Eurostat (2019.07.04)

SDG 9 - Industry, innovation and infrastructure

Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation

Data extracted in May 2019.
Planned article update: June 2020.

Highlights

EU trend of SDG 9 on industry, innovation and infrastructure

This article provides an overview of statistical data on SDG 9 ‘Industry, innovation and infrastructure’ in

the European Union (EU). It is based on the set of EU SDG indicators for monitoring of progress towards the UN Sustainable Development Goals (SDGs) in an EU context.

This article is a part of a set of statistical articles, which are based on the Eurostat publication 'Sustainable development in the European Union — Monitoring report - 2019 edition'. This report is the third edition of Eurostat's series of monitoring reports on sustainable development, which provide a quantitative assessment of progress of the EU towards the SDGs in an EU context.

Goal 9 calls for building resilient and sustainable infrastructure and promotes inclusive and sustainable industrialisation. It also recognises the importance of research and innovation for finding lasting solutions to social, economic and environmental challenges.

Full article

Industry, innovation and infrastructure in the EU: overview and key trends

Monitoring SDG 9 in an EU context focuses on two main dimensions: R&D and innovation, and sustainable transport. As Table 1 shows, the EU has progressed in R&D and innovation along several lines over the past few years, while some areas remained stagnant. Similarly, a mixed picture can be observed concerning sustainable transport: while the share of buses and trains in passenger transport has increased and CO2 emissions from cars have declined, the share of rail and inland waterways in freight transport has not changed substantially.

Indicator	Long-term trend (past 15 years)	Short-term trend (past 5 years)
R&D and innovation		
Gross domestic expenditure on R&D	↘	↘
Employment in high- and medium-high technology manufacturing and knowledge-intensive services	↗ (1)	↗
R&D personnel	↑	↑
Patent applications to the European Patent Office (EPO)	↗	↘
Sustainable transport		
Share of buses and trains in total passenger transport	↘	↗
Share of rail and inland waterways in total freight transport	↘ (2)	↓
Average CO_2 emissions per km from new passenger cars (*)	↗ (1)	↗

(*) Multi-purpose indicator.
(1) Past 10-year period.
(2) Past 12-year period.

Table 1: Indicators measuring progress towards SDG 9, EU-28

Symbol	With quantitative target	Without quantitative target
	Trends for indicators marked with this 'target' symbol are calculated against an official and quantified EU policy target. In this case the arrow symbols should be interpreted according to the left-hand column below. Trends for all other indicators should be interpreted according to the right-hand column below.	
↑	Significant progress towards the EU target	Significant progress towards SD objectives
↗	Moderate progress towards the EU target	Moderate progress towards SD objectives
↘	Insufficient progress towards the EU target	Moderate movement away from SD objectives
↓	Movement away from the EU target	Significant movement away from SD objectives
:	Calculation of trend not possible (for example) time series too short)	

Note: The two methods for calculating progress used in this report are explained in more detail in the introduction and in the annex; for an overview of the considered policy targets see Table II.18 in the annex.

Table 2: Explanation of symbols for indicating progress towards SD objectives and targets

R&D and innovation

R&D expenditure is a vital contributor to human capital development as it creates knowledge and improves skills, making it a key enabling factor for smart, sustainable and inclusive growth. Highly skilled human resources, in turn, are imperative for keeping the EU's research and innovation capacity and competitiveness up to date. Innovative products and services, as a result of R&D activities, not only contribute to smart growth, but also to inclusiveness and sustainability objectives. Introducing new ideas to the market promotes job creation, labour productivityand efficient use of resources. R&D and innovation are also essential for finding solutions to societal challenges such as climate change and clean energy, security, and active and healthy ageing.

The selected indicators look at the monetary input into R&D and innovation activities, the human resources employed in this sector, and the innovation output in terms of filed patents. The picture derived from available data for these indicators for the EU since 2008 is generally characterised by stagnation of the inputs and outputs (R&D intensity and patents), accompanied by a continuous increase human resources engaged in R&D and innovation activities.

More investment in R&D needed to meet the Europe 2020 target

The EU economy is facing increasing global competition and can only remain competitive with other countries and regions in the world by strengthening its scientific and technological base. Therefore, one of the key aims of EU policies over recent decades has been to encourage increasing investment in R&D. However, EU expenditure on R&D in relation to GDP (R&D intensity) has shown only modest growth during the past 15 years. After prolonged stagnation between 2000 and 2007, R&D intensity has increased slowly and has stabilised at slightly above 2.0 % since 2012, reaching 2.06 % in 2017 (in absolute terms this corresponds to an R&D expenditure of nearly EUR 320 billion in 2017). With a gap of 0.94 percentage points, the EU thus remains far from its 3 % target for 2020.

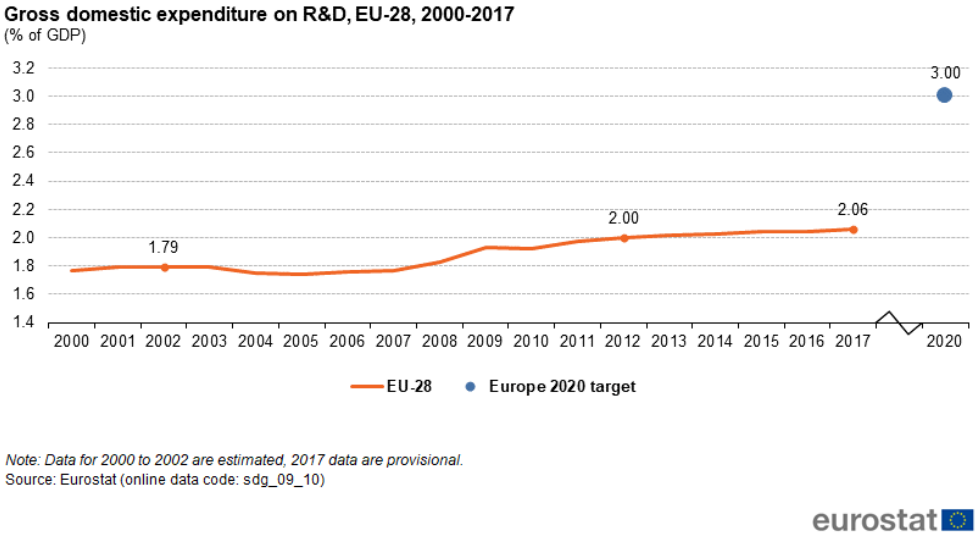

Figure 1: Gross domestic expenditure on R&D, EU-28, 2000-2017 (% of GDP)

Source: Eurostat (sdg_09_10)

Overall, in many Member States R&D intensity emerged stronger from the economic crisis following stagnation in GDP and increased public funding for R&D. Nevertheless, only Sweden, Austria, Denmark and Germany recorded R&D intensities above 3 % of GDP in 2017.

Private expenditure accounts for almost two-thirds of total R&D expenditure

An analysis of R&D expenditure by sector of performance shows that the two biggest spenders in 2017 remained the business enterprise sector (66.0 % of total R&D expenditure) and the higher education sector (21.8 %). Despite its more modest share of 11.2 % in 2017, the government sector plays an important role, especially in the long-term stability of R&D expenditure and in fostering public-private initiatives. The size of the private non-profit sector is almost negligible, accounting for less than 1.0 % of the total R&D expenditure in 2017.

The business enterprise sector did not only account for the lion's share of total R&D expenditure, it also increased its R&D intensity from 1.14 % of GDP in 2002 to 1.36 % in 2017, showing growth of 0.22 percentage points over 15 years. In contrast, the R&D intensities of the three other sectors – higher education, government and non-profit – have more or less stagnated at relatively low levels. Expenditure in the higher education sector increased from 0.40 % of GDP in 2002 to 0.45 % in 2017.

The R&D intensities of the government sector (0.23 %) and the private non-profit sector (0.02 %) were virtually identical to the ratios recorded some 15 years earlier.

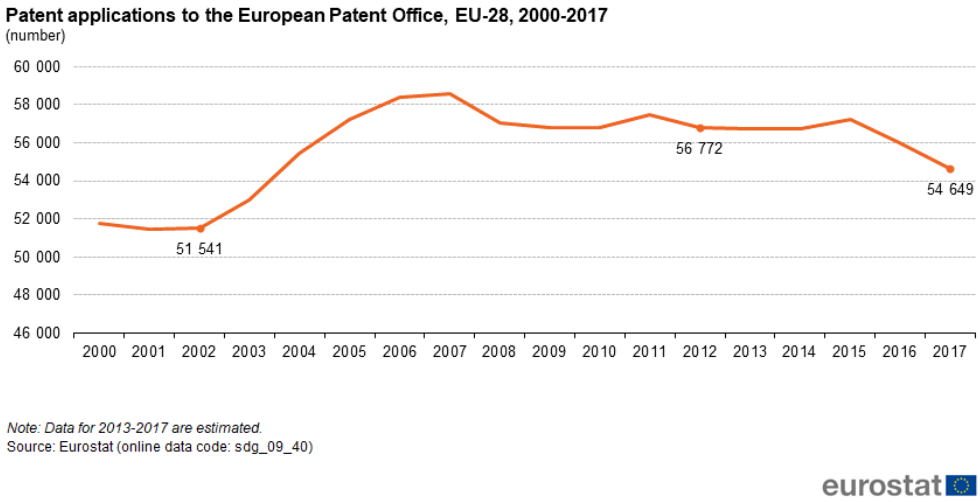

Figure 2: Patent applications to the European Patent Office, EU-28, 2000-2017 (number)

Source: Eurostat (sdg_09_40)

R&D expenditure in EU business enterprises boosts knowledge creation, turning ideas into new products and services, for which new patents are registered. Patents provide a valuable measure of the exploitation of research results and of the inventiveness of countries, regions and companies. While EU patent applications increased considerably in the years before the economic crisis (up to 2007), they have more or less stagnated since then, despite the slight but continuous increase in businesses' R&D intensity. In 2017, the number of patent applications submitted to the European Patent Office was below 55,000, which is almost 4 000 applications fewer than ten years earlier.

The business sector is the largest source of R&D investment across Member States

Differences between countries' R&D investment, particularly business R&D spending, reflect the industrial structure of economies, differences in the knowledge intensity of sectors and the research capabilities of countries [1]. In general, a low business sector R&D intensity indicates that the broader innovation system and framework conditions for this type of investment are insufficiently attractive [2]. Business R&D can integrate and transform available knowledge into commercially viable technologies and innovation, such as greener products, processes and services that enable higher labour productivity, industrial competitiveness, resource efficiency and reduced environmental impacts.

In most EU Member States, R&D expenditure in the business sector was the main determinant of a country's total R&D intensity over the past decade. Furthermore, the business enterprise sector was the biggest employer of R&D personnel, providing jobs (full-time equivalent) for more than half of this workforce in 2017. The business sector consequently is the largest R&D sector in most Member States. However, in some of the least research-intensive countries, such as the Baltic countries and some southern Member States, the public sector — higher education and government — tends to account for most of the R&D expenditure. There are, however, exceptions to this pattern in the east (Hungary and Slovenia) with above-average private expenditure.

The EU strives to provide the necessary human capital for a knowledge-based society

Achieving the Sustainable Development Goals will require significant innovation and will create new scientific and technical occupations in key manufacturing and other sectors, such as the energy sector. This structural change has important implications for employment as it helps to accommodate and stimulate the development of a highly skilled labour force. The share of employed people working either in high- and medium-high technology manufacturing or in knowledge-intensive service sectors sectors has grown continuously in the EU since 2008, reaching 46.1 % in 2018. Furthermore, the EU aims to create an innovation-friendly environment for researchers and entrepreneurs that makes it easier for great ideas to be turned into products and services. Possibly due to these efforts, the share of R&D personnel in the economically active population — including researchers and other staff employed directly in R&D — has increased steadily since 2002 to reach 1.3 % in 2017. This trend was mainly driven by the business enterprise sector, where the share of R&D personnel (full-time equivalent) grew by 0.23 percentage points between 2002 and 2017.

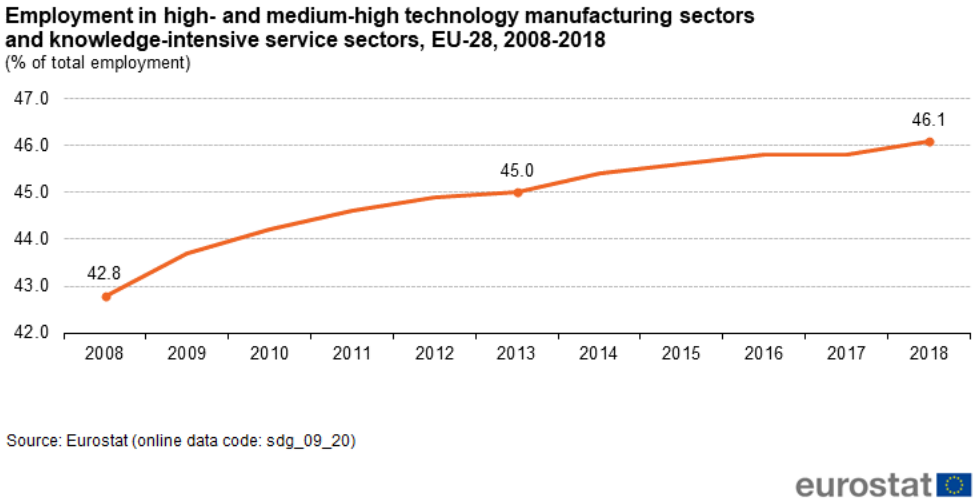

Figure 3: Employment in high- and medium-high technology manufacturing and knowledge-intensive services, EU-28, 2008-2018 (% of total employment)

Source: Eurostat (sdg_09_20)

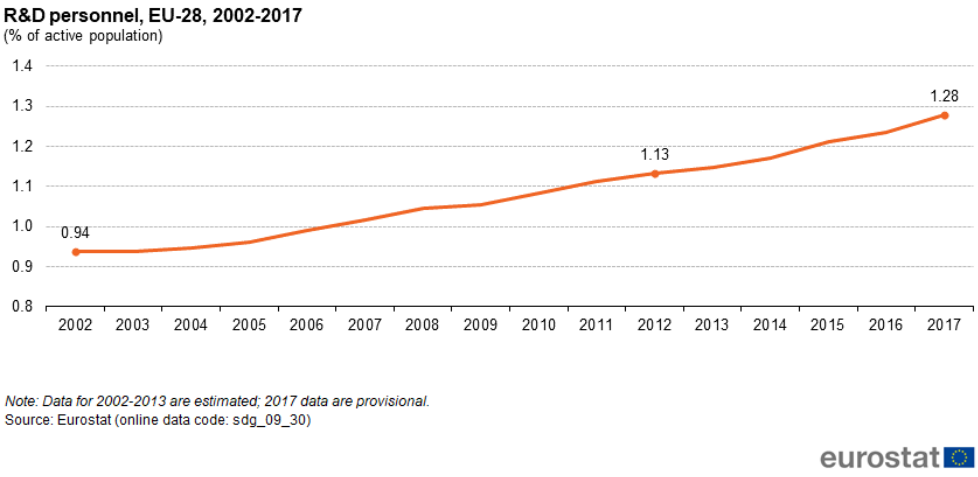

Figure 4: R&D personnel, EU-28, 2002-2017 (% of active population)

Source: Eurostat (sdg_09_30)

Women remain underrepresented in the R&D sector, but are overrepresented in knowledge-intensive jobs

In the EU, women accounted for more than a third of those employed in R&D in 2015 (35.0 %) [3].

Despite growth in the number of women with a tertiary education in science over the past few years,

they are still underrepresented in the science and technology fields in the EU. This might be explained by the fact that women still engage in different fields of study than men. For instance, men are more than two times more likely than women to choose a degree in engineering, manufacturing and construction, while women are twice as likely to pursue an education degree [4].

Gender differences are also evident when looking at people employed in high- and medium-high technology manufacturing and knowledge-intensive service sectors. Employment in knowledge-intensive services makes up the lion's share of total employment in these areas, amounting to 40.3 % in 2018. Notably, less than a third of all employed men (30.6 %) but more than half of all employed women (51.6 %) were working in this sector in this year. The shares of this sector in total employment have slightly grown for both men and women over the past few years. In contrast, employment in high- and medium-high technology manufacturing sectors has stagnated at slightly below 6 % of total employment since 2008, amounting to 5.8 % in 2018. In this year, 7.9 % of all employed men but only 3.4 % of all employed women were working in these sectors [5].

Sustainable transport

In addition to R&D and innovation, well-functioning and efficient transport and mobility systems are key elements for a competitive economy. As the transport sector is responsible for nearly one quarter of greenhouse gas (GHG) emissions in the EU (see the article on [[SDG 13 - Climate action|SDG 13 'Climate action']), sustainable transport is an essential ingredient in sustainable development strategies. Rethinking future mobility includes optimising the use of all modes of transport, car sharing and integration between different modes of collective transport such as train, tram, metro, bus and taxi (multimodal transport). At the EU level, however, the long-term trends of the selected indicators do not point to a shift towards more sustainable transport modes. The dominant modes for freight and passenger transport – trucks and passenger cars, respectively – have further increased their shares since 2000. The short-term trends paint a more favourable picture for passenger transport, including progress towards cleaner car fleets.

Signs of passenger transport becoming more sustainable over the past few years

Growth in transport activities puts increasing pressure on natural resources and on societies. Emissions of greenhouse gases, air pollutants and noise from transport affect the climate, the environment and

human health. The shares of different transport modes in total passenger transport have not changed substantially since 2000, with passenger cars still accounting for almost 83 % of total land passenger transport in the EU [6]. The share of buses and trains has slightly fallen over the same period, from 17.2 % in 2001 to 17.1 % in 2016. In the short term (since 2011), the share of these transport modes has increased moderately, by 0.3 percentage points.

Figure 5: Share of buses and trains in total passenger transport, EU-28, 2000-2016 (% of total inland passenger-km)

Source: Eurostat (sdg_09_50)

The largest increases in the share of cars in total passenger transport over the past five years were recorded in some eastern Member States, reflecting their economic growth and the increase in personal income. While cars remain the dominant mode for passenger transport across the EU, new car fleets are becoming cleaner: average carbon dioxide (CO_2) emissions from new passenger cars have fallen almost continuously since 2007, reaching 118.5 g CO2 per km in 2017. While the emission reduction target for new passenger cars for 2015 (130 g CO2 per km) was met two years in advance, further progress will be needed to also meet the stricter target of 95 g CO2 per km set for 2021.

The decline in car fleets' CO2 emissions can be attributed to newly implemented environmental regulation policies and technological progress. Member States have also managed to speed up the reduction of new cars' CO2 emissions by demand-oriented incentives, such as scrappage schemes, extra taxes on cars with high CO2 emissions, or purchase grants for low-emission vehicles such as

hybrids. However, it should be noted that under real-world driving conditions, new passenger cars emit more CO2 per km than in the laboratory (for a more detailed discussion, see the article on SDG 12 'Responsible consumption and production').

The EU's freight transport system still relies on road transport

Similar to the modal split of passenger transport, the modal split of freight transport has not changed substantially since 2005. Despite the EU policy objective of shifting freight from road to rail, road continues to have by far the largest share of EU freight transport among the three inland transport modes analysed in this report (road, rail and inland waterways). Due to a marked increase in the share of road freight transport from 2014 to 2017, the share of rail and inland waterways in 2017 was lower than in most preceding years, accounting for 23.3 % of total freight transport in the EU. Over the past five years, rail transport in particular has declined in importance (a 1.2 percentage points decrease from 2012 to 2017), reaching 17.3 % in 2017, while the share of inland waterways transport fluctuated between 6 % and 7 % over this period.

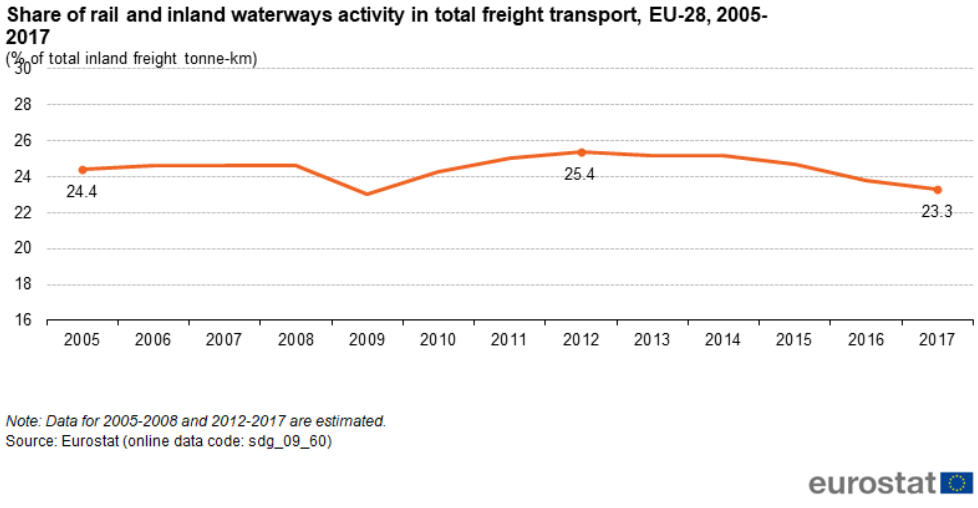

Figure 6: Share of rail and inland waterways activity in total freight transport, EU-28, 2005-2017 (% of total inland freight tonne-km)

Source: Eurostat (sdg_09_60)

Availability of infrastructure is an important factor in the choice of freight transport mode

How transport is organised depends on a country's broader logistical system and the availability of infrastructure for the various transport modes. Even though the modal split between different freight

transport modes does not change substantially from year to year at the EU level, considerable differences do exist at the country level. In 2017, four countries (Latvia, Lithuania, Romania and the Netherlands) had higher freight transport shares for rail and inland waterways than for road. Particularly high shares of rail transport were reported in the Baltic countries (Latvia, Lithuania and Estonia), essentially linked to the transport of Russian energy products to the Baltic ports [7]. In the Netherlands, freight transport via inland waterways still plays a very important role (modal split of 44.7 % in 2017), almost matching the share of road (49.4 % in 2017) [8].

Context

To combat a wide range of political, economic and sustainability challenges the EU is facing, SDG 9 calls on countries to build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation. Inclusive and sustainable industrial development is the primary source of income and allows for rapid and sustained increases in living standards for all people. Research and development (R&D) and innovation drive economic growth, job creation, labour productivity and resource efficiency. They are crucial for a knowledge-based economy and to ensuring EU companies remain competitive. Similarly, investment in sustainable and energy-efficient transport and mobility systems are key elements for achieving sustainable development.

Notes

1. Jump up↑ Reinstaller, A., Unterlass, F., (2012). Comparing business R&D across countries over time: a decomposition exercise using data for the EU27, Applied Economics Letters, 19:12, pp. 1143–1148.
2. Jump up↑ European Commission (2013), Innovation Union Competitiveness Report.
3. Jump up↑ Source: Eurostat (rd_p_persocc).
4. Jump up↑ European Commission (2015), She Figures 2015 — Gender in Research and Innovation, Publications Office of the European Union, Luxembourg, p. 20.
5. Jump up↑ Source: Eurostat (htec_emp_nat2)
6. Jump up↑ Source: Eurostat (tran_hv_psmod).
7. Jump up↑ Eurostat (2018), Freight transport statistics — modal split.
8. Jump up↑ Source: Eurostat (tran_hv_frmod).