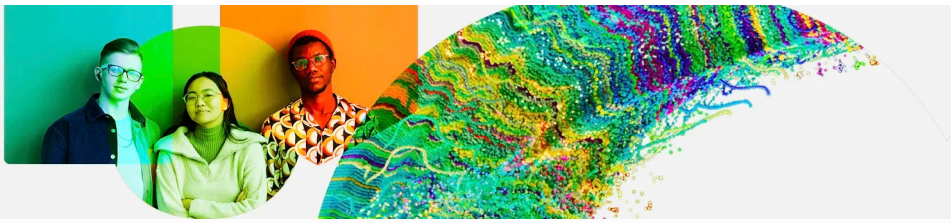
# Global Innovation Index 2024



## Luxembourg ranking in the Global Innovation Index 2024

**Luxembourg ranks 20th among the 133 economies featured in the GII 2024.**

The Global Innovation Index (GII) ranks world economies according to their innovation capabilities. Consisting of roughly 80 indicators, grouped into innovation inputs and outputs, the GII aims to capture the multi-dimensional facets of innovation.



Luxembourg ranks 19th among the 51 high-income group economies.



Luxembourg ranks 12th among the 39 economies in Europe.



### Luxembourg GII Ranking (2020-2024)

The table shows the rankings of Luxembourg over the past four years. Data availability and changes to the GII model framework influence year-on-year comparisons of the GII rankings. The statistical confidence interval for the ranking of Luxembourg in the GII 2024 is between ranks 18 and 24.

| Year | GII Position | Innovation Inputs | Innovation Outputs |
|---|---|---|---|
| 2020 | 18th | 24th | 14th |
| 2021 | 23rd | 26th | 18th |
| 2022 | 19th | 20th | 18th |
| 2023 | 21st | 22nd | 23rd |
| 2024 | 20th | 24th | 21st |

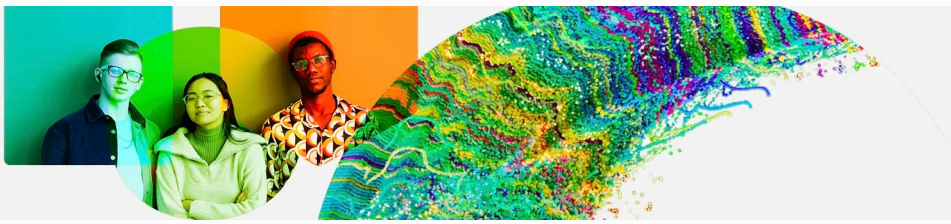
Luxembourg performs better in innovation outputs than innovation inputs in 2024.

This year **Luxembourg ranks 24th in innovation inputs.** This position is lower than last year.

**Luxembourg ranks 21st in innovation outputs.** This position is higher than last year.

Luxembourg has no clusters in the top 100 S&T clusters of the Global Innovation Index.

# Global Innovation Index 2024



## > Global Innovation Tracker

The Global Innovation Tracker 2024 shows what is the current state of innovation in Luxembourg, how rapidly is technology being embraced and what are the resulting societal impacts.

For Luxembourg, 5 indicators have improved in the short-term and 6 indicators have worsened.

### Science and innovation investment

| Scientific publications | R&D investments | Venture capital | | International patent filings |
|---|---|---|---|---|
| | | Deal numbers | Deal values | |
| ▼ -3.6%<br>2022 - 2023 | ▼ -4.9%<br>2021 - 2022 | ▼ -6.2%<br>2022 - 2023 | ▼ -67.6%<br>2022 - 2023 | ▲ 6.7%<br>2022 - 2023 |
| ▲ 7.1%<br>2013 - 2023 | ▲ 0.4%<br>2012 - 2022 | ▲ 22.3%<br>2013 - 2023 | ▲ 33.2%<br>2013 - 2023 | ▼ -2%<br>2013 - 2023 |

### Technology adoption

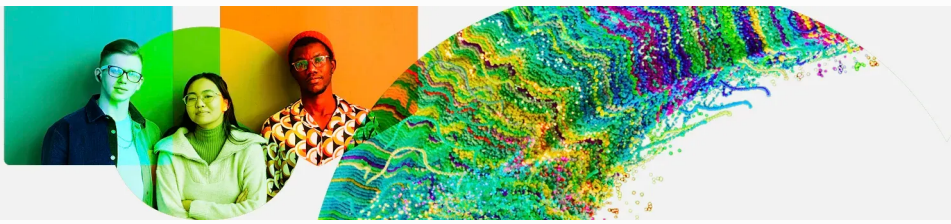
| Safe sanitation | Connectivity | | Robots | Electric vehicles |
|---|---|---|---|---|
| | Fixed broadband | 5G | | |
| ▲ 0.3%<br>2021 - 2022 | ▲ 1.5%<br>2021 - 2022 | ▲ 367.6%<br>2021 - 2022 | n/a | n/a |
| ▲ 0.3%<br>2012 - 2022 | ▲ 1.9%<br>2012 - 2022 | | n/a | n/a |
| 95.8<br>per 100 inhabitants in 2022 | 38.7<br>per 100 inhabitants in 2022 | 98<br>per 100 inhabitants in 2022 | | n/a |

### Socioeconomic impact

| Labor productivity | Life expectancy | Temperature change |
|---|---|---|
| ▼ -3.5%<br>2022 - 2023 | ▲ 0.5%<br>2021 - 2022 | ▲ 2.6°C<br>2023 |
| ▼ -0.4%<br>2013 - 2023 | ▲ 0.2%<br>2012 - 2022 | n/a |
| 182,238<br>USD in 2023 | 83<br>years in 2022 | |

Notes: Not all indicators of the Global Innovation Tracker are used to calculate the Global Innovation Index. Long-term annual growth refers to the compound annual growth rate (CAGR) over the indicated period. For each variable, a one-year growth rate is set for the short run, and ten-year CAGR is set for the long run; time windows might differ when gaps exist in data availability. The end period corresponds to the most recent available observation, which may differ among countries. Temperature change is an exception: it indicates the change in degrees Celsius with respect to the average temperature in the country from 1951–1980. Figures are rounded.

# Global Innovation Index 2024



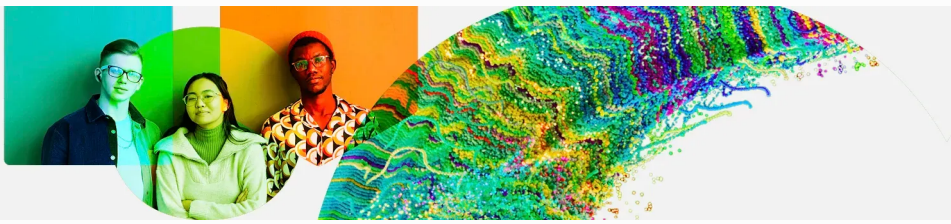
## Expected vs. observed innovation performance

The bubble chart below shows the relationship between income levels (GDP per capita) and innovation performance (GII score). The trend line gives an indication of the expected innovation performance according to income level. Economies appearing above the trend line are performing better than expected and those below are performing below expectations.

Luxembourg is an innovation leader, ranking in the top 25 of the GII.

> Innovation overperformers relative to their economic development

Global Innovation Index 2024



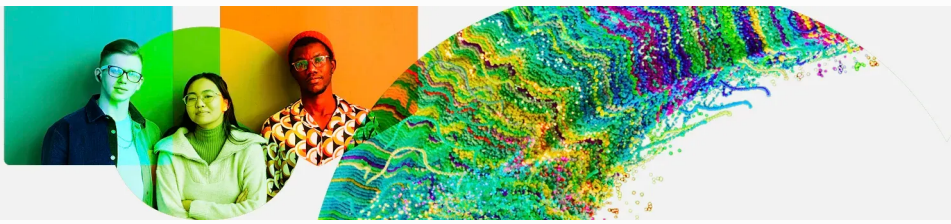
## Effectively translating innovation investments into innovation outputs

The chart below shows the relationship between innovation inputs and innovation outputs. Economies above the line are effectively translating costly innovation investments into more and higher-quality outputs.

Luxembourg produces less innovation outputs relative to its level of innovation investments.

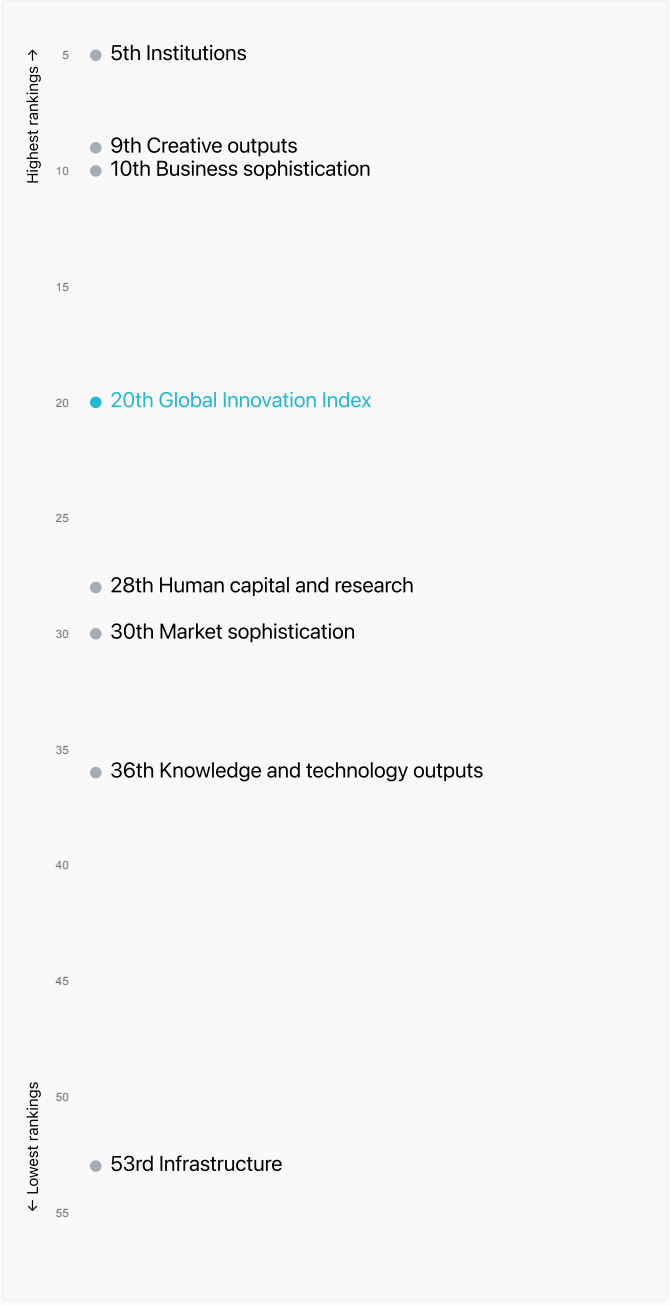
> Relationship between innovation inputs and outputs

# Global Innovation Index 2024



## Overview of Luxembourg's rankings in the seven areas of the GII in 2024

The chart shows the ranking for each of the seven areas that the GII comprises. The strongest areas for Luxembourg are those that rank above the GII (shown in blue) and the weakest are those that rank below.




### Highest rankings

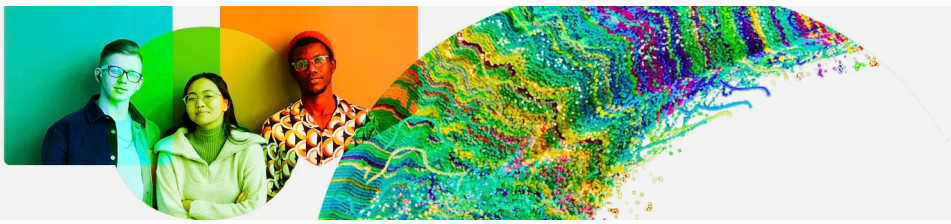
Luxembourg ranks highest in Institutions (5th), Creative outputs (9th) and Business sophistication (10th).

### Lowest rankings

Luxembourg ranks lowest in Infrastructure (53rd), Knowledge and technology outputs (36th) and Market sophistication (30th).

The full WIPO Intellectual Property Statistics profile for Luxembourg can be found on this link.

# Global Innovation Index 2024



## Benchmark of Luxembourg against other economy groupings for each of the seven areas of the GII Index

The charts shows the relative position of Luxembourg (blue bar) against other economy groupings (grey bars), for each of the seven areas of the GII Index.

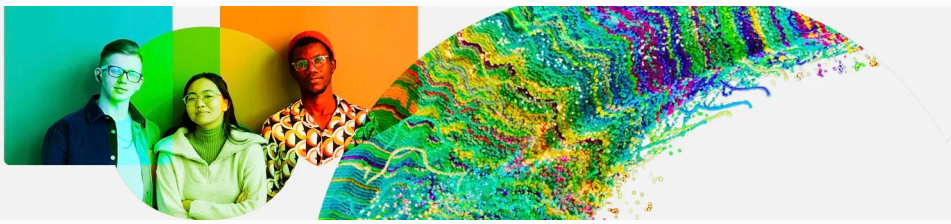
### High-Income economies

Luxembourg performs above the high-income group average in Institutions, Market sophistication, Business sophistication, Creative outputs.

### Europe

Luxembourg performs above the regional average in Institutions, Human capital and research, Market sophistication, Business sophistication, Creative outputs.

Global Innovation Index 2024



## Innovation strengths and weaknesses in Luxembourg

The table below gives an overview of the indicator strengths and weaknesses of Luxembourg in the GII 2024.

Luxembourg's main innovation strengths are **Cultural and creative services exports, % total trade** (rank 1), **ICT access*** (rank 1) and **ICT services imports, % total trade** (rank 1).

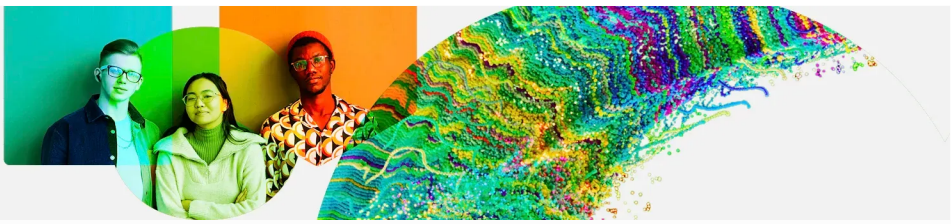
Strengths

| Rank | Code | Indicator name |
|---|---|---|
| 1 | 7.2.1 | Cultural and creative services exports, % total trade |
| 1 | 3.1.1 | ICT access* |
| 1 | 5.3.3 | ICT services imports, % total trade |
| 1 | 5.3.1 | Intellectual property payments, % total trade |
| 1 | 5.1.1 | Knowledge-intensive employment, % |
| 1 | 2.2.3 | Tertiary inbound mobility, % |
| 3 | 1.3.1 | Policy stability for doing business† |
| 4 | 5.1.2 | Firms offering formal training, % |
| 4 | 1.2.2 | Rule of law* |
| 4 | 4.2.2 | Venture capital (VC) investors, deals/bn PPP$ GDP |
| 5 | 1.1.2 | Government effectiveness* |
| 5 | 1.2.1 | Regulatory quality* |
| 5 | 7.3.1 | Top-level domains (TLDs)/th pop. 15–69 |

Weaknesses

| Rank | Code | Indicator name |
|---|---|---|
| 132 | 5.3.2 | High-tech imports, % total trade |
| 131 | 5.3.4 | FDI net inflows, % GDP |
| 116 | 6.2.1 | Labor productivity growth, % |
| 111 | 3.2.3 | Gross capital formation, % GDP |
| 99 | 2.2.1 | Tertiary enrolment, % gross |
| 98 | 3.3.2 | Low-carbon energy use, % |
| 96 | 7.2.4 | Creative goods exports, % total trade |
| 96 | 6.3.5 | ISO 9001 quality/bn PPP$ GDP |
| 92 | 4.3.3 | Domestic market scale, bn PPP$ |
| 75 | 2.3.4 | QS university ranking, top 3* |

# Global Innovation Index 2024



## Luxembourg's innovation system

As far as practicable, the plots below present unscaled indicator data.

### Innovation inputs in Luxembourg


2.1.1 **Expenditure on education**

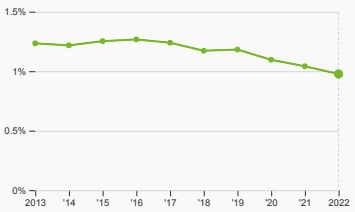
was equal to 4.7 % GDP in 2022, up by 0.003 percentage points from the year prior – and equivalent to an indicator rank of 48.


2.2.2 **Graduates in science and engineering**

was equal to 22.88 % of total graduates in 2022, up by 3.1 percentage points from the year prior – and equivalent to an indicator rank of 61.

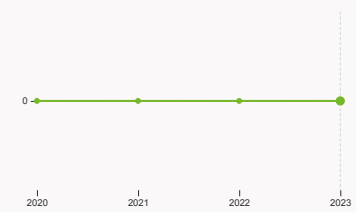

2.3.1 **Researchers**

was equal to 4881.03 FTE per million population in 2022, down by 1.2% from the year prior – and equivalent to an indicator rank of 21.




2.3.2 **Gross expenditure on R&D**

was equal to 0.98 % GDP in 2022, down by 0.07 percentage points from the year prior – and equivalent to an indicator rank of 40.



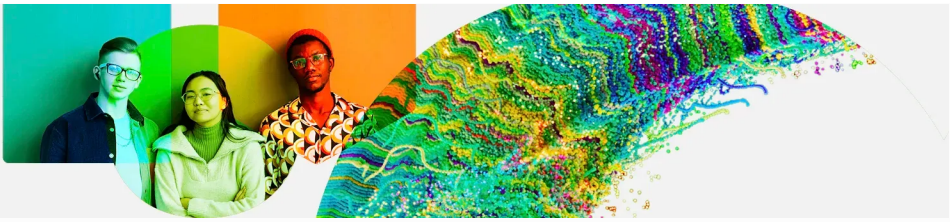

2.3.4 **QS university ranking**

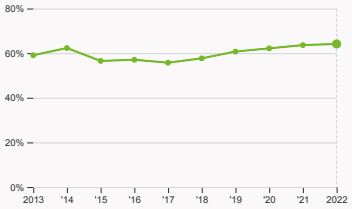
was equal to an average score of 0 for the top three universities in 2023 with no change from the year prior – and equivalent to an indicator rank of 75.


4.2.4 **VC received, value**

was equal to 190.48 thousand USD in 2023, down by 67.57% from the year prior – and equivalent to an indicator rank of 12.

# Global Innovation Index 2024

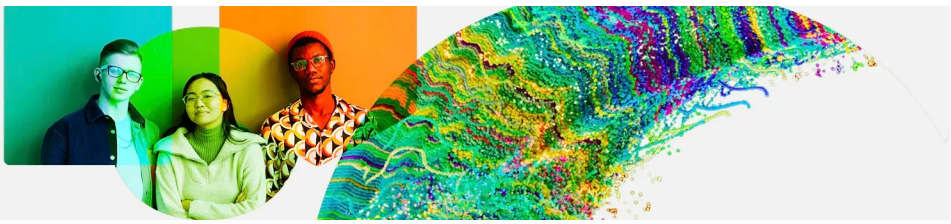




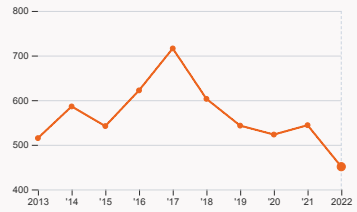

5.1.1 **Knowledge-intensive employment**

was equal to 64.14 % in 2022, up by 0.53 percentage points from the year prior – and equivalent to an indicator rank of 1.

# Global Innovation Index 2024

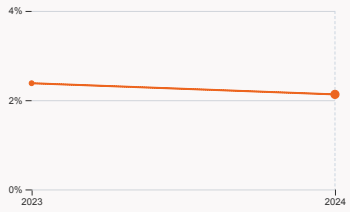


## Innovation outputs in Luxembourg



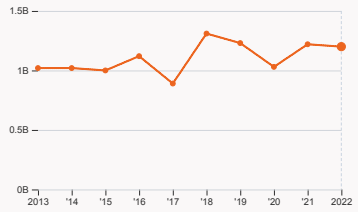

### 6.1.1 Patents by origin

was equal to 451 patents in 2022, down by 17.1% from the year prior – and equivalent to an indicator rank of 15.



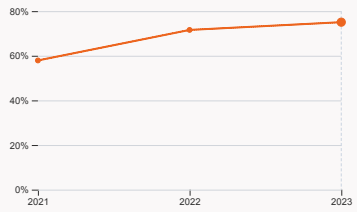

### 6.2.2 Unicorn valuation

was equal to 2.13 % GDP in 2024, down by 0.25 percentage points from the year prior – and equivalent to an indicator rank of 16.



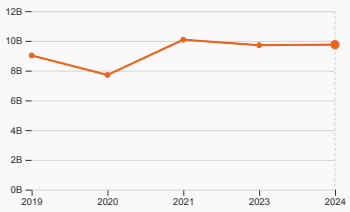

### 6.3.3 High-tech exports

was equal to 1.2 billion USD in 2022, down by 1.64% from the year prior – and equivalent to an indicator rank of 82.




### 7.1.1 Intangible asset intensity

was equal to 75.05 % for the top 15 companies in 2023, up by 3.47 percentage points from the year prior – and equivalent to an indicator rank of 12.




### 7.1.3 Global brand value

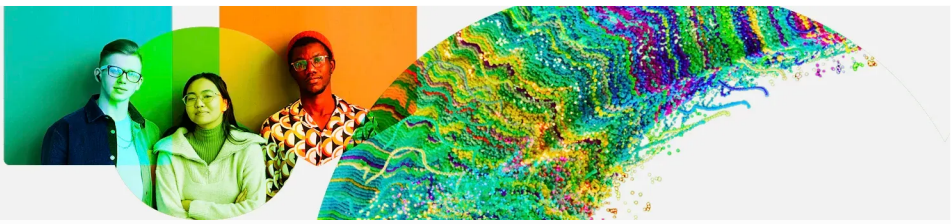
was equal to 9.75 billion USD for the brands in the top 5,000 in 2024, up by 0.41% from the year prior – and equivalent to an indicator rank of 15.


### 7.2.2 National feature films

was equal to 5 films in 2022, up by 400% from the year prior – and equivalent to an indicator rank of 6.


### 7.3.3 Mobile app creation

was equal to 43.42 million global downloads of mobile apps in 2023, down by 33.23% from the year prior – and equivalent to an indicator rank of 35.



# Luxembourg's innovation top performers

## 2.3.3 Global corporate R&D investors from Luxembourg

| Rank | Firm | Industry | R&D | R&D Growth | R&D Intensity |
|---|---|---|---|---|---|
| | | | [mn EUR] | [%] | [%] |
| 175 | SPOTIFY | Software & Computer Services | 1,347 | 52 | 11 |
| 630 | ARCELORMITTAL | Industrial Metals & Mining | 294 | 1 | 0.4 |
| 1400 | OUTSYSTEMS | Financial Services | 113 | 36 | 41 |
| 1462 | SUSE | Software & Computer Services | 106 | 12 | 17 |

Source: European Commission's Joint Research Centre (https://iri.jrc.ec.europa.eu/scoreboard/2022-eu-industrial-rd-investment-scoreboard).
Note: European Commission's Joint Research Centre ranks the top 2,500 firms by R&D investment annually.

## 6.2.2 Top Unicorn Companies in Luxembourg

| Rank | Unicorn Company | Industry | City | Valuation, bn USD |
|---|---|---|---|---|
| 1 | OCSIAL | Industrials | Leudelange | 2 |

Source: CBInsights, Tracker – The Complete List of Unicorn Companies: https://www.cbinsights.com/research-unicorn-companies

## 7.1.1 Top 15 intangible-asset intensive companies in Luxembourg

| Rank | Firm | Intensity, % |
|---|---|---|
| 1 | SPOTIFY TECHNOLOGY S.A. | 90.22 |
| 2 | EUROFINS SCIENTIFIC SE | 84.47 |
| 3 | ALLEGRO.EU SA | 98.62 |

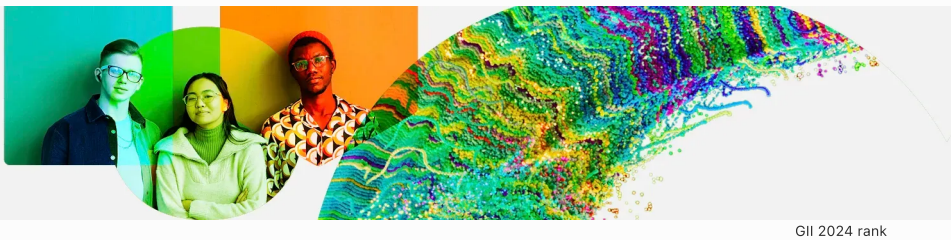
Source: Brand Finance (https://brandirectory.com/reports/gift-2022).
Note: Brand Finance only provides within economy ranks.

## 7.1.3 Top 5,000 companies in Luxembourg with highest global brand value

| Rank | Brand | Industry | Brand Value, mn USD |
|---|---|---|---|
| 1 | ARCELORMITTAL | Mining, Iron & Steel | 4,648.9 |
| 2 | EUROFINS SCIENTIFIC | Healthcare Facilities | 1,741.6 |
| 3 | TENARIS | Engineering | 1,070.7 |

Source: Brand Finance (https://brandirectory.com).
Note: Rank corresponds to within economy ranks.

# Global Innovation Index 2024



# Luxembourg

GII 2024 rank **20**

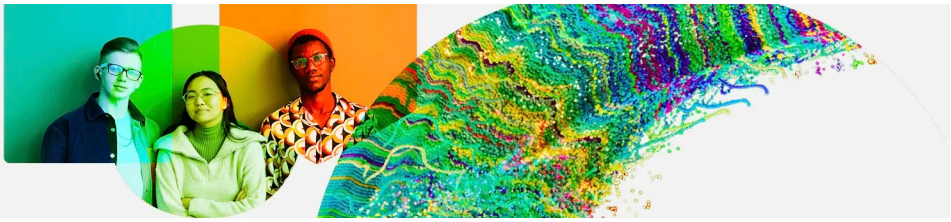
| Output rank | Input rank | Income | Region | Population (mn) | GDP, PPP$ (bn) | GDP per capita, PPP$ |
|---|---|---|---|---|---|---|
| 21 | 24 | High | EUR | 0.7 | 94.2 | 143,303.6 |

| | Score / Value | Rank | |
|---|---|---|---|
| **Institutions** | **83.9** | **5** | ●◆ |
| **1.1 Institutional environment** | **88.1** | **7** | |
| 1.1.1 Operational stability for businesses* | 86 | 11 | |
| 1.1.2 Government effectiveness* | 90.3 | 5 | ●◆ |
| **1.2 Regulatory environment** | **92.3** | **4** | ●◆ |
| 1.2.1 Regulatory quality* | 90 | 5 | ●◆ |
| 1.2.2 Rule of law* | 94.6 | 4 | ●◆ |
| **1.3 Business environment** | **71.3** | **20** | |
| 1.3.1 Policy stability for doing business† | 92.2 | 3 | ●◆ |
| 1.3.2 Entrepreneurship policies and culture† | 50.4 | 26 | |
| **Human capital and research** | **46.9** | **28** | ◇ |
| **2.1 Education** | **57.2** | **52** | ◇ |
| 2.1.1 Expenditure on education, % GDP | 4.7 | 48 | |
| 2.1.2 Government funding/pupil, secondary, % GDP/cap | 21.3 | 41 | |
| 2.1.3 School life expectancy, years | 14.2 | 65 | ◇ |
| 2.1.4 PISA scales in reading, maths and science | 476.7 | 32 | |
| 2.1.5 Pupil–teacher ratio, secondary | 7.8 | 8 | ◆ |
| **2.2 Tertiary education** | **52** | **11** | |
| 2.2.1 Tertiary enrolment, % gross | 20.7 | 99 | ○◇ |
| 2.2.2 Graduates in science and engineering, % | 22.9 | 61 | |
| 2.2.3 Tertiary inbound mobility, % | 49.3 | 1 | ●◆ |
| **2.3 Research and development (R&D)** | **31.7** | **33** | ◇ |
| 2.3.1 Researchers, FTE/mn pop. | 4,881 | 21 | |
| 2.3.2 Gross expenditure on R&D, % GDP | 1 | 40 | ◇ |
| 2.3.3 Global corporate R&D investors, top 3, mn USD | 61.7 | 22 | |
| 2.3.4 QS university ranking, top 3* | 0 | 75 | ○◇ |
| **Infrastructure** | **45.7** | **53** | ◇ |
| **3.1 Information and communication technologies (ICTs)** | **85.1** | **25** | |
| 3.1.1 ICT access* | 100 | 1 | ●◆ |
| 3.1.2 ICT use* | 84.4 | 35 | |
| 3.1.3 Government's online service* | 81.4 | 29 | |
| 3.1.4 E-participation* | 74.4 | 25 | |
| **3.2 General infrastructure** | **29.3** | **73** | ◇ |
| 3.2.1 Electricity output, GWh/mn pop. | 1,771 | 86 | ◇ |
| 3.2.2 Logistics performance* | 68.2 | 25 | ◇ |
| 3.2.3 Gross capital formation, % GDP | 18.2 | 111 | ○◇ |
| **3.3 Ecological sustainability** | **22.7** | **57** | |
| 3.3.1 GDP/unit of energy use | 22.7 | 7 | |
| 3.3.2 Low-carbon energy use, % | 7 | 98 | ○◇ |
| 3.3.3 ISO 14001 environment/bn PPP$ GDP | 1 | 71 | |
| **Market sophistication** | **45.8** | **30** | ◇ |
| **4.1 Credit** | **42.2** | **34** | |
| 4.1.1 Finance for startups and scaleups† | 47.9 | 45 | ◇ |
| 4.1.2 Domestic credit to private sector, % GDP | 101.5 | 21 | |
| 4.1.3 Loans from microfinance institutions, % GDP | n/a | n/a | |
| **4.2 Investment** | **48.8** | **13** | |
| 4.2.1 Market capitalization, % GDP | 67.9 | 28 | |
| 4.2.2 Venture capital (VC) investors, deals/bn PPP$ GDP | 1.6 | 4 | ●◆ |
| 4.2.3 VC recipients, deals/bn PPP$ GDP | 0.1 | 23 | |
| 4.2.4 VC received, value, % GDP | 0.005 | 12 | |
| **4.3 Trade, diversification and market scale** | **46.4** | **87** | ◇ |
| 4.3.1 Applied tariff rate, weighted avg., % | 1.1 | 21 | |
| 4.3.2 Domestic industry diversification | n/a | n/a | |
| 4.3.3 Domestic market scale, bn PPP$ | 94.2 | 92 | ○ |

| | Score / Value | Rank | |
|---|---|---|---|
| **Business sophistication** | **58.3** | **10** | |
| **5.1 Knowledge workers** | **69.2** | **13** | |
| 5.1.1 Knowledge-intensive employment, % | 64.1 | 1 | ●◆ |
| 5.1.2 Firms offering formal training, % | 66.1 | 4 | ●◆ |
| 5.1.3 GERD performed by business, % GDP | 0.5 | 40 | ◇ |
| 5.1.4 GERD financed by business, % | 44.2 | 39 | ◇ |
| 5.1.5 Females employed w/advanced degrees, % | 27.6 | 12 | |
| **5.2 Innovation linkages** | **56.7** | **15** | |
| 5.2.1 Public Research-Industry co-publications, % | 4 | 19 | |
| 5.2.2 University-industry R&D collaboration† | 78 | 17 | |
| 5.2.3 State of cluster development† | 75.2 | 27 | |
| 5.2.4 Joint venture/strategic alliance deals/bn PPP$ GDP | 0.1 | 15 | |
| 5.2.5 Patent families/bn PPP$ GDP | 3.6 | 12 | |
| **5.3 Knowledge absorption** | **48.8** | **12** | |
| 5.3.1 Intellectual property payments, % total trade | 5.4 | 1 | ●◆ |
| 5.3.2 High-tech imports, % total trade | 1.5 | 132 | ○◇ |
| 5.3.3 ICT services imports, % total trade | 4.8 | 1 | ●◆ |
| 5.3.4 FDI net inflows, % GDP | -117.3 | 131 | ○◇ |
| 5.3.5 Research talent, % in businesses | 33.2 | 39 | ◇ |
| **Knowledge and technology outputs** | **30.5** | **36** | ◇ |
| **6.1 Knowledge creation** | **39.3** | **22** | |
| 6.1.1 Patents by origin/bn PPP$ GDP | 4.9 | 15 | |
| 6.1.2 PCT patents by origin/bn PPP$ GDP | 3.2 | 10 | |
| 6.1.3 Utility models by origin/bn PPP$ GDP | - | - | |
| 6.1.4 Scientific and technical articles/bn PPP$ GDP | 15.8 | 43 | ◇ |
| 6.1.5 Citable documents H-index | 12 | 66 | ◇ |
| **6.2 Knowledge impact** | **32.3** | **46** | ◇ |
| 6.2.1 Labor productivity growth, % | -0.8 | 116 | ○◇ |
| 6.2.2 Unicorn valuation, % GDP | 2.1 | 16 | |
| 6.2.3 Software spending, % GDP | 0.2 | 80 | ◇ |
| 6.2.4 High-tech manufacturing, % | n/a | n/a | |
| **6.3 Knowledge diffusion** | **20** | **57** | ◇ |
| 6.3.1 Intellectual property receipts, % total trade | 1.5 | 16 | |
| 6.3.2 Production and export complexity | n/a | n/a | |
| 6.3.3 High-tech exports, % total trade | 0.8 | 82 | ◇ |
| 6.3.4 ICT services exports, % total trade | 3.2 | 37 | |
| 6.3.5 ISO 9001 quality/bn PPP$ GDP | 1.9 | 96 | ○◇ |
| **Creative outputs** | **53.6** | **9** | |
| **7.1 Intangible assets** | **48.2** | **24** | |
| 7.1.1 Intangible asset intensity, top 15, % | 75 | 12 | |
| 7.1.2 Trademarks by origin/bn PPP$ GDP | 47.6 | 38 | |
| 7.1.3 Global brand value, top 5,000, % GDP | 10.4 | 15 | |
| 7.1.4 Industrial designs by origin/bn PPP$ GDP | 2.5 | 35 | |
| **7.2 Creative goods and services** | **55.1** | **2** | ●◆ |
| 7.2.1 Cultural and creative services exports, % total trade | 6.5 | 1 | ●◆ |
| 7.2.2 National feature films/mn pop. 15–69 | 10.4 | 6 | ◆ |
| 7.2.3 Entertainment and media market/th pop. 15–69 | n/a | n/a | |
| 7.2.4 Creative goods exports, % total trade | 0.1 | 96 | ○ |
| **7.3 Online creativity** | **63** | **14** | |
| 7.3.1 Top-level domains (TLDs)/th pop. 15–69 | 66.8 | 5 | ●◆ |
| 7.3.2 GitHub commits/mn pop. 15–69 | 49.6 | 22 | ◇ |
| 7.3.3 Mobile app creation/bn PPP$ GDP | 72.5 | 35 | |

NOTES: ● indicates a strength; ○ a weakness; ◆ an income group strength; ◇ an income group weakness; * an index; † a survey question, 🕓 that the economy's data is outdated. Square brackets [ ] indicate the the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level; n/a represents missing values; a dash - indicates an indicator which is not relevant to this economy and thus not considered for DMC thresholds.

# Global Innovation Index 2024



## Data availability

The following tables list indicators that are either missing or outdated for Luxembourg.

Luxembourg has missing data for six indicators and outdated data for six indicators.

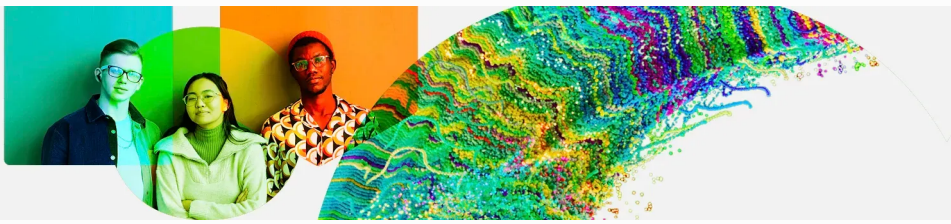
### Missing data for Luxembourg

| Code | Indicator name | Economy Year | Model Year | Source |
|---|---|---|---|---|
| 4.1.3 | Loans from microfinance institutions, % GDP | n/a | 2022 | International Monetary Fund, Financial Access Survey (FAS) |
| 4.3.2 | Domestic industry diversification | n/a | 2021 | United Nations Industrial Development Organization (UNIDO), Industrial Statistics Database (INDSTAT) Rev.3 and 4 |
| 6.1.3 | Utility models by origin/bn PPP$ GDP | n/a | 2022 | World Intellectual Property Organization; International Monetary Fund |
| 6.2.4 | High-tech manufacturing, % | n/a | 2021 | United Nations Industrial Development Organization |
| 6.3.2 | Production and export complexity | n/a | 2021 | Harvard University, Growth Lab |
| 7.2.3 | Entertainment and media market/th pop. 15–69 | n/a | 2023 | PwC, GEMO; United Nations, World Population Prospects; International Monetary Fund |

### Outdated data for Luxembourg

| Code | Indicator name | Economy Year | Model Year | Source |
|---|---|---|---|---|
| 2.1.3 | School life expectancy, years | 2021 | 2022 | UNESCO Institute for Statistics |
| 2.1.4 | PISA scales in reading, maths and science | 2018 | 2022 | OECD, PISA |
| 2.1.5 | Pupil–teacher ratio, secondary | 2021 | 2022 | UNESCO Institute for Statistics |
| 2.2.1 | Tertiary enrolment, % gross | 2021 | 2022 | UNESCO Institute for Statistics |
| 2.2.3 | Tertiary inbound mobility, % | 2021 | 2022 | UNESCO Institute for Statistics |
| 5.1.2 | Firms offering formal training, % | 2020 | 2023 | World Bank Enterprise Surveys |

# Global Innovation Index 2024



## About the Global Innovation Index

- The Global Innovation Index (GII) is published by the World Intellectual Property Organization (WIPO), a specialized agency of the United Nations.
- Recognizing that innovation is a key driver of economic development, the GII aims to provide an innovation ranking and rich analysis referencing around 130 economies. Over the last decade, the GII has established itself as both a leading reference on innovation and a "tool for action" for economies that incorporate the GII into their innovation agendas.


Source: Global Innovation Index Database, WIPO, 2024.

The Index is a ranking of the innovation capabilities and results of world economies. It measures innovation based on criteria that include institutions, human capital and research, infrastructure, credit, investment, linkages; the creation, absorption and diffusion of knowledge; and creative outputs.

The GII has two sub-indices: the Innovation Input Sub-Index and the Innovation Output Sub-Index, and seven pillars, each consisting of three sub-pillars.