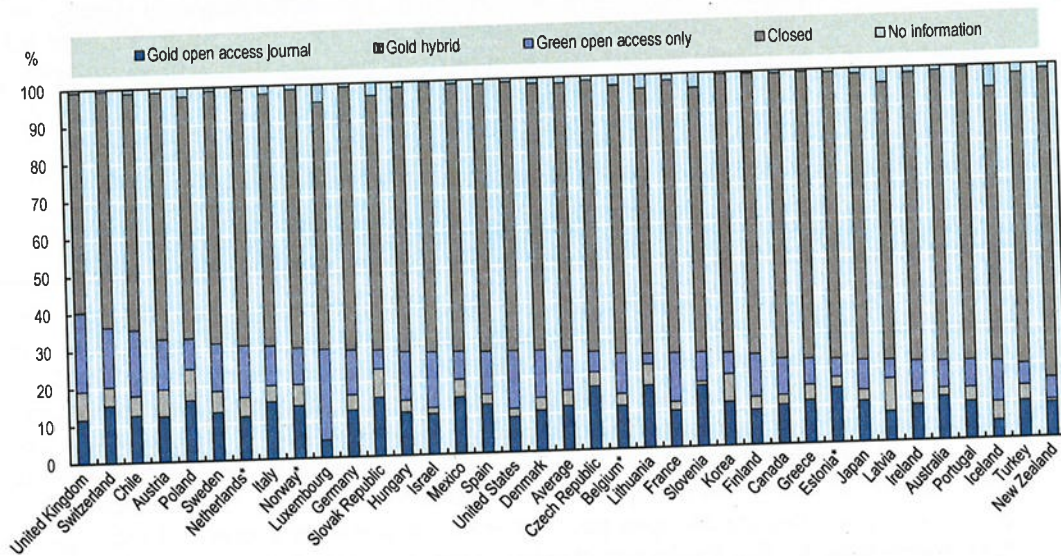
Note: *Participating in the Benchmarking Higher Education System Performance exercise 2017/2018. OECD calculations based on Scopus Custom Data, Elsevier, Version 4.2017; and roadoi "wrapper" routine for the oaDOI API.

Source: Adapted from OECD (2017[48]), OECD Science, Technology and Industry Scoreboard 2017: The digital transformation, http://dx.doi.org/10.1787/9789264268821-en.

StatLink ⟨⟩ http://dx.doi.org/10.1787/888933941861

The National Research Council (NWO) in the Netherlands requires immediate open access publishing of publicly funded research and has additional requirements on data management. In 2017, the Netherlands published its National Plan Open Science. A coalition of stakeholders[4] is working together in the National Platform Open Science to realise the ambition of 100% open access to their publications by 2020, the optimal re-use of research data and the inclusion of open science in the evaluation and assessment of researchers. The guiding principle to the National Plan Open Science is open when possible and closed when necessary. The government expects open access and open science to become the norm in scientific research. The Association of Universities in the Netherlands (VSNU) negotiates with scientific publishers on behalf of universities; and new contracts with open access opportunities have been concluded with several scientific publishers (e.g. allowing researchers to choose the open access option for journal publications at no costs).

The Research Council of Norway (RCN) has a policy on open access that requires grant beneficiaries to make their publicly funded scientific publications available in open access repositories. RCN has a dedicated funding scheme to support open access publishing (2015-2019). However, targeted financial support for open access publishing will be cut from RCN by 2019 when publishing costs are to be included in the indirect costs in applications (European Commission; OECD, 2018[95]).

> **Box 7.7. Who "owns" knowledge?**
>
> "Knowledge is a commons because it is non-excludable; with sufficient mental capacity, no person can be excluded from acquiring it, [...however], its expression is not. When ideas are expressed in tangible form — as books and musical compositions — those forms can be made excludable and commodified. In order to incentivize authors and musicians to continue to write and compose, governments grant limited monopolies to knowledge creators in the form of intellectual property rights. IP, and specifically copyright, is the legal mechanism that allows creators to exclude others from accessing the book or composition, and ultimately charge a fee for their work. IP transforms common resources into commodities" (Bernstein-Sierra, 2017[94]).

The 2017 OECD Science Technology and Innovation Scoreboard provides an assessment of open access of scientific documents based on an analysis of the levels of access provided by a random sample of 100 000 citable documents published in 2016 (Figure 7.5). The review has four labels: gold open access, gold hybrid, green open access and closed. Gold open access refers to documents associated with publishers who make their content available at no charge to readers. Gold hybrid refers to documents accessible from a publisher that typically require a subscription for general access, but allows open access to specific documents upon payment from the author or sponsors. Lastly, green open access indicates that the document exists in repositories and does not match either of the other gold options (OECD, 2017[48]).

Overall, the main model remains by far one of closed access (Figure 7.5). On average in 2016, around 4% of authors appeared to be paying a fee to make their papers publicly available within traditional subscription journals (gold hybrid). Among the different open access channels, publishing in gold open access journals was the most common option for authors in Estonia, Norway and Belgium. In the Netherlands, the green open access model was the most commonly used among open access journals.

All participating jurisdictions have policies to encourage further open access. In the Flemish Community, as part of the Work, Economy, Science and Innovation 2014-2019 strategy, Flemish universities are encouraged to develop a consistent open access and data policy.

Commission, 2017[91]). The EU framework on open access to and preservation of scientific information aims to provide researchers, business, and citizens with free, online access to EU-funded research results, optimising the impact of publicly funded research at the European level. The main objectives are to enhance quality, reduce duplication, speed up scientific progress, help to curtail scientific fraud, and contribute to economic growth and innovation (European Commission, 2018[92]). The European Commission supports two publishing categories: the self-archiving 'green open access' and the 'gold open access' publishing. 'Green open access' means that the published article or peer-reviewed manuscript is archived by the researcher (or representative) in an online repository – with access often being delayed, as publishers may wish to recover their investment by selling subscriptions and charging pay-per-download fees. In the case of 'gold open access publishing,' the article is provided in open access immediately by the scientific publisher (with costs borne by the research institute or funding agency supporting the research) (European Commission, 2017[91]).

Horizon 2020 Regulations and Rules of Participation for open access to peer reviewed scientific publications are implemented through provisions in the grant agreement. Beneficiaries must submit a scanned copy of the final version of their peer-reviewed manuscript accepted for publication in a repository for scientific publications and ensure open access either through open access publishing (open access journals or journals that sell subscriptions and offer the option of making certain articles open (hybrid journals)) or through self-archiving in a repository of their choice ('green open access,' available within six months of publication). Publication costs incurred during the grant agreement period are eligible for reimbursement, and a mechanism will be piloted to address costs incurred after the end of the grant agreement. Open access also covers bibliographic metadata and underlying data (data underpinning the publication), although without obligation (European Commission, 2017[91]) Sustainable funding for the preservation of scientific research is important, as curation costs for digitised content are still high (European Commission, 2018[92]).

In addition, the framework also includes the Open Research Data Pilot, which is an initiative that aims to maximise access to and re-use of data generated by projects. The foci include future and emerging technologies; research infrastructures; leadership in enabling and industrial technologies; societal challenge (clean energy, climate action and inclusive innovative societies); as well as science with and for society (European Commission, 2017[91]).

Finland has been referred to as a case study for adopting open innovation platforms (OIPs) as a policy tool (Cervantes, 2017[12]). OIPs have been adopted in many cities and are being used as collaboration models by higher education institutions to fulfil their third mission (Raunio, Räsänen and Kautonen, 2016[93]).

Some of the shortcomings involved in adopting open access and open science movements are related to the way incentives are organised, as the tenure structure within higher education institutions and the ownership of scholarly communication systems deter academics from wanting to publish in open access journals (Bernstein-Sierra, 2017[94]). The tenure structure perpetuates the property regime, as there is an expectation of work dissemination through prestigious and traditional journals (Box 7.7). These journals are often owned by large corporate publishers and have a more restricted access channel.

or investigate an issue of public interest or concern, including societal challenges" (Irish Universities Association; Irish Research Council, 2017[86]). CampusEngage has championed the use of a wide range of indicators to measure community engagement in higher education, which includes collaborative research methods.

The Research Councils UK (RCUK) have also developed incentives for research engagement through activities that foster national coordination and impact. The National Co-ordinating Centre for Public Engagement works with key national partners to draw participation from the public in the knowledge creation process (University of Bristol; University of West England, 2018[87]). Impact is measured as academic, economic and social; for example, as a condition for funding, researchers must use the Pathways to Impact statement as a component of their research projects in grant applications to the government (UK Research and Innovation, 2018[88]). The Pathways to Impact statements require grant applicants to be project-specific and focus on potential outcomes. In addition, the RCUK Catalysts Seed Fund (CSF) functions as a source of flexible funding for higher education institutions, so that they can create and improve models for embedding public engagement in research at the institutional level (UK Research and Innovation, 2018[89]). In the 2015/2016 round of the CSF programme, 10 higher education institutions received GBP 65 000 each for 12 months.

7.4.2. Expanding open access and open science movements

Access to academic research is often only available for a fee, which can be expensive, limiting its availability to practitioners, stakeholders and the general public. Issues of intellectual property rights and ownership are complex, but movements for open access and open science are gaining traction. "Open science" refers to unrestricted access to publicly funded research results, and requires the ability of scientific systems to exchange and make use of research results and data. OECD member and non-member countries are increasingly developing legal and policy frameworks, guidelines and initiatives to encourage greater openness in science, with several countries implementing strategic approaches (OECD, 2015[90]).

Open science also enables the increased engagement of citizens in scientific progress and innovation. It has the potential to provide multiple benefits, including:

- **Improving efficiency in science.** Open science could increase research productivity by: 1) reducing research duplication and the re-creation of data; 2) allowing a more accurate verification of research results; 3) enabling more research to be conducted based on the same data; and 4) multiplying opportunities for domestic and global participation in research.
- **Generating knowledge spill-overs.** Increased access to research results could spur knowledge spill-overs, innovation and efficiencies across the economy and society.
- **Helping to address global challenges.** Addressing global challenges requires access to and sharing of reliable data from many countries. The international Human Genome Project is an example of a large-scale research endeavour in which an openly accessible data repository has been used successfully by researchers all over the world, for different purposes in different contexts. Furthermore, for scientists in developing countries, greater access to international science and data can help meet social and economic goals (OECD, 2015[90]).

Open access is defined by the European Commission as "the practice of providing online access to scientific information that is free of charge to the end-user" (European

Flanders and Norway have recently incorporated the concept of RRI into their research and innovation strategies. Flanders accounts for the major part of total Belgian participation, as well as the largest share of grants secured through Horizon 2020 in the country (and about 3% of the total Horizon 2020 funding across Europe). It performs particularly well in projects relating to governance for the advancement of RRI (Flemish Department of Economy, Science and Innovation, 2017[78]). Estonia's national Research, Development and Innovation strategy also makes commitments to further align R&D with the interests of the Estonian society and economy (Estonian Ministry of Education and Research, 2014[54]).

RRI is a strategic priority in Norway under the *IKT og digital innovasjon* (IKTPLUSS) programme. IKTPLUSS was created by the Research Council of Norway and is a large-scale initiative on information technology and digital innovation. By contributing to ICT solutions through the production of knowledge and technology, the programme aims to enhance productivity and efficiency, and address key societal challenges. Applicants must include RRI perspectives in their applications and demonstrate a commitment to engagement (The Research Council of Norway, 2018[79]).

Engaging citizens in the research process

Engaged research is a term that emphasises the use of collaborative research methods and the scholarship of engagement.[3] It often appears in the form of community-based research, participatory action research and service learning. Participatory action research is a methodology in social sciences that helps build bridges between academics, local communities, and government agencies by developing a public sphere for creating knowledge (McTaggart, 1997[80]). Service learning represents a combination of experiential learning and community involvement used in schools and higher education institutions; it is also referred to as involved learning (Roza, Lonneke; Meijs, 2014[81]) and community service (Haski-Leventhal et al., 2010[82]).

In the Flemish Community, examples of research projects with a direct impact on the environment and on the community include *Curieuzeneuzen*, a collaboration project to engage citizens in scientific research and the Participatory Platform for Sustainable Energy Management (PARENT), which promotes the reduction of household energy consumption in the local community.

The Netherlands has a long history with engaged research that dates back to the 1970s, with the development of "Science Shops." Science Shops are small entities that carry out scientific research in a wide range of disciplines at the request of citizens and local civil society, usually free of charge. By the 1980s, Science Shops had been established at all Dutch universities as bureaus of the institution, serving many scientific disciplines (The International Science Shop Network, 2018[83]). These developments aimed to strengthen community-university research partnerships. The Science Shops model has been the recipient of EU funding (FP7) to scale public engagement in research and has been cited as a good practice (Mulder, Henk; Straver, 2015[84]; Wageningen University, 2014[85]). The Netherlands also defined its National Research Agenda (NWA) through a bottom-up process with researchers, the private sector, NGOs, citizens and other stakeholders (see Chapter 6).

Other jurisdictions also provide examples of recent programmes which aim to improve engagement. CampusEngage in Ireland is a programme that defines engaged research as "a wide range of rigorous research approaches and methodologies that share a common interest in collaborative engagement with the community and aim to improve, understand

In the Netherlands, the government has tested indicators for valorisation in the performance agreements that were in place during the period 2012-2016 (Box 7.5). The government recently invited higher education institutions to develop their own set of valorisation indicators, allowing for more transparency on valorisation activities and results.

The Australian Research Council undertook an Engagement and Impact Assessment Pilot in 2017 (Australian Research Council, 2017[75]). The pilot and methodologies were evaluated to develop a full assessment which incorporates feedback from universities, industry and end-user participants. The full assessment was launched in 2018. Impact will be assessed through qualitative studies that show the direct social, economic, environmental and cultural impact of university research. It will also show what universities are doing to facilitate the delivery of these impacts (Box 7.6).

Box 7.6. Engagement and Impact Assessment in Australia

As part of the National Innovation and Science Agenda, the Australian government is developing a framework for assessing how universities are translating their research into economic, social and other benefits, and incentivising greater collaboration between universities, industry and other end-users of research. A pilot was undertaken in 2017 providing a basis for a national rollout in 2018. The national assessment will be undertaken as a companion to Excellence in Research for Australia.

The objectives of the Engagement and Impact Assessment are to:

- clarify to the government and the Australian public how public expenditure in university research translates to benefits beyond academia
- identify institutional processes and infrastructure that enable research engagement
- identify how institutions currently translate research into impact
- increase support for the translation of research impact within institutions for the benefit of Australia beyond academia.

In the 2018 Engagement and Impact Assessment, universities are assessed in each discipline using qualitative statements, a small number of quantitative indicators for engagement and a narrative-based study for impact. The assessment panels are organised according to broadly cognate disciplines and are comprised of academic researchers and research end-users.

Source: Australian Research Council (2017[75]), *Engagement and Impact Assessment*, www.arc.gov.au/engagement-and-impact-assessment.

The United Kingdom is developing a Knowledge Exchange Framework (KEF) to measure university-business collaboration and knowledge exchange, building on data from the Higher Education Business and Community Interaction Survey and other sources. The two key assessment criteria of the KEF are metrics and good practice (e.g. in the processes of capitalising on university intellectual property through spin out companies or licensing) (HEFCE, 2017[76]).

Supranational initiatives are also promoting a greater focus on improving the societal impact of research. For example, Responsible Research and Innovation (RRI) is a concept in the European Commission's Horizon 2020 Framework Programme for Research and Innovation (see Table 7.1 for the definition of RRI). In Horizon 2020, RRI focuses on six priority areas: engagement, gender equality, science education, open access, ethics and governance. The European Commission promotes RRI through its Science with and for Society programme, focusing on these priority areas (European Commission, 2019[77]).

competitive products, services, processes and entrepreneurial activity" (Nederland Ondernemend Innovatieland, 2009[73]) (Box 7.5).

Box 7.5. Valorisation Programme and Centres of Expertise in the Netherlands

The Ministry of Education, Culture and Science and the Ministry of Economic Affairs in the Netherlands both consider valorisation to be an important issue and have contributed to the development of a broad conceptualization of the term, which serves as a basis for several policy initiatives.

In 2010, the Valorisation Programme was initiated with co-operation from both ministries, with the aim of professionalising the knowledge transfer process. A budget of EUR 63 million was allocated for the period 2010-2018 to finance several regional consortia centred on one or more higher education institutions. The programme provides funding for 13 large-scale regional innovation projects to professionalise knowledge transfer (VSNU, NWO and KNAW, 2014[74]).

The consortia bring together companies, knowledge and research institutes, civil society organisations and local and regional governments. The programme provides 50% co-funding for valorisation plans (maximum EUR 5 million), on the condition that the plans are carried out by a public-private consortium. Funds support entrepreneurial education, the screening and scouting of knowledge transfer opportunities, intellectual property applications, pre-seed funding, proof-of-concept funding, network creation and other activities that contribute to knowledge transfer. The objective is that the consortia continue their activities beyond the period during which they receive government funding.

The Centres of Expertise (CoEs) are a new form of co-operation between professional HEIs, industry and government. CoEs develop and deliver knowledge services based on public-private partnerships and in co-operation with regional partners. The CoEs focus not only on applied research, but also on improving education through involving students in practice-oriented research projects. As part of the performance agreements with professional HEIs, 1% of the core grant was set aside for competitively awarding grants of EUR 1 million per year for the creation of 17 CoEs in 2012 and 2013. So far, 25 CoEs have been established, some without a dedicated government subsidy.

Higher education institutions in the Netherlands have agreed to work on making valorisation more transparent, through reporting on entrepreneurship education and the other activities aimed at valorisation. Over the years, potential indicators for monitoring valorisation activity have been proposed, and some institutions have agreed to use some of these in their performance agreements, along with qualitative statements. So far, there is no universal set of valorisation indicators used for all Dutch higher education institutions.

Additionally, the societal relevance of academic research is assessed in the peer reviews that take place every six years and assess the universities' research quality on the basis of the Standard Evaluation Protocol (SEP). The evaluation looks at the economic, social and cultural contribution of research through indicators such as contract research, advisory reports for policy makers or contributions to public debate.

Social impact is much more difficult to assess than scientific impact, because it manifests in different ways and may take many years to become evident. In addition, it may be difficult to assess a potentially wide-ranging impact on different groups of stakeholders. Nonetheless, there is increased pressure to demonstrate the social relevance and impact of academic research, which has led to efforts to create indicators for social impact and include these in performance assessments of research. As a result, many OECD countries have developed or are developing indicators to measure engagement activity in research and innovation.

initiatives. A new performance indicator was introduced in 2017, which is based on third-party public and private funding (separate from Research Council and regional research funding). The newly introduced performance agreements also include indicators for entrepreneurship and innovation for some institutions.

7.4. Engagement for wider development

In previous reviews of the engagement activity of higher education systems, the OECD noted that the softer and longer-term community engagement activities in higher education were relatively under-developed, partly due to problems of measurement and the absence of incentives in policy frameworks (OECD, 2007[5]). This remains a challenge, particularly at national and international levels, even though substantial efforts have been made in many jurisdictions to open up multiple channels of engagement in higher education.

Engagement for wider development, in addition to the role that higher education systems play in developing and serving their surrounding regional area, can include efforts to foster mutually beneficial relationships with wider civil society, activity that contributes to a richer cultural environment and activity that promotes greater environmental awareness and contributes to achieving broader social goals on sustainability.

7.4.1. Increasing the social relevance and impact of research

In addition to the more typical individual economic benefits, such as employment, earnings, and income generated from intellectual property as a result of research, the knowledge produced through higher education is considered to be a public good which provides benefits to wider population (Tilak, 2008[69]). For example, higher education contributes to general innovation capacity, the production of evidence, and the formation and reproduction of knowledge and social relations through which knowledge is shared. Higher education also produces individual goods which have collective benefits, such as social and scientific literacy, effective citizenship and economic competence (Marginson, 2014[70]).

Through the lens of higher education as a public good, the social relevance and impact of research can be defined in different ways, depending on the national priorities of each country and on the context within which R&D systems operate.

- The Research Excellence Framework (REF) in the United Kingdom includes an assessment of both the quality of scientific contribution as well as social contribution and defines impact as: "an effect on, change or benefit to the economy, society, culture, public policy or services, health, the environment or quality of life, beyond academia" (HEFCE, 2016, p. 4[71]).
- The National Science Foundation (NSF) in the United States applies the concept of "broader impact" as a key condition in the impact review of project proposals. The concept is comprised of five core long-term outcomes, including broadening participation of under-represented groups, broadening dissemination of scientific and technological understanding, and providing benefits to society (National Science Foundation, 2018[72]).
- The Valorisation Programme in the Netherlands defines valorisation as "the process of creating value from knowledge by making knowledge suitable and/or available for economic and/or societal use and translating that knowledge into

is a competitive support scheme that was created to improve collaboration and knowledge exchange between professional HEIs and SMEs.

In addition, a series of reforms have been implemented in Dutch professional HEIs to strengthen their role in regional research and innovation networks. The position of "lector," which is a form of associate professorship, was introduced in 2001 to bring research expertise into the subsector. Around the same time, so-called Knowledge Circles were created (comprised of lectors, other academics working in professional HEIs and local stakeholders) to work on research activities of common interest, with a regional focus based on the location of the institution. The research involves students and is expected to be incorporated in the curricula of the professional HEIs. More recently, the Netherlands has introduced Centres of Expertise in professional HEIs to further enhance co-operation between institutions, government, industry and other social partners (Box 7.5).

In 2007, **Norway** established a ten-year funding programme for regional R&D and innovation (*Virkemidler for regional FoU og innovasjon*) through the Research Council. The funding programme aimed to promote greater regional collaboration between trade and industry, R&D institutions and government authorities. It also contributed to the establishment of closer ties with other national and global networks and innovation initiatives, such as the Arena programme, Norwegian Centres of Expertise and the Regions of Knowledge initiative.

In addition, Regional Research Funds were established in 2010 in Norway in order to promote R&D for regional innovation and development. Higher education institutions, public research institutes, local industry and other organisations can apply for funding from one of the seven major regional funds, depending on geographic location. The aim is to support the region's competitive strengths in R&D (OECD, 2017[66]).

The Norwegian Innovation Clusters programme was launched in June 2014, building on existing innovation structures (19 Arena Clusters, 14 Centres of Expertise and 3 Global Centres of Expertise), adding new levels, modules and elements to further develop existing and potential new cluster initiatives (Norwegian Innovation Clusters, 2019[67]). In addition, the FORNY2020 funding programme of the Research Council supports the commercialisation of R&D results and helps bring products and services to the market.

The Norwegian Act on higher education was also amended in 2003 to transfer the right to commercial exploitation of research results from individuals to institutions (Government of Norway, 2010[68]). This gave Norwegian higher education institutions institutional ownership, in certain circumstances, to patentable inventions. It also elevated the importance of entrepreneurship and led to the establishment of Technology Transfer Offices (TTOs), which contribute to the commercialisation of research findings (Norwegian Ministry of Education and Research, Norwegian Ministry of Local Government and Regional Development and Norwegian Ministry of Trade and Industry, 2014[27]). Technology Transfer Offices are also located in all regions of Norway, and are supported through a grant programme managed by the Research Council, jointly funded by the Ministry of Education and Research and the Ministry of Trade and Industry.

As part of the performance-based component of funding for Norwegian higher education institutions, additional funding is awarded based on reported income from regional research grants and grants from the Research Council. In 2017, roughly EUR 31.5 million was granted to higher education institutions on this basis. Institutions can also receive additional funding if they receive grants from the European interregional co-operation

universities, local government and SMEs. For universities, this involves gaining a better understanding of regional issues through the acquisition of specialist knowledge and through problem-based learning using the region for field work (Japanese Ministry of Education, Culture, Sports, Science and Technology, 2016[61]).

The role of higher education in place-based innovation systems

Place matters for innovation; the importance of geography in interactions which promote innovation is well-documented in studies of clusters, agglomeration economies and knowledge spill-overs (Cervantes, 2017[12]; OECD, 2013[62]). Different measures of the benefits of innovation activities find that the strongest interactions take place within a radius of approximately 200 kilometres (OECD, 2013[62]). This cluster of interactions at the local level with "a group of local actors and dynamic processes, which together produce solutions to different challenges" creates place-based innovation eco-systems (Rissola et al., 2017[63]; Senior, Hautamäki and Oksanen, 2014, p. 4[64]). In place-based innovation systems, the policy focus is on local and regional eco-systems that can generate growth by applying a multi-sector, whole-of-government approach and aligning objectives across multiple levels of the government through a networked governance model.

The importance of location within innovation systems is now reflected in initiatives such as the European Commission's Cohesion Policy, which aims to reduce differences between regions and to ensure growth across Europe. The European Structural Investment Funds are among its main tools - the implementation of Research and Innovation Strategy for Smart Specialisation (RIS3) is an ex-ante condition for the application of the funds. Smart specialisation strategies can form part of a national or regional research and innovation strategic policy framework in order to address emerging opportunities and market developments in a coherent manner and avoid the duplication and fragmentation of efforts (European Commission, 2014[65]). This draws on the understanding that local, regional and national interests must be harmonised, and that implementation of the RIS3 should be monitored to ensure inclusive participation and the cohesive use of the funds.

The Netherlands aims to foster a place-based innovation system that reflects its strengths and streamlines efforts to priority areas for growth. The main source of regional funding for research comes from the European Structural Investment Funds. The funds are tied to five smart specialisation priority areas (manufacturing and industry; sustainable innovation; human health and social work activities; services; and energy production and distribution) corresponding to selected geographic areas in the country. The smart specialisation strategies are drawn up and implemented by Programme Monitoring Committees, which represent the provinces in these geographic areas.

To strengthen its regional approach, the Netherlands has also supported the creation of various regional platforms. For example, several regions, including Amsterdam, Rotterdam, Utrecht, Eindhoven, Gronigen and Twente, have established Economic Boards (i.e. platforms including regional stakeholders) to stimulate innovation activities in the region. Board members include education providers, business sector organisations and representatives of the local government.

The Netherlands also recognises the important role of SMEs in building innovative and entrepreneurial eco-systems. The Regional Attention and Action for Knowledge Circulation programme (RAAK) provides project-based financial support for professional HEIs that engage in collaborative research with external partners. The RAAK programme

Box 7.4. The City Deals on Education in the Netherlands

The City Deals on Education (*Kennis Maken*) was introduced in 2017, with support from the Ministry of Education, Culture and Science, with the aim of finding solutions for social challenges in cities through the large-scale involvement of researchers, lecturers and students. Not only does this strengthen the problem-solving capacity of the city, but it also contributes to the training of students who will contribute to shaping society – and gives them a better understanding of social issues. Using society as a learning environment for students is an important theme in the Strategic Agenda for Higher Education and Research 2015-25.

The idea is that students formulate the relevant research questions together with researchers and partners in the field (businesses, government, social institutions, citizens' initiatives, etc.), carry out further research on urban problems and evaluate whether or not assumed problem-solving approaches are effective. This can take different forms, such as community service, knowledge workshops, field laboratories and student housing in the learning environment itself. Collaboration takes place in multi-disciplinary and multi-level teams, and within the framework of "triple helix" and "quadruple helix" partnerships.

Currently, universities in 11 major Dutch cities (including all professional HEIs) are participating in the initiative. Six additional cities will join the initiative in 2019.

In 2016, the OECD, in partnership with the Ford Foundation, launched the Inclusive Growth in Cities initiative, which invites mayors from around the world, as well as leaders from business, philanthropic organisations, associations of cities, think-tanks and international institutions to identify and promote the role of cities in addressing rising inequalities. Currently, there are 50 mayors working on a common agenda with four policy pillars to promote inclusive growth in cities. These pillars refer to an inclusive education system, labour market, housing market and urban environment, and infrastructure and public services. Activities vary from city to city; however, they have previously included increasing access for disadvantaged groups to education, including higher education (OECD, 2016[59]).

UNESCO has also developed initiatives that encourage higher education engagement in territorial development, such as the Learning City Award and the Global Network of Learning Cities (GNLC). The Learning City Award was launched in 2013 and recognises cities that are playing an active role in the development of education. Key features of the initiative include promoting inclusive learning from basic to higher education and fostering a culture of learning throughout life (UNESCO Institute for Lifelong Learning, 2018[60]). The UNESCO GNLC serves as a platform for sharing best policy practices of lifelong learning. The network is currently composed of more than 200 member cities worldwide.

Non-urban regions, including rural regions close to cities as well as remote rural regions, contribute to national prosperity in many ways (OECD, 2016[57]) and higher education systems in many countries aim to play a role in promoting the prosperity of their local region. In Japan, a Programme for Promoting Regional Revitalisation by Universities as Centres of Community (COC+) has been implemented. The Japanese Ministry of Education, Culture, Sports, Science and Technology (MEXT) allocated approximately EUR 36 million in 2015 to fund the COC+ programme. MEXT assigns COC+ coordinators, manages the progress of projects, and facilitates linkages between regions participating in the project. The COC+ programme aims to improve the employability of graduates in the local region and spur local job creation through collaboration between

number of top-level scientific publications per million population to reach 1600 by 2020 (Estonian Ministry of Education and Research, 2014[54]).

In the case of the Flemish Community, the number of publications and citations is one of the parameters that dictates the allocation of funds derived from the Special Research Fund.

In the Netherlands, higher education institutions are able to include both quantitative and qualitative components in performance-based funding. For the more quantitative approach, indicators such as the number of co-publications with industry are used.

In Norway, result-based funding has been in place since 2002 and accounts for approximately 30% of the block grant. Publication points[2] is a close-end budget indicator of the results-based funding for higher education, which allocates a set amount of funding and requires competition among institutions (as opposed to indicators that have an open-end budget and are not subject to a fixed pool of funds).

Examples of factors that may inhibit the share of multiple-affiliation university-industry co-publications (i.e. with at least one author listing a university address and a company address as a percentage of the total university-industry co-publications output) include: research mobility patterns; institutional policies on academic appointments; and national regulations that either endorse or prohibit multiple appointments (Tijssen, Yegros-Yegros and Winnink, 2016[55]).

As seen in this section, some OECD countries have developed (or are at the early stages of developing) indicators to measure the social impact of engagement activity in research. Such developments have the potential to eventually evolve into comparable indicators across OECD countries.

7.3.2. Higher education as a driver for local and regional innovation

Higher education institutions have an important impact on their local environments. The effects of institutions in urban or regional areas can be political, demographic, economic, infrastructural, cultural, educational and social (Peer and Penker, 2014[56]). They can directly contribute to the economy and help increase productivity (OECD, 2016[57]). They can also have an indirect impacts on human capital, the pool of knowledge and the attractiveness of a local area (OECD, 2007[5]).

The majority of OECD residents live in urban areas; and urbanisation rates are set to rise from low double-digit rates to more than 80% by the end of the century. Projections of population growth indicate that many cities will undergo a heavy urbanisation process in the coming years. By 2050, 70% of the world's population will live in cities (and more than 60% of the cities that will exist in 2050 have yet to be built) (KPMG, 2017[58]). Higher education can play a role in developing solutions to challenges posed by increasing urbanisation. For example, as part of the Urban Agenda, the Dutch government, with the participation of knowledge institutions and the business sector, initiated the "City Deals on Education" to enhance the capacity for growth and innovation, as well as the quality of life in cities (Box 7.4).

economic benefits grew, and annual evaluations were performed, assessing the nature and scale of the engagement between universities and industry/society through the Higher Education-Business and Community Interaction Survey (HEFCE, 2015[51]). Using econometrics to measure the extent to which a particular policy instrument used affected the pattern and direction of interaction between 2006-2014, expert assessments of attribution of knowledge exchange income to funding suggested that each £1 of the fund supported £6.4 of knowledge exchange income (Ulrichsen, 2015[52]).

University-private co-publication

Science-industry relationships are difficult to measure given the diversity and intangibility of knowledge transfer channels. University-private co-publications are one of the more tangible ways of showing collaboration between higher education and private sectors. Figure 7.4 provides an overview of university-private co-publications as a share of the total co-publication output in OECD countries.

Figure 7.4. University-private co-publications as a share of total co-publication output (2015)
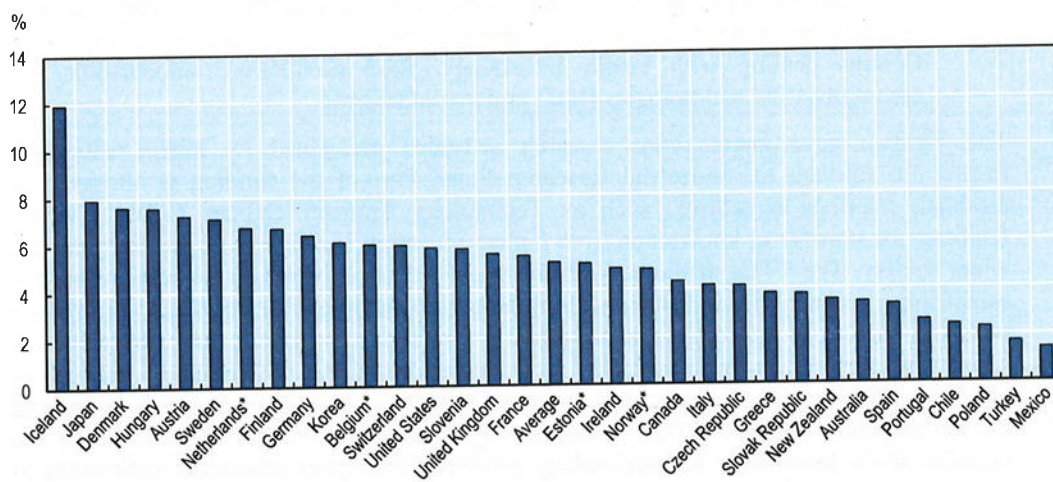
Note: *Participating in the Benchmarking Higher Education System Performance exercise 2017/2018.
Source: Adapted from Web of Science/CWTS (2015[53]), *Share of public-private co-publications*, www.rathenau.nl/en/page/share-public-private-co-publications-international.

StatLink 🖵 http://dx.doi.org/10.1787/888933941842

In 2015, the share of co-publications ranged between 4.8% and 6.7% for the participating jurisdictions. Belgium and the Netherlands had a higher percentage of university-private co-publications as a share of total co-publications, as well as the total co-publication output, than that of the OECD average. Meanwhile, the total co-publication output of Norway was higher than the OECD average, but the share of university-private co-publications was below average. Estonia on the other hand, had both the university-private co-publication share and the total co-publication output below the OECD average.

Policies to encourage the production of publications are typically included in indicators of performance-based funding schemes (block grant for research) in participating jurisdictions. For example, Estonia has set targets for the share of scientific publications among the top 10% most cited scientific publications worldwide to reach 11% and the

as well as through access to analytical research facilities across the Baltic Sea Region, and also through various programmes and investments (e.g. enterprise development programme, environmental investments). ADAPTER is funded through the ASTRA programme, which supports institutional development for higher education and research institutions.

- NUTIKAS is a funding programme to support applied research in smart specialisation growth areas. Enterprises can apply for funding to commission research and development projects from the qualified research institutions, including universities. The programme helps build the capabilities of R&D institutions in relevant applied research and collaboration between R&D institutions and enterprises.

- Competence Centres are knowledge-based organisations that help strengthen co-operation between government, R&D institutions and the business sector. The centres provide a space for co-operative activities with qualified specialists and for the provision of research and training. They aim to increase the quality and volume of applied research, increase the number of R&D employees and their movement between entrepreneur and research institutions, and strengthen the long-term strategic planning and management capability in companies and research institutions (Enterprise Estonia, 2000[50]). There are six Competence Centres dealing with health technology, food production, information and communication technologies (ICT) and manufacturing.

The Flemish government funds research activities performed by higher education institutions through the Industrial Research Fund. Part of the funding is allocated to establish interface structures, such as Technology Transfer Offices (TTOs), which facilitate the transfer of knowledge from higher education institutions to industry and the wider society. The TTOs affiliated with the five Flemish universities are responsible for establishing contact with industry, offering legal support related to contracts, promoting education activities for engagement, offering protection of intellectual property and supporting start-ups and spin-offs. The TTOs have formed the TTO Flanders network to provide a unique point of contact to industry. The network also plays a role in improving the collaboration between TTOs, strengthening their performance, and maximising the benefits of the knowledge and technology produced by higher education institutions to the economy and society.

In 2011, the Dutch government launched a 'top sectors' initiative to align public resources for R&D and innovation across nine strategic sectors: horticulture and propagation materials; agro-food; high-tech systems and materials; energy; logistics; creative industry; life sciences; chemicals; and water. Strategies were developed for each sector, and consortia for knowledge and innovation, known as Top Consortia for Knowledge and Innovation (TKI), were formed to implement them. These TKI consortia consist of public-private partnerships, which include higher education institutions. Every two years, the Dutch Statistical Office monitors the success of the top sectors initiative in the areas of macro-economy, enterprise development, employment characteristics, innovation performance and education output.

Outside of the participating jurisdictions, the "Third Stream[1]" fund in the United Kingdom is an example of how governments can support engagement activities that promote R&D collaboration with other sectors of the economy. The fund was created in 1999 and focused on supporting higher education institutions' responsiveness to the needs of business and the wider community through a broad range of knowledge exchange activities. Over time, the need to assess how the funding secured direct and indirect

Community, for example, the Flanders Agency for Innovation and Entrepreneurship funds the TETRA programme to improve the transfer of knowledge and technology from higher education to SMEs and the social profit sector.

Belgium and Norway were among the OECD countries with the highest proportion of large businesses collaborating on innovation with higher education or research institutions (around 50%). By contrast, about 34% of large businesses in the Netherlands and about 24% in Estonia collaborated with higher education or research institutions on innovation.

Figure 7.3. Businesses collaborating on innovation with higher education or research institutions, by size (2012-2014)
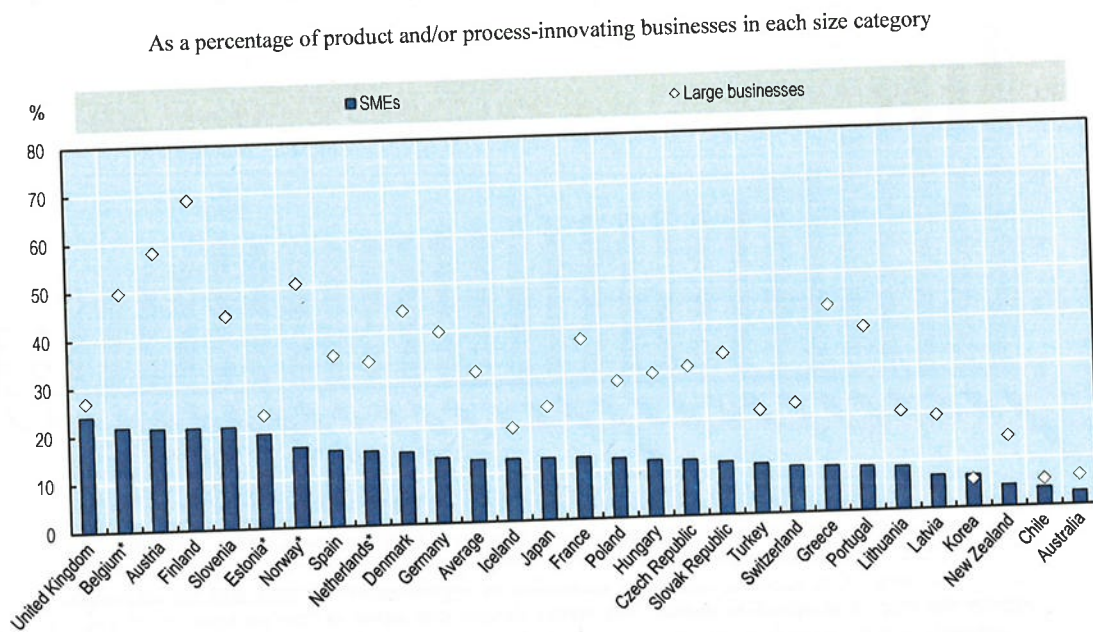
As a percentage of product and/or process-innovating businesses in each size category

Note: *Participating in the Benchmarking Higher Education System Performance exercise 2017/2018.
Source: Adapted from OECD (2017[48]), OECD Science, Technology and Industry Scoreboard 2017: The digital transformation, http://dx.doi.org/10.1787/9789264268821-en.

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While higher education and business co-operation is improving in Estonia, it needs to be further strengthened (European Commission, 2017[49]). Estonia has introduced a number of initiatives to connect research with business:

- The ADAPTER programme is a network of Estonian universities and R&D organisations (i.e. Estonian Academy of Arts, Estonian Academy of Music and Theatre, National Institute of Chemical Physics and Biophysics, Centre of Food and Fermentation Technologies, Software Technology and Applications Competence Centre and BioCC LLC) established in late 2016. The network coordinates education and R&D services to enterprises and other organisations. Services offered by the network include contract research, data analysis, continuing education and other training services. Support is provided through vouchers (e.g. the development voucher grant and the innovation voucher grant),

Netherlands and Norway. In all four participating jurisdictions, the share of enterprises co-operating with the higher education sector was higher than the share of enterprises co-operating with government or public research institutes, and with private research institutes.

Figure 7.2. Businesses collaborating on innovation with higher education or research institutions (2016)

As a percentage of total enterprises with 10 or more employees
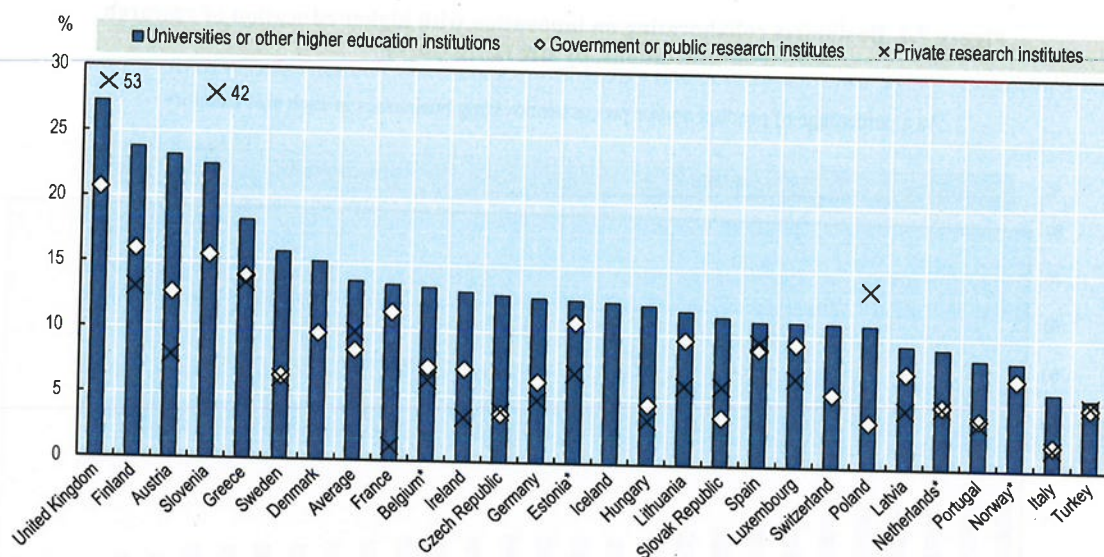
Note: *Participating in the Benchmarking Higher Education System Performance exercise 2017/2018. The Eurostat Community Innovation Survey asks the following question: "Did your enterprise co-operate on any of your innovation activities with other enterprises or organisations?" It then asks the respondent to identify the type of co-operation partner. The survey defines innovation as "the introduction of a new or significantly improved product, process, organisational method, or marketing method by your enterprise" (Eurostat, 2018[47]). It also specifies that both partners do not need to commercially benefit to be counted as co-operating on innovation activities.
Source: Adapted from Eurostat (2018[47]), *Community Innovation Survey, Science, Technology and Innovation Indicators*, http://ec.europa.eu/eurostat/web/science-technology-innovation/data/database.

StatLink ⟶ http://dx.doi.org/10.1787/888933941804

Evidence from the OECD STI Scoreboard 2017 shows that in all OECD countries with available data except for Korea, a higher share of large businesses collaborated on innovation with higher education or research institutions compared to small and medium-sized enterprises (SMEs) from 2012-2014 (Figure 7.3). The UK reported the largest share, nearly one-quarter, of SMEs engaging in this form of collaboration, followed by Belgium with about 22%. In Estonia, almost 20% of SMEs collaborated on innovation activities with higher education or research institutions, followed by Norway with about 17% and the Netherlands with about 16%.

The relatively high level of collaboration between SMEs and higher education institutions in Belgium might be due to a number of systemic initiatives created to stimulate higher education engagement with companies, and in particular with SMEs. In the Flemish

universities in their respective countries, on a scale from 1 (not at all) to 7 (to a great extent) (World Economic Forum, 2017[46]). Figure 7.1 shows the results of the Executive Opinion Survey on this indicator in OECD countries. The top five countries that reported a high level of higher education-business collaboration in the Global Competitiveness Index in 2017 were Switzerland, Israel, the United States, Finland and the Netherlands.

Figure 7.1. Higher education-business collaboration in R&D (2017)

Extent to which businesses collaborate with universities on a scale from 1 to 7

(1= do not collaborate and 7 = collaborate extensively)
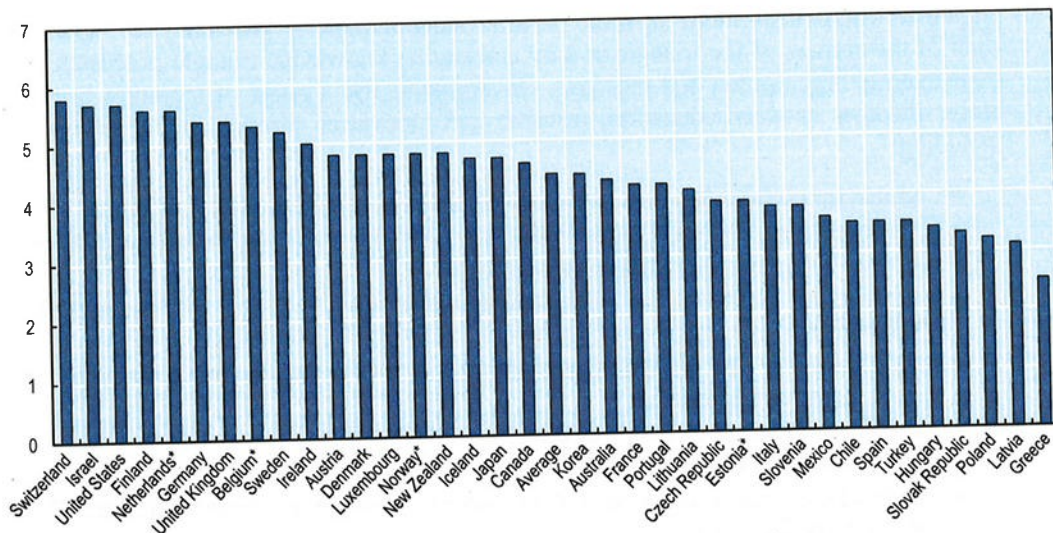
Note: *Participating in the Benchmarking Higher Education System Performance exercise 2017/2018.
This chart shows the response to the question: In your country, to what extent do business and universities collaborate on research and development?
Source: Adapted from World Economic Forum (2017[46]), The Global Competitiveness Report 2017-2018, https://www.weforum.org/reports/the-global-competitiveness-report-2017-2018.

StatLink ᵐˢ🔗 http://dx.doi.org/10.1787/888933941785

EU Average Data from Eurostat's Community Innovation Survey (CIS) form the basis of the European Innovation Scorecard, which is used to measure national innovation performance in European countries. The CIS differs from the World Economic Forum Executive Opinion Survey in that it asks individual enterprises if they have collaborated with the higher education sector over the period 2012-2014, whereas the Executive Opinion Survey asks the enterprise to make a judgement about the level of university-business collaboration for the country as a whole. This should be taken into account when interpreting the data from the two surveys, as the Executive Opinion Survey measures perceptions of university-business collaboration rather than factual collaboration.

Data at an enterprise level show that, across OECD countries with available data, on average, about 14% of enterprises reported co-operating with the higher education sector in 2016 (Figure 7.2). While more than one-fifth of businesses co-operated with higher education institutions in Austria, Finland, Slovenia and the United Kingdom, less than 6% of enterprises reported co-operation in Italy and Turkey. The level of reported co-operation was around the OECD average in Belgium and Estonia and below 10% in the

- public-private partnerships
- university-industry research contracts
- commercialisation of publicly funded research
- academic spin-offs and start-ups
- knowledge and technology transfer offices
- incubators
- open science and open innovation platforms.

- *Interaction between education and innovation:* support for the development of an entrepreneurial culture in academic programmes and entrepreneurial skills (Cervantes, 2017[12]).

Higher education institutions integrate the knowledge triangle by providing key inputs for each of the corners of the triangle and by embedding knowledge triangle processes into their internal organisation and missions. Governments use a range of measures to build closer linkages between education, research and innovation through higher education, including:

- grants for collaborative research for higher education institutions and firms
- tax incentives for firms that purchase services from higher education institutions
- financial support for institutional spin-offs
- funding to promote the internationalisation and mobility of students and researchers
- incentives to encourage participation in commercialisation activities by researchers and academics
- funding for entrepreneurship education
- open access to publicly-funded research
- networking events open to various actors involved in science-industry links (Cervantes, 2017[12]).

7.3.1. Collaboration across sectors to drive innovation

Collaboration with other sectors of the economy is important for R&D to ensure that knowledge is generated, shared and applied in a way that maximises its benefits to the economy and society. Many problems, such as those related to the environment or the global sanitation crisis, are becoming increasingly difficult to solve without scientific advice, and governments have shifted to more evidence-informed approaches to tackling the biggest challenges in society. In this context, connecting the knowledge produced by higher education institutions more deeply with different stakeholders, such as non-profit organisations, foundations and civil organisations, strengthens the relevance of higher education (OECD, 2011[45]).

Collaboration between higher education and industry is necessary to make sure the research produced by higher education is in line with industry's needs for innovation. It also helps higher education institutions strengthen their role in national and global knowledge systems, and become more financially sustainable. This collaboration provides benefits for enterprises, which gain easy access to knowledge that is relevant for product development and innovation. Finally, it gives researchers better access to business and social networks and more opportunities to work in various fields.

The Global Competitiveness Index is based on the World Economic Forum's Executive Opinion Survey, which covered 133 economies and over 12 000 executive responses in 2017. Executives were asked to rate the extent to which businesses collaborate with

new skills and update their existing skills to meet changing labour market demands without having to enrol in a complete degree programme. However, continuing education students can use the credits they accumulate through the *videreutdanning* courses towards a degree.

Additional examples of continuing education include the Osher Lifelong Learning Institutes in the United States, which are funded by the Bernard Osher Foundation and are located on the campuses of more than 100 higher education institutions across various states. These institutes provide a wide range of non-credit courses and activities for adults older than 50 who are interested in learning for personal interest. In Denmark, universities provide non-formal education through "university extension courses" (Box 7.3).

Box 7.3. University extension courses in Denmark

Danish universities have a long tradition of delivering non-formal education in the form of extension courses. The university extension courses are a nationwide initiative delivered through four divisions in the cities of Copenhagen, Aarhus, Odense and Aalborg. In addition, there are also more than 100 university extramural committees delivering non-formal education in other regions. The objective of the programme is to disseminate the results of the research produced by higher education institutions to the wider community in the form of lectures, lecture series and university courses. These cover a wide range of subjects, including health and natural sciences, humanities, social sciences and theology. The Danish government provides grants to help cover some of the costs associated with teaching, travel and administration, the amount of which is determined in the annual Appropriations Act. The Council for the University Extramural Department (*Folkeuniversitetet*) is responsible for distributing the grants. Participants in these courses have to pay a fee, which amounts to a minimum of one-fourth or, on some occasions, one-third of the expenditure on teaching (Danish Ministry of Education, 2018[42]).

7.3. Engagement to support innovation

Higher education research and innovation are core elements of a country's knowledge system. Higher education systems across the OECD are the key producers of basic research, which is used in applied research and experimental development, and ultimately in the production of new products and processes in business, government and other sectors of society. By engaging with the private, public and social sectors, higher education can create stronger potential for innovation within its research function. As a result, it can better address society's biggest challenges, including climate change, public health, energy, food and water supply (OECD, 2016[43]).

The Knowledge Triangle

The Knowledge Triangle (Sjoer, Nørgaard and Goossens, 2012[44]) refers to the interaction between education, research and innovation to drive a knowledge-based society. Interactions between these three areas are facilitated by a range of activities, including:

- *Interaction between research and education:* through geographic and sectoral mobility of graduates, postgraduate training programmes, basic and applied research as the basis for research-led teaching.
- *Interaction between research and innovation:* support for knowledge transfer and knowledge exchange via various initiatives, including: