

DENMARK

Denmark is a highly developed European economy with strong business innovation and one of the most developed renewable energy technology sectors in the world. At the same time Danish labour productivity level is lower than the OECD average (figure 1). In 2014 its gross R&D expenditures amounted to more than 3% of GDP, which is much higher than the OECD average (table 1). Its ICT and Internet infrastructure are good and the e-government development index is also quite high (figure 4^{k,l,m,n}). However, the Danish government that took office in mid-2015 decreased the budget for research (1.01% of GDP), which in longer term could have impacts on the innovation system (C. Grimpe, Mitchell J., 2015)¹. The Innovation Strategy: Denmark A Nation of Solutions (2012-20), launched in 2012, includes 27 policy initiatives focused on research, innovation and education and represents a shift to a demand-driven innovation policy approach with an emphasis on enhanced knowledge flows and stronger innovation capabilities in education. The Innovation Strategy was complemented in 2015 by the "Growth and development in the whole of Denmark" strategy (Vækst og udvikling i hele Danmark) – that intends to foster regional growth and development in the country through "regional smart specialisation". The program includes more than 100 concrete initiatives focused on strengthening partnerships between research institutions and business and intensifying knowledge sharing and innovation in businesses.

Table 1. Gross domestic expenditure on R&D (GERD)

	DNK	OECD
GERD		
USD million PPP, 2014	7 921	1 181 495
As a % of total OECD, 2014	0.7	100
GERD intensity and growth		
As a % of GDP, 2014	3.05	2.38
(annual growth rate, 2009-14)	(+0.6)	(+2.3)
GERD publicly financed		
As a % of GDP, 2014	0.93	0.61
(annual growth rate, 2009-14)	(+4.7)	(+2.5)

¹ In particular, Danish universities are required to save 2% every year from 2016 to 2019 in their education area, which has repercussions for the scientific personnel employed and consequently for the research activity. Moreover, the budget available annually to the Danish Council for Independent Research has been reduced markedly by about €36m (C. Grimpe, Mitchell J., 2015).



Hot issues

Improving the framework conditions for innovation (including competitiveness)

Denmark ranks very high among OECD countries on the Ease of Entrepreneurship Index (figure 4^l), and its entrepreneurship environment continues to improve. Availability of venture capital is on par with the OECD median. Since 2013 the Danish Growth Fund (DGF, Vaekstfonden) supports business with subordinated loans, and in 2014 a new programme was introduced to provide debt finance to entrepreneurs, who lack sufficient collateral to finance their start-up, including expansion and growth. Other initiatives to facilitate entrepreneurship include the Green Entrepreneurship House and the Entrepreneurial Company Registration (IVS). Since July 2013, initiatives have been launched to enhance enforcement of IPR rules by the police and public prosecutors. Standard contracts for commercialisation aim to make it easier for large and small businesses in creative industries to collaborate on the commercialisation of designs and ideas. At the European level, an EU-DK Support program coordinated by the Danish Agency on Science was launched in December 2012 in order to help Danish researchers, businesses and other users who are looking for the funding from EU programmes. The aim of EU-DK Support is to coordinate national advisory efforts in order to achieve synergy effects with the purpose of enhancing knowledge and overview of relevant EU programmes.

Improving overall human resources, skills and capacity

Danish STI skills are in the mid-range of OECD countries (figure 4^{t,u,v,w}), although tertiary education spending and share of PhD graduates in science and engineering are at the top of this mid-range (figure 4^{s,w}). The older population is also quite skilled: about 85% of those who are 65yrs or older use the Internet which is much higher than in most OECD countries (figure 4). **Denmark's national innovation strategy includes a range of initiatives to strengthen innovation capacity through education. The government anticipates that at least 25% of the present youth cohort will complete a master's degree by 2020, and that the uptake of PhD students will remain at the 2010 level of 2 400 a year.** At the end of 2013, the Danish government established the Quality Committee (kvalitetsudvalget) to look into how to improve the quality and relevance of higher education. In 2014 the Ministry of Higher Education and Science created a task force on attracting women into science. The recommendations that were published in April 2015 have been shared with universities, research councils and foundations.



Some key STI performance indicators

Figure 1. Economic performance

Labour productivity, GDP per hour worked, index 2005=100

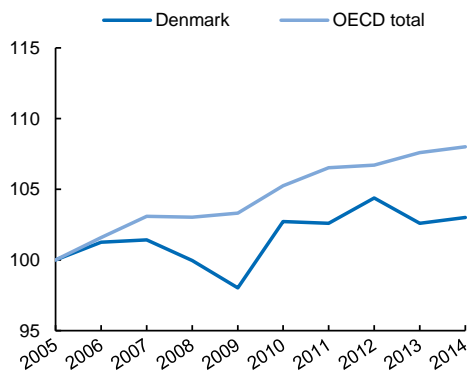


Figure 2. Environmental performance

Green productivity, GDP per unit of CO₂ emitted, index 2005=100

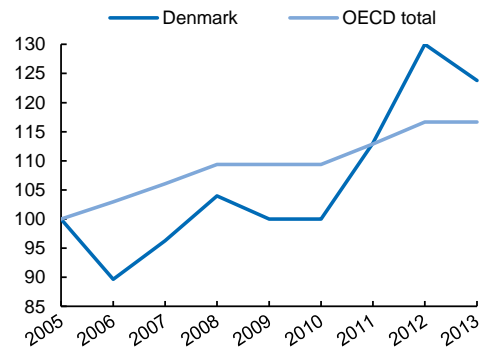
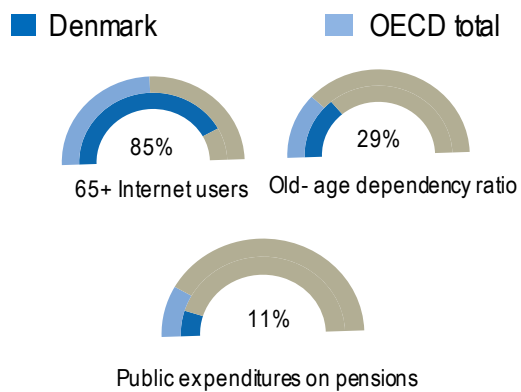


Figure 3. Ageing

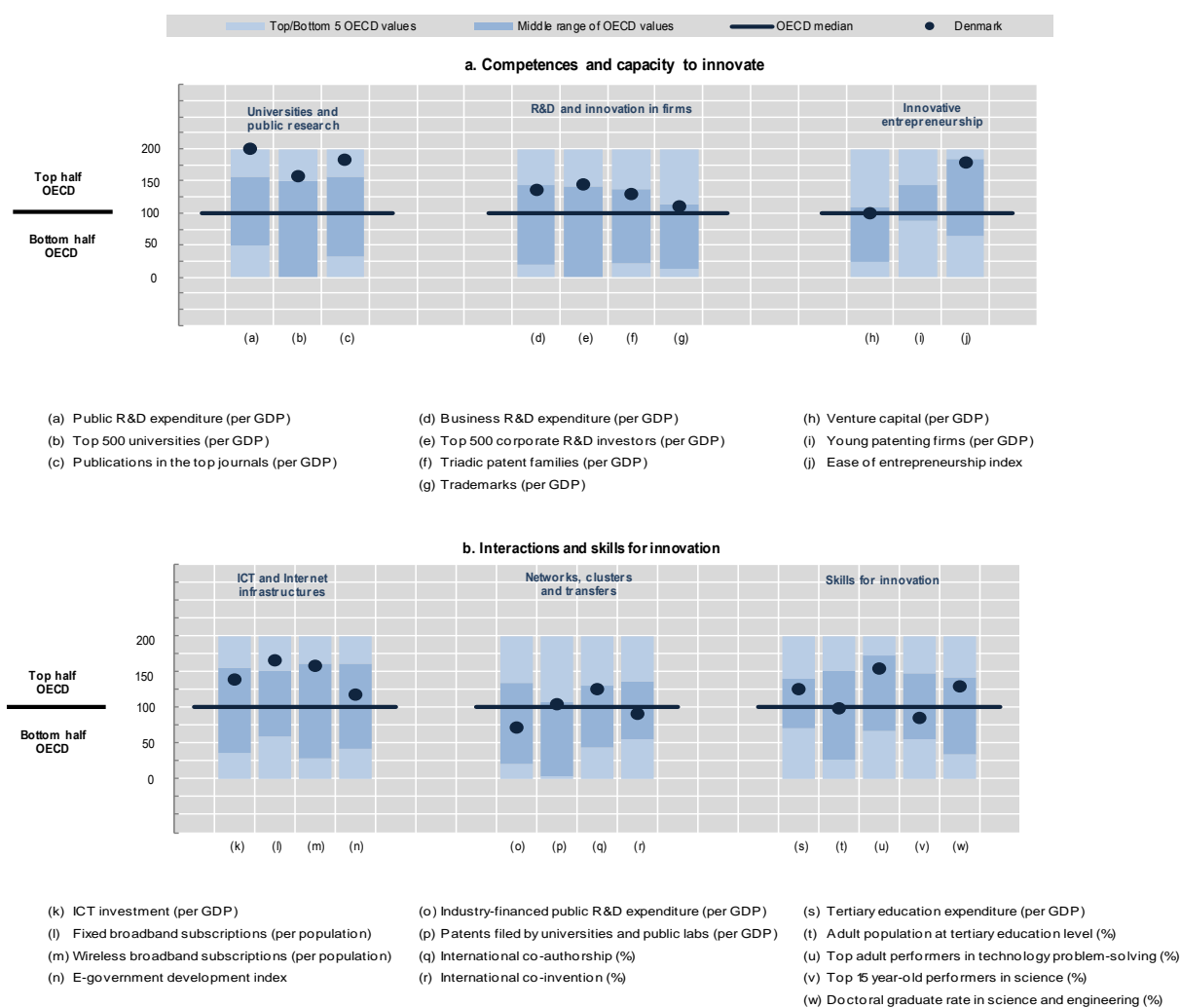
2015 or latest year available, percentages



Benchmarking national STI systems

Figure 4. Science and Innovation in Denmark

Comparative performance of national science and innovation systems, 2016



Note: Normalised index of performance relative to the median values in the OECD area (Index median=100).



Highlights of the Danish STI system

STI policy governance

Innovation Fund Denmark (InnovationsFonden) was established in April 2014 by a merger of the Danish National Advanced Technology Foundation, the Danish Council for Technology and Innovation, and the Danish Council for Strategic Research. Its role is to support innovative projects throughout the value chain from strategic research to commercialisation. Societal Innovation Partnerships – a new model of cooperation between enterprises, research institutions and public sector that was initially part of the Innovation Strategy have become a part of the Fund. A new InnoBooster-programme launched in August 2015 has replaced the previous innovation voucher scheme. The total amount the Fund is planning to invest in 2016 to create growth and employment in Denmark is scheduled at DKK 1.25 bn.

In 2013 the Ministry of Higher Education and Science (MHES) called on a broad variety of stakeholders to prepare the so-called INNO+ catalogue of promising focus areas for strategic investments in innovation. The five areas selected for 2014 were: blue jobs via green solutions; intelligent, sustainable and efficient plant production; Denmark as a preferred country for early clinical testing of new medicines; water-efficient industrial production; and world-class renovation of buildings. The mandate of the Danish Council for Research Policy was widened as of spring 2014 to include technological development and innovation. The development of quantitative impact assessments is continuing, and the Central Innovation Manual on Excellent Econometric Impact Analyses of Innovation Policy (CIM) has been updated and is now called CIM 2.0.

New sources of growth

Denmark, like many other western nations, has experienced a reduction in the number of production and industry workplaces. Therefore new methods (i.e. automatisisation, digitalisation etc.) need to be adopted in order to maintain competitiveness. The "Growth and development in the whole of Denmark" strategy proposes a number of instruments, including lower taxes, financial instruments and grants for new and small enterprises as well as stronger partnerships between research institutions and businesses.

New challenges

Since its creation in 2013 the Fund for Green Business Development has allocated grants of approximately EUR 8.33 million to more than 30 projects to help the increase of business competitiveness and growth and make environmental improvements. Currently the fund has three main programmes: Green Business Development program gives grants to companies to improve eco-efficiency; New Green Business Models program acts as an accelerator on green business model innovation and Green Industrial Symbiosis programme promotes green co-operation between companies so that the waste or reserves of a given resource, e.g. water or materials, of one company become a resource for another company

Universities and public research

Denmark has a strong science base, which is dominated by universities (figure 7). Public expenditures on R&D are among the highest in the OECD, and the number of Danish HEIs in the top 500 universities is higher than in many OECD counties. (figure 4^{a,b}). Moreover, Danish researches perform well in terms of S&T publications in top international journals, co-publications and patent applications (figure 4^{c,p,q}). At the end of 2014 the University Act was amended to give universities more autonomy for arranging their management structures. As part of the government's effort to increase the internationalisation of higher education, a two-part action plan has been launched. The first part "Enhanced insight through global outlook" focuses on sending more Danish students to study abroad, creating stronger international learning environments, and improving Danish students' foreign language skills. The second part "Denmark – an attractive study destination" aims to attract the most capable international students and retain international graduates in Denmark. Danish universities are also in the process of implementing open access policies regarding research data. The Danish public research councils are aligned with the recommendations of the European



Commission Horizon 2020, which plans to make open access to research publications a general requirement. The Danish Roadmap for Research Infrastructure-2015 that replaced the 2011 roadmap presents the vision and strategic focus areas of the Ministry of Higher Education and Science for research infrastructure until 2020 and a catalogue of 22 concrete proposals for national research infrastructures. The Ministry has proposed 8 strategic activities that will be the focus areas for the next five years. The objective up to 2020 is to make investments into at least 15 proposals from the roadmap

Innovation in firms

The BERD ratio and triadic patents to GDP are at the top of the mid-range of OECD countries (figure 4^{d,f}) and Denmark has an important share of leading global corporate R&D investors for the size of its economy. Moreover, Denmark is increasing the share of tax incentives, coming closer to the OECD average (figure 7). The Market Development Fund (Markedsmodningsfonden) that since 2012 supports the development process just before commercialisation (when a functioning prototype must be customised to fit the demands of the market) allocated dkk 56.4 million in 2016. The fund co-finances facilitation of end-consumer testing **and adaptation of the new product or service, thereby shortening the developer's time to market** and strengthening the potential for growth and employment. In 2012 a tax credit scheme was introduced to provide the opportunity for firms with a negative balance sheet to obtain a credit for the tax value of their R&D expenditures. The scheme has greater impact on young small innovative companies owing to a built-in maximum of R&D expenditure to be granted a tax credit. In 2013 the Danish Growth Fund introduced subordinated loans to facilitate the access of SMEs to debt financing.

Technology transfer and commercialisation

Danish universities and PRIs are quite active in patenting (figure 4^e) although the share of public R&D expenditures financed by industry is still slightly below the OECD median (figure 4^e). The new innovation strategy: Denmark A Nation of Solutions (2012-20) focuses on better knowledge exchange between companies and knowledge institutions, between public and private sectors, as well as across national borders.



Structural aspects and specialisation

Figure 5. Structural composition of BERD, 2013 or latest year available

As a % of total BERD or sub-parts of BERD

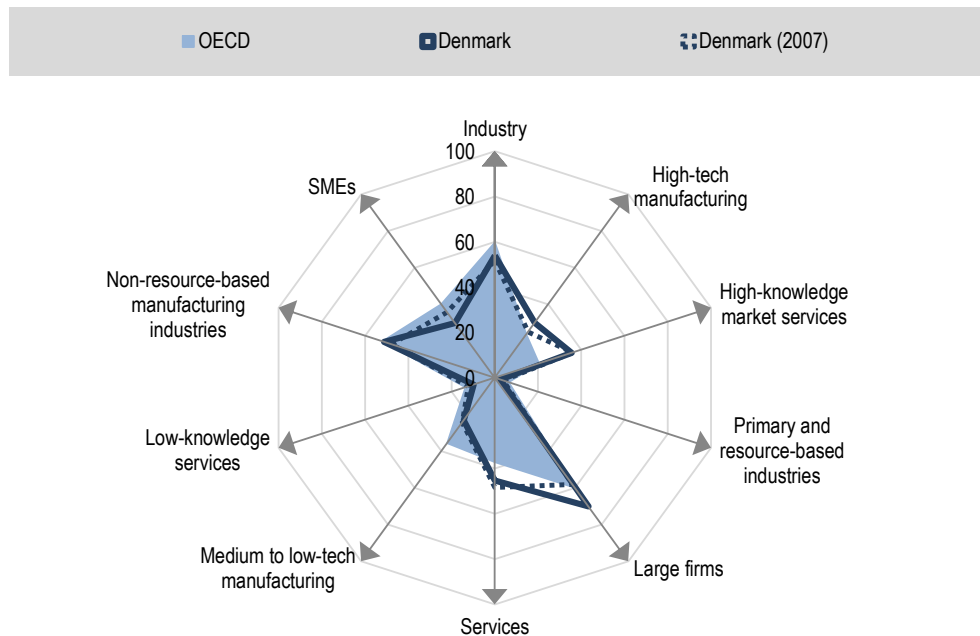
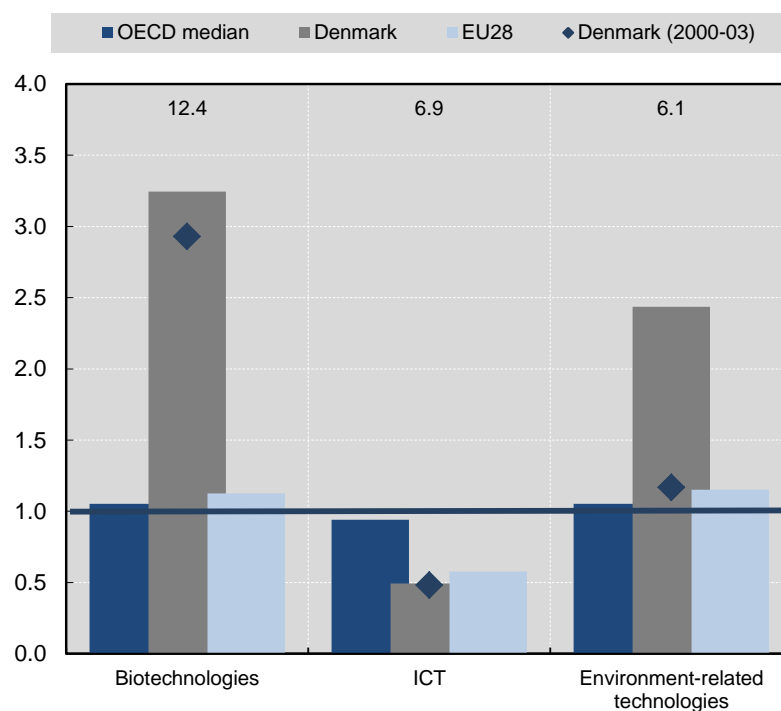


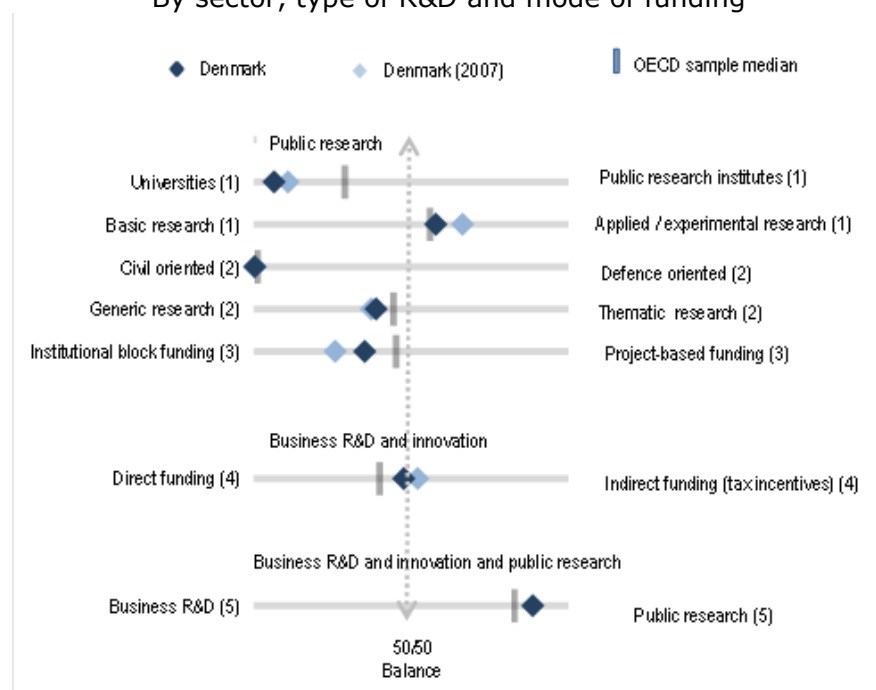
Figure 6. Revealed technology advantage in selected fields, 2011-2013

Index based on IP5 patent families applications



National STI policy mix

Figure 7. Allocation of public funds to R&D, 2014 or latest year available
By sector, type of R&D and mode of funding



(1). Balance as a share of both higher education (HERD) and government (GOVERD) R&D expenditure.

(2). Balance as a share of total government budget appropriations and outlays for R&D (GBAORD).

(3). Balance as a share of total funding to national performers.

(4). Balance as a share of both indirect funding (through R&D tax incentives) and direct funding (through grants, procurement, loans, etc.).

(5). Balance as a share of publicly-funded HERD and GOVERD and components of (4).

Note: Policy information comes from country responses to the EC/OECD International Survey on STI Policies (STIP) 2016 and 2014. Denmark's responses are available in the EC/OECD International Database on STI Policies, edition 2016 at http://qdd.oecd.org/DATA/STIPSurvey/DNK..STIO_2016.

Source: See the reader's guide and methodological annex.

StatLink  <http://dx.doi.org/10.1787/888933433767>



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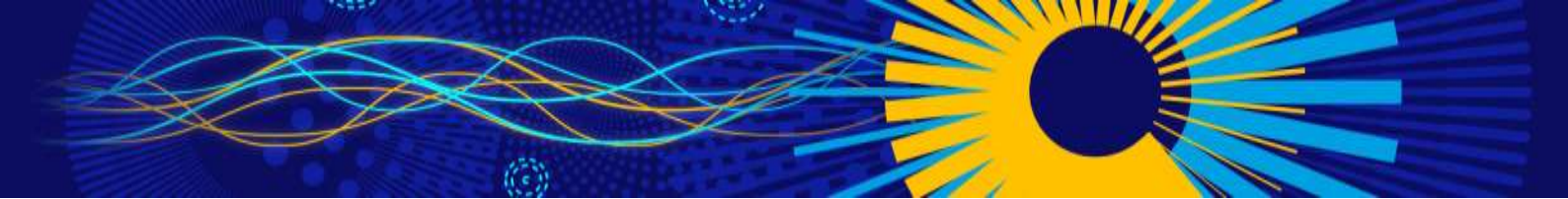


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