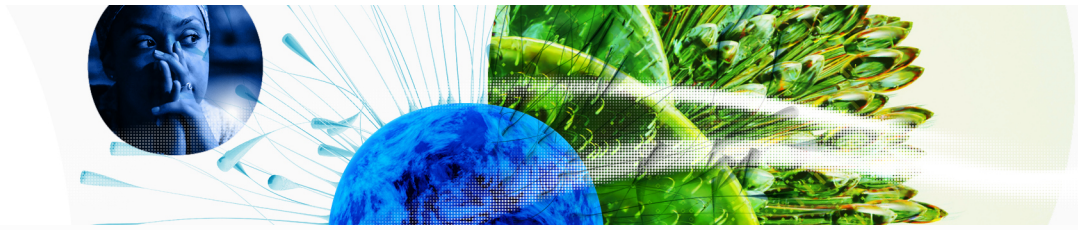
Global Innovation Index 2023



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 ranking in the Global Innovation Index 2023

> Luxembourg ranks 21st among the 132 economies featured in the GII 2023.

> Luxembourg ranks 20th among the 50 high-income group economies.

> Luxembourg ranks 13th among the 39 economies in Europe.

> Luxembourg GII Ranking (2020-2023)

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 2023 is between ranks 18 and 24.

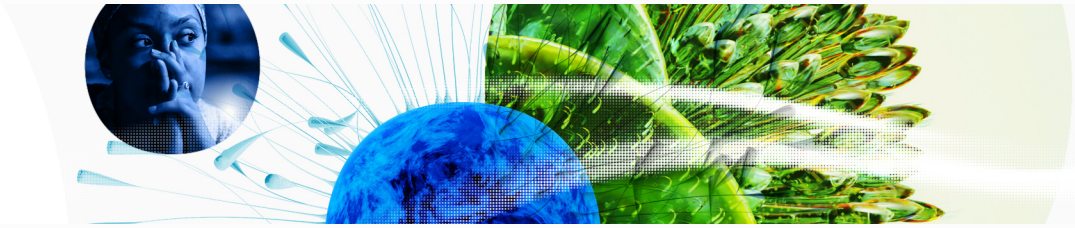
	GII Position	Innovation Inputs	Innovation Outputs
2020	18th	24th	14th
2021	23rd	26th	18th
2022	19th	20th	18th
2023	21st	22nd	23rd

Luxembourg performs worse in innovation outputs than innovation inputs in 2023.

This year Luxembourg ranks 22nd in innovation inputs. This position is lower than last year.

Luxembourg ranks 23rd in innovation outputs. This position is lower than last year.

Global Innovation Index 2023

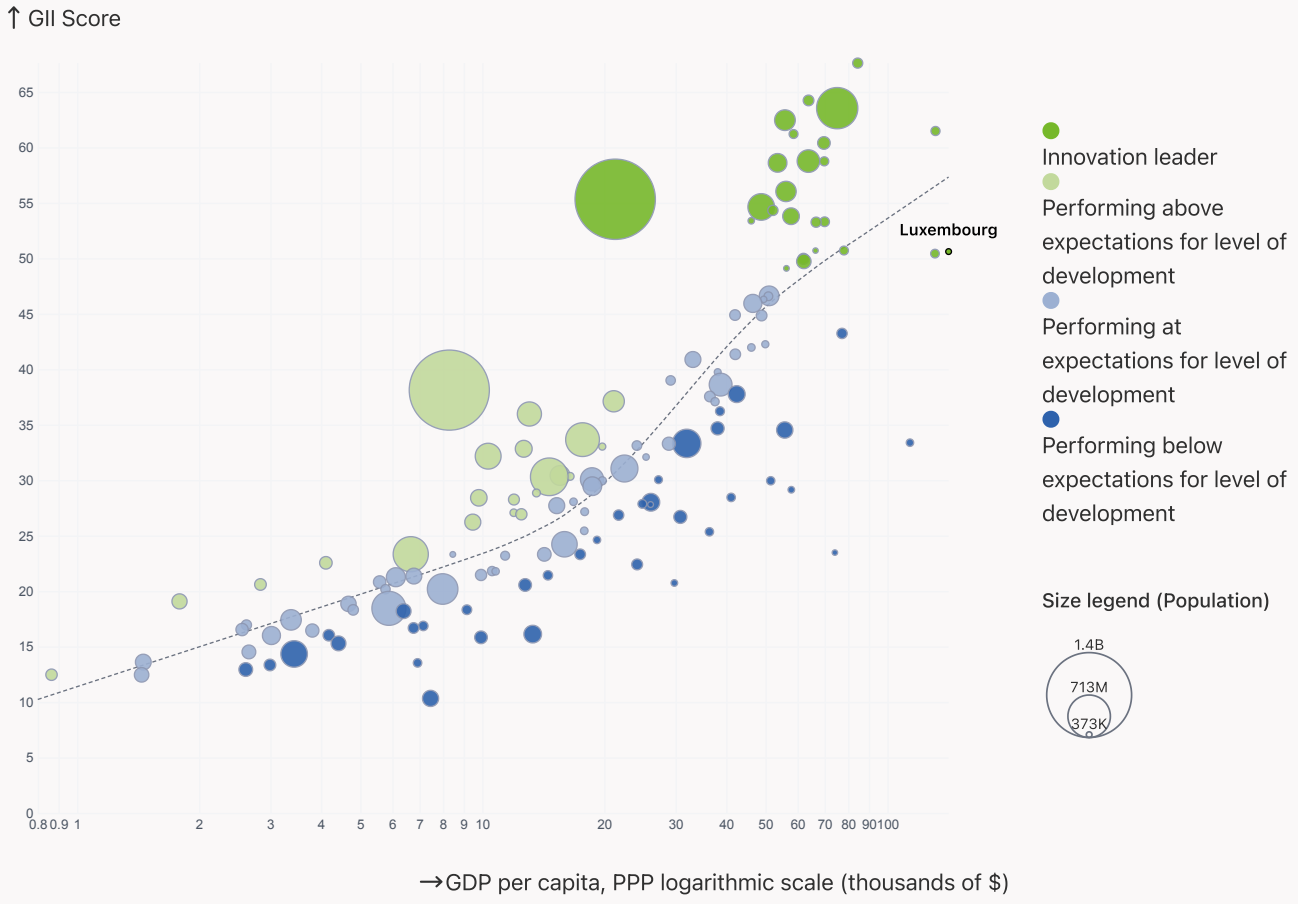


→ Expected vs. observed innovation performance

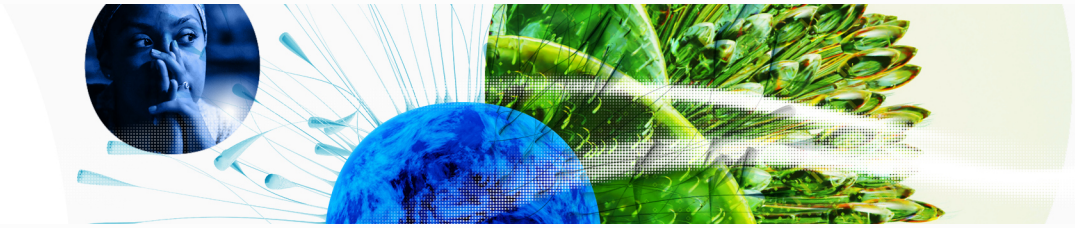
The bubble chart below shows the relationship between income levels (GDP per capita) and innovation performance (GII score). The trend line gives an indication of the expected innovation performance according to income level. Economies appearing above the trend line are performing better than expected 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 2023

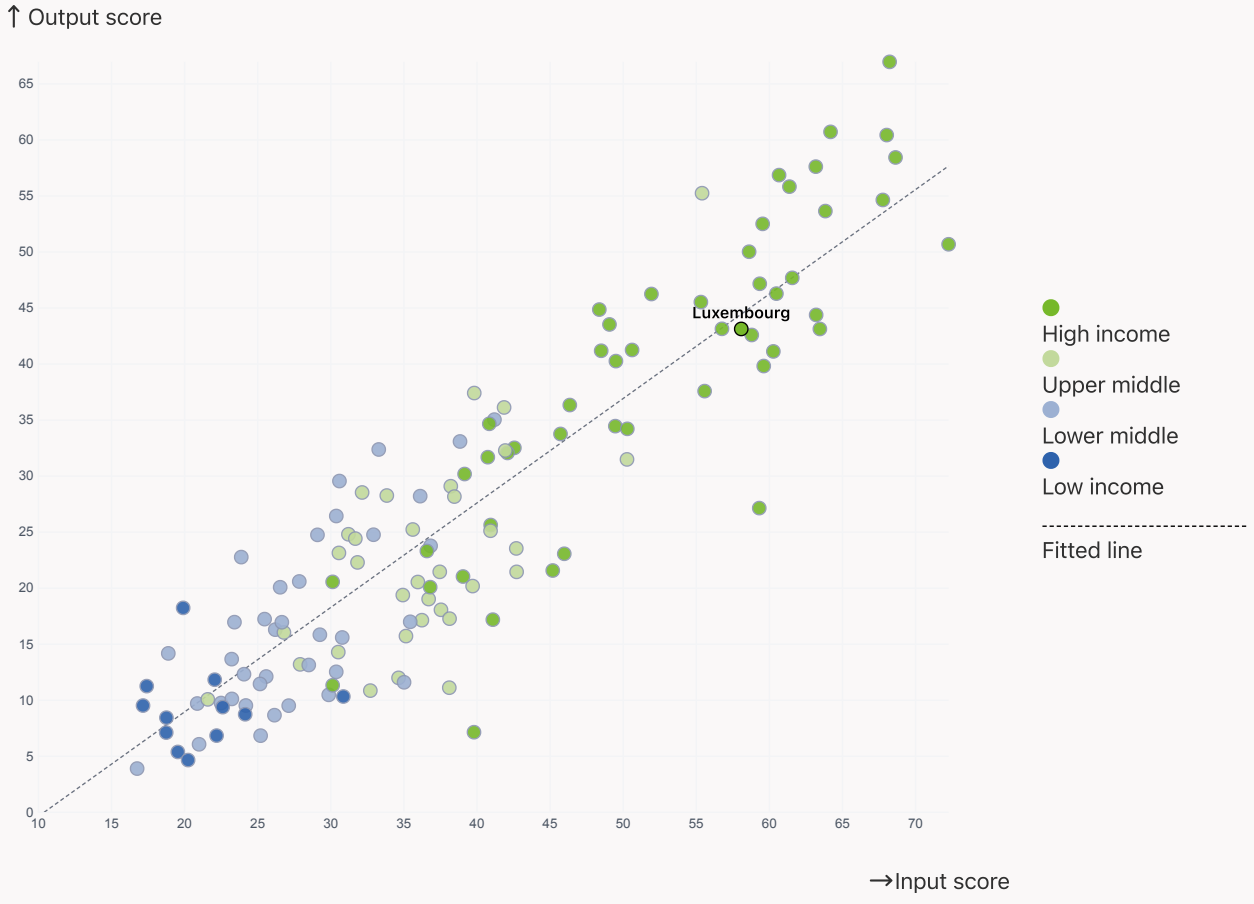


→ Effectively translating innovation investments into innovation outputs

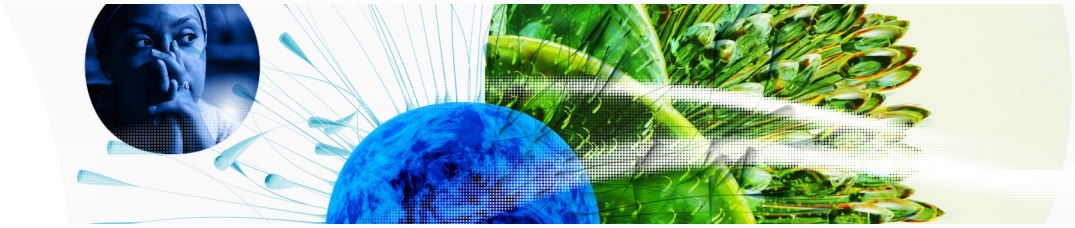
The chart below shows the relationship between innovation inputs and innovation outputs. Economies above the line are effectively translating costly innovation investments into more and higher-quality outputs.

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

> Relationship between innovation inputs and outputs



Global Innovation Index 2023



→ Overview of Luxembourg's rankings in the seven areas of the GII in 2023

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

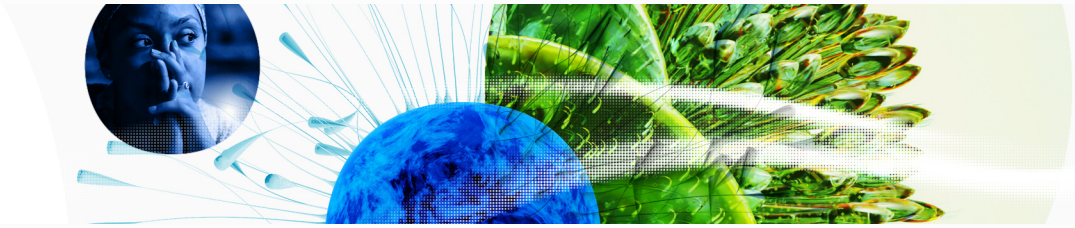
Luxembourg ranks highest in Institutions, Business sophistication (7th) and Creative outputs (11th).

> Lowest rankings

Luxembourg ranks lowest in Knowledge and technology outputs (38th), Market sophistication (35th) and Human capital and research, Infrastructure (31st).

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

Global Innovation Index 2023



→ Benchmark of Luxembourg against other country groupings for each of the seven areas of the GII Index

The charts shows the relative position of Luxembourg (blue bar) against other country 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 Creative outputs, Business sophistication, Institutions.

> Europe

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

Knowledge and technology outputs

- Top 10 | Score: 58.96
- Europe | Score: 38.80
- High income | Score: 38.62
- Luxembourg | Score: 31.94

Creative outputs

- Top 10 | 56.09
- Luxembourg | 54.21
- High income | 40.27
- Europe | 39.87

Business sophistication

- Top 10 | 64.39
- Luxembourg | 63.81
- High income | 46.38
- Europe | 44.61

Market sophistication

- Top 10 | 61.93
- High income | 46.42
- Luxembourg | 45.20
- Europe | 43.65

Human capital and research

- Top 10 | 60.28
- High income | 46.30
- Luxembourg | 44.42
- Europe | 44.05

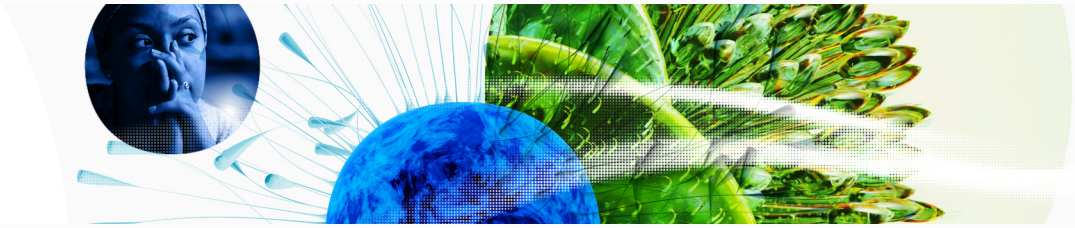
Infrastructure

- Top 10 | 62.83
- High income | 55.85
- Luxembourg | 55.57
- Europe | 54.69

Institutions

- Luxembourg | 81.60
- Top 10 | 79.85
- High income | 68.16
- Europe | 61.69

Global Innovation Index 2023



→ Innovation strengths and weaknesses in Luxembourg

The table below gives an overview of the indicator strengths and weaknesses of Luxembourg in the GII 2023.

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

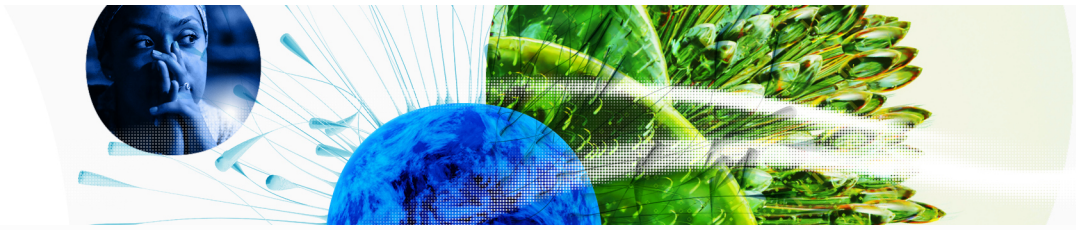
Strengths

Rank	Code	Indicator name
1	7.2.1	Cultural and creative services exports, % total trade
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, %
2	5.3.4	FDI net inflows, % GDP
2	3.1.1	ICT access
2	1.2.1	Regulatory quality
2	4.2.2	Venture capital (VC) investors, deals/bn PPP$ GDP
3	1.3.1	Policies for doing business
4	7.3.1	Generic top-level domains (TLDs)/th pop. 15-69

Weaknesses

Rank	Code	Indicator name
132	5.3.2	High-tech imports, % total trade
119	6.2.1	Labor productivity growth, %
106	3.2.3	Gross capital formation, % GDP
101	2.2.1	Tertiary enrolment, % gross
97	7.2.4	Creative goods exports, % total trade
95	1.2.3	Cost of redundancy dismissal
89	4.3.3	Domestic market scale, bn PPP$
88	6.3.3	High-tech exports, % total trade
81	2.2.2	Graduates in science and engineering, %
71	2.3.4	QS university ranking, top 3

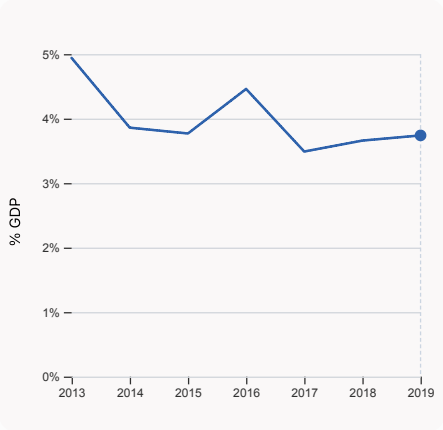
Global Innovation Index 2023



→ Luxembourg's innovation system

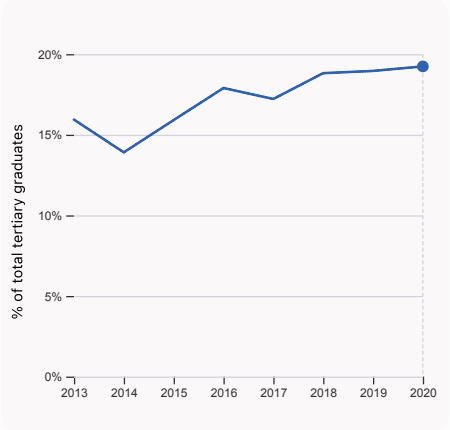
As far as practicable, the plots below present unscaled indicator data.

> Innovation inputs in Luxembourg



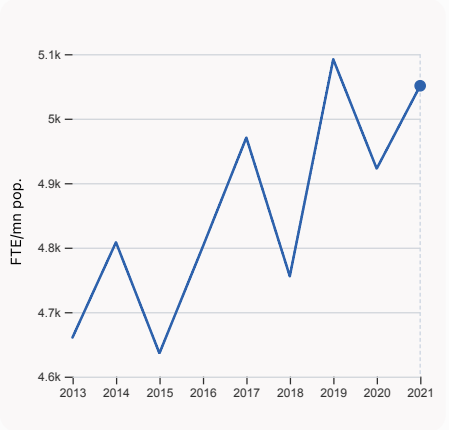
2.1.1 Expenditure on education, % GDP

was equal to 3.74% GDP in 2019, up by 0.08 percentage points from the year prior – and equivalent to an indicator rank of 81.



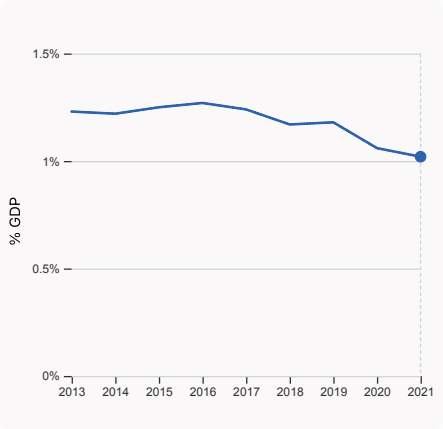
2.2.2 Graduates in science and engineering, %

was equal to 19.24% of total tertiary graduates in 2020, up by 0.28 percentage points from the year prior – and equivalent to an indicator rank of 81.



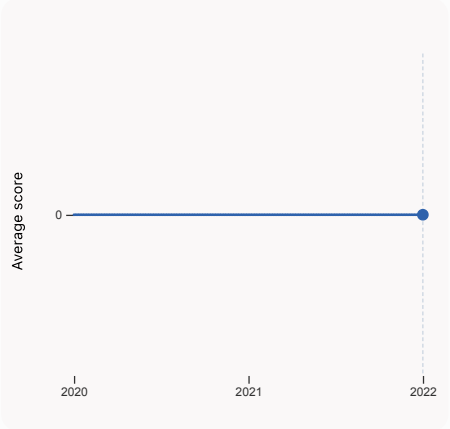
2.3.1 Researchers, FTE/mn pop.

was equal to 5,050.97 FTE/mn pop. in 2021, up by 2.61% from the year prior – and equivalent to an indicator rank of 17.



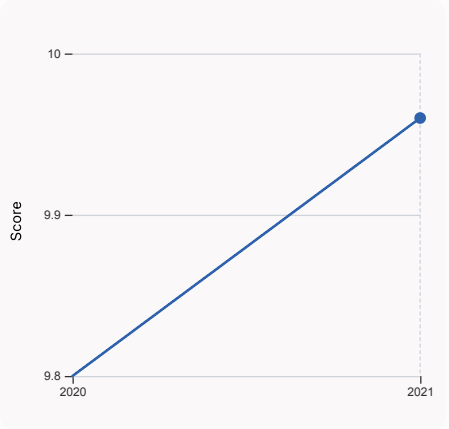
2.3.2 Gross expenditure on R&D, % GDP

was equal to 1.02% GDP in 2021, down by 0.04 percentage points from the year prior – and equivalent to an indicator rank of 39.



2.3.4 QS university ranking, top 3

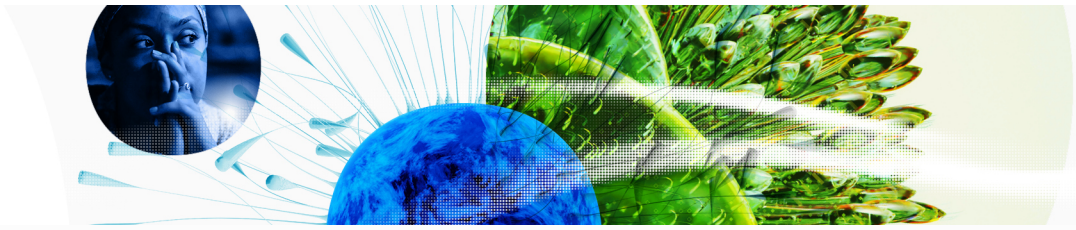
was equal to an average score of 0 for the top 3 universities in 2022, equivalent to an indicator rank of 71.

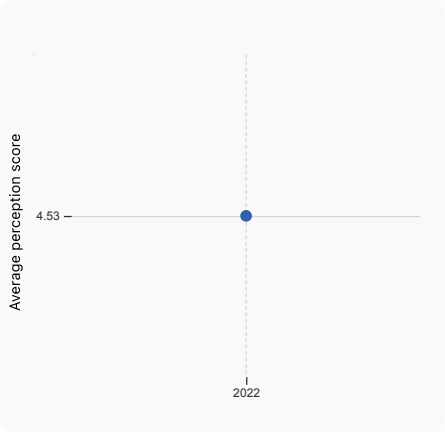


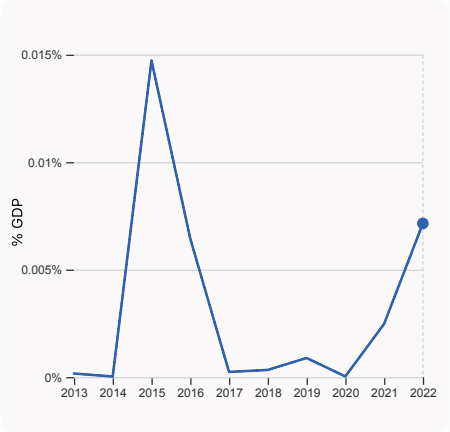
3.1.1 ICT access

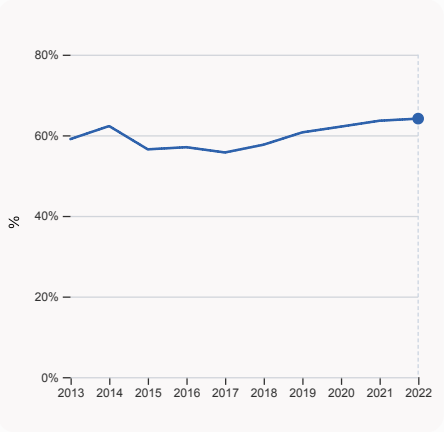
was equal to a score of 9.96 in 2021, up by 1.63% from the year prior – and equivalent to an indicator rank of 2.

Global Innovation Index 2023









4.1.1 Finance for startups and scaleups

was equal to an average perception score of 4.53 in 2022, equivalent to an indicator rank of 48.

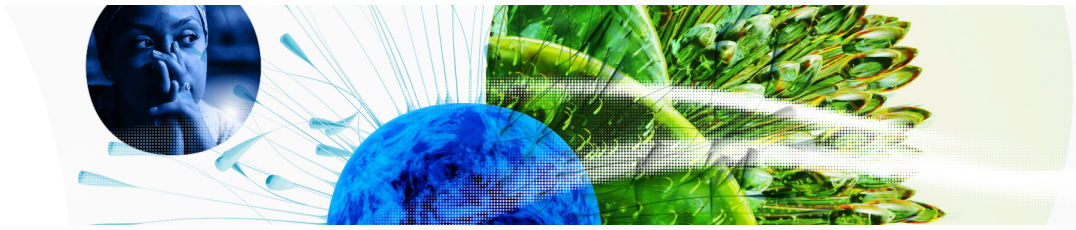
4.2.4 VC received, value, % GDP

was equal to 0.00715% GDP in 2022, up by 0.0047 percentage points from the year prior – and equivalent to an indicator rank of 21.

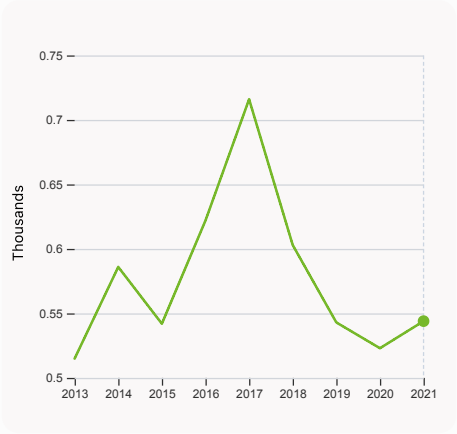
5.1.1 Knowledge-intensive employment, %

was equal to 64.13% in 2022, up by 0.52 percentage points from the year prior – and equivalent to an indicator rank of 1.

Global Innovation Index 2023

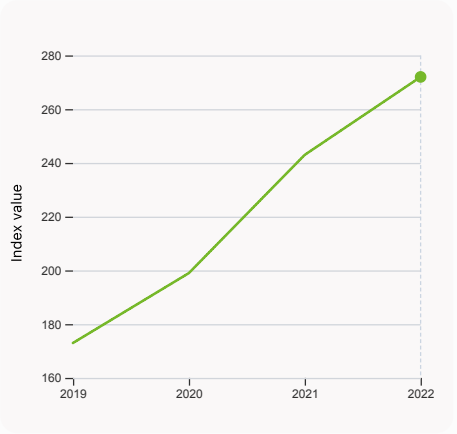


> Innovation outputs in Luxembourg



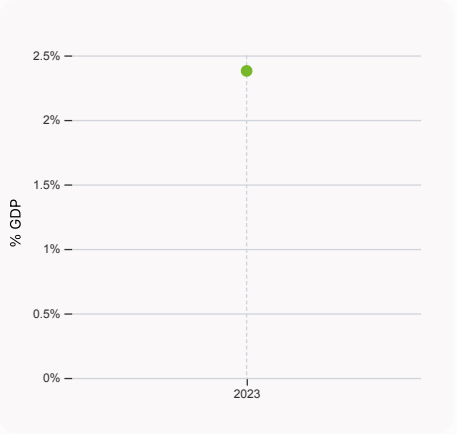
6.1.1 Patents by origin

was equal to 0.54 Thousands in 2021, up by 4.015% from the year prior – and equivalent to an indicator rank of 14.



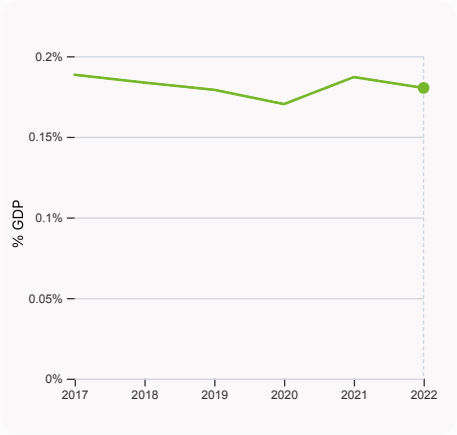
6.1.5 Citable documents H-index

was equal to an index value of 272 in 2022, up by 11.93% from the year prior – and equivalent to an indicator rank of 65.



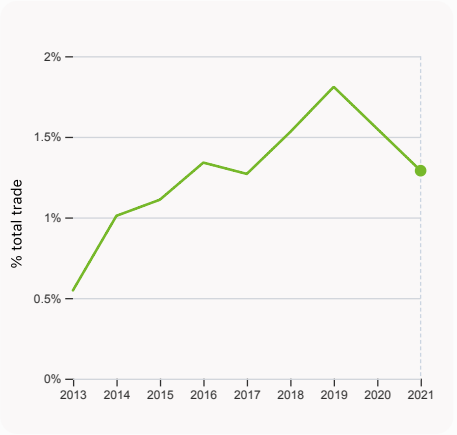
6.2.2 Unicorn valuation, % GDP

was equal to 2.38 % GDP in 2023 – and equivalent to an indicator rank of 15.



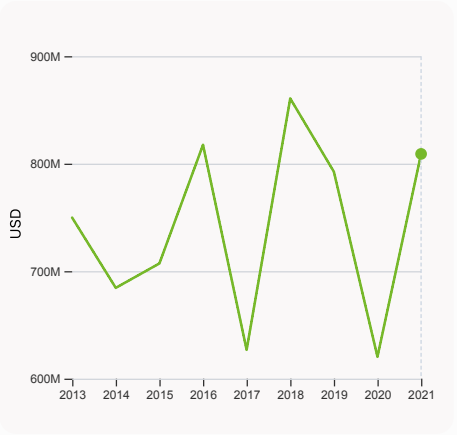
6.2.3 Software spending, % GDP

was equal to 0.18% GDP in 2022, down by 0.0067 percentage points from the year prior – and equivalent to an indicator rank of 78.



6.3.1 Intellectual property receipts, % total trade

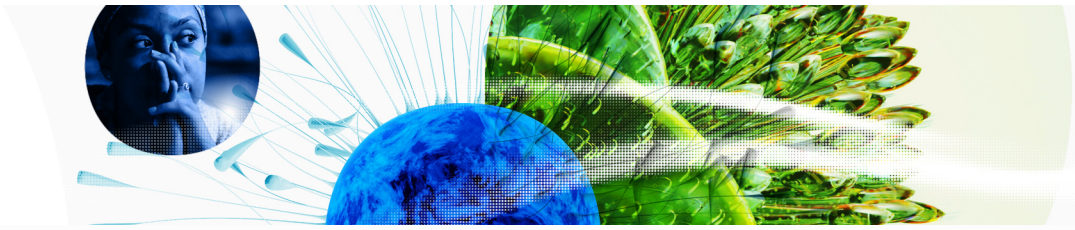
was equal to 1.29% total trade in 2021, down by 0.26 percentage points from the year prior – and equivalent to an indicator rank of 17.

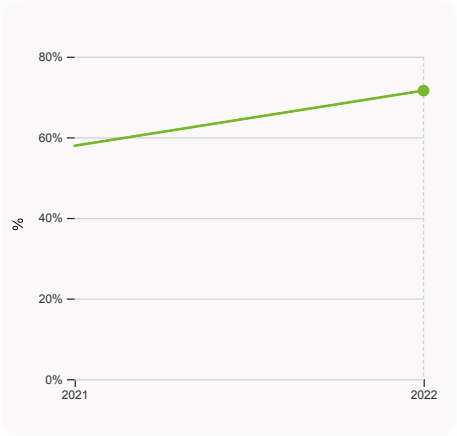


6.3.3 High-tech exports

was equal to 809,095,343 USD in 2021, up by 30.42% from the year prior – and equivalent to an indicator rank of 88.

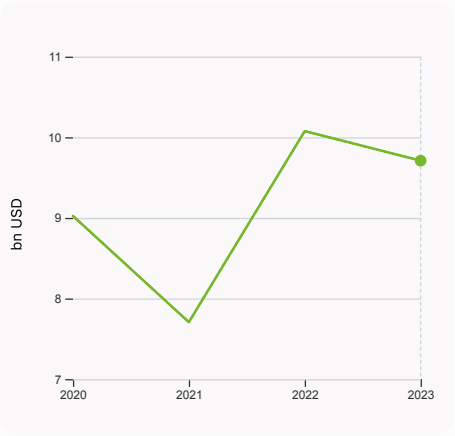
Global Innovation Index 2023





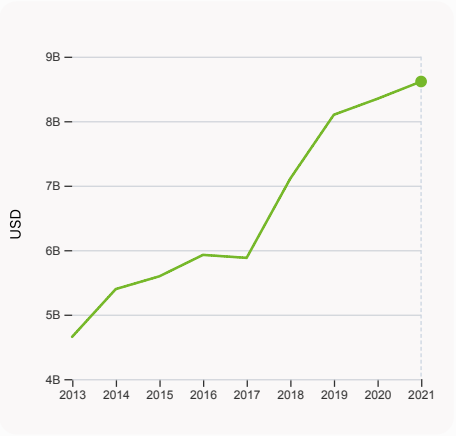
7.1.1 Intangible asset intensity, top 15, %

was equal to 71.58% in 2022, up by 13.68 percentage points from the year prior – and equivalent to an indicator rank of 18.



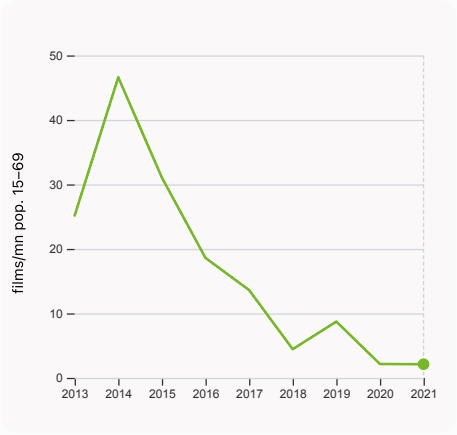
7.1.3 Global brand value, top 5,000

was equal to 9.71 bn USD in 2023, down by 3.64% from the year prior – and equivalent to an indicator rank of 14.



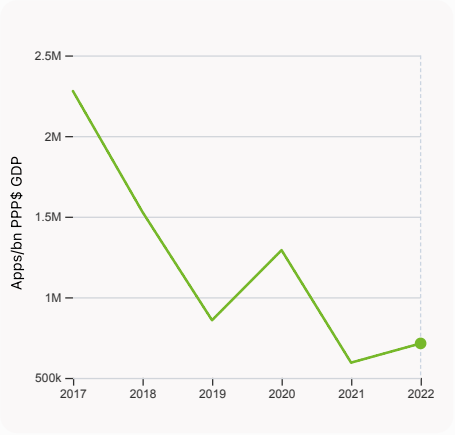
7.2.1 Cultural and creative services exports

was equal to 8,614,481,000 USD in 2021, up by 3.2% from the year prior – and equivalent to an indicator rank of 1.



7.2.2 National feature films/mn pop. 15-69

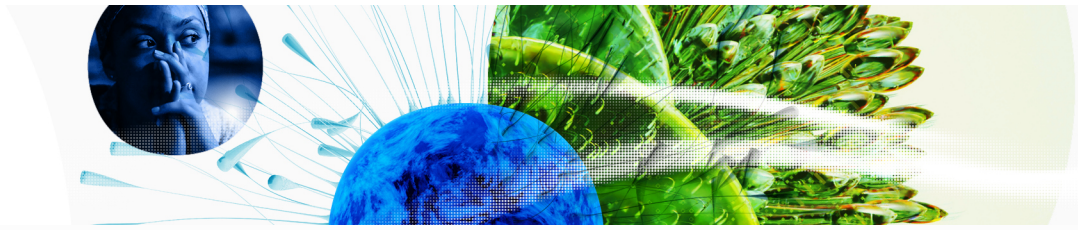
was equal to 2.12 films/mn pop. 15–69 in 2021, down by 1.4% from the year prior – and equivalent to an indicator rank of 45.



7.3.4 Mobile app creation/bn PPP$ GDP

was equal to 713,804.23 Apps/bn PPP$ GDP in 2022, up by 20.041% from the year prior – and equivalent to an indicator rank of 35.

Global Innovation Index 2023



→ 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]	[%]	[%]
224	SPOTIFY	Software & Computer Services	887	8	9
607	ARCELORMITTAL	Industrial Metals & Mining	275	27	0
1550	SUSE	Software & Computer Services	89	23	18

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	Other	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	EUROFINS SCIENTIFIC SE	88.46
2	TENARIS SA	41.62
3	GLOBANT SA	89.51

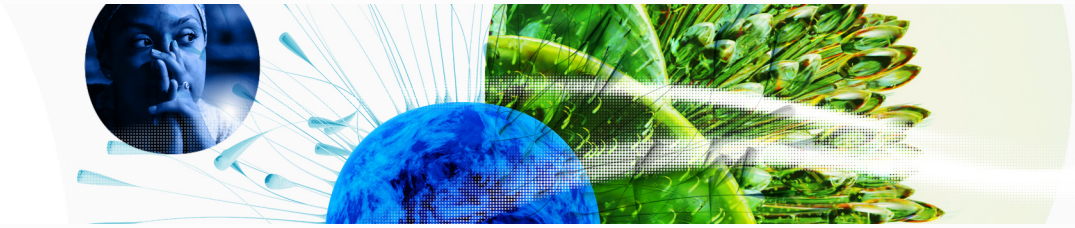
Source: Brand Finance (https://brandirectory.com/reports/gift-2022).
Note: Brand Finance only provides within economy ranks.

> 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	3,387.1
2	EUROFINS SCIENTIFIC	Healthcare Facilities	1,972.7
3	RTL	Media	1,289.2

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

Global Innovation Index 2023



Luxembourg

GII 2023 rank **21**

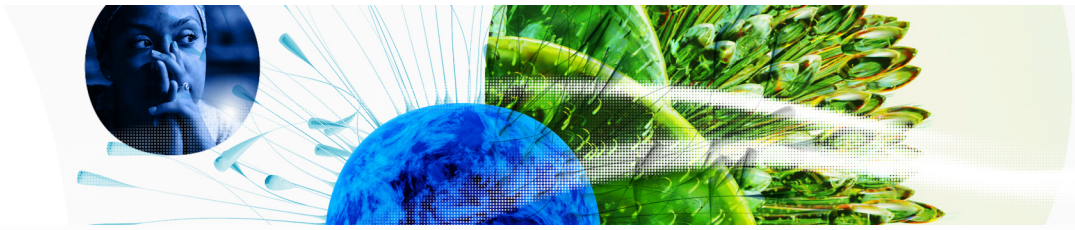
Output rank	Input rank	Income	Region	Population (mn)	GDP, PPP$ (bn)	GDP per capita, PPP$
23	22	High	EUR	0.6	91.1	141,587.1

	Score / Value	Rank	
Institutions	**81.6**	**7**	
1.1 Institutional environment	**84.1**	**7**	
1.1.1 Operational stability for businesses*	84.0	7	
1.1.2 Government effectiveness*	84.2	7	
1.2 Regulatory environment	**82.4**	**23**	
1.2.1 Regulatory quality*	91.8	2 ●	
1.2.2 Rule of law*	92.1	8	
1.2.3 Cost of redundancy dismissal	21.7	95 ○ ◇	
1.3 Business environment	**78.3**	**10**	
1.3.1 Policies for doing business†	94.3	3 ●	
1.3.2 Entrepreneurship policies and culture†	62.2	21	
Human capital and research	**44.4**	**31**	◇
2.1 Education	**53.8**	**60**	◇
2.1.1 Expenditure on education, % GDP	3.7	81	◇
2.1.2 Government funding/pupil, secondary, % GDP/cap	20.3	50	
2.1.3 School life expectancy, years	14.6	62	◇
2.1.4 PISA scales in reading, maths and science	476.7	35	◇
2.1.5 Pupil-teacher ratio, secondary	7.8	8	
2.2 Tertiary education	**46.6**	**16**	
2.2.1 Tertiary enrolment, % gross	19.2	101 ○ ◇	
2.2.2 Graduates in science and engineering, %	19.2	81 ○	
2.2.3 Tertiary inbound mobility, %	48.4	1 ●	
2.3 Research and development (R&D)	**32.8**	**34**	◇
2.3.1 Researchers, FTE/mn pop.	5,051.0	17	
2.3.2 Gross expenditure on R&D, % GDP	1.0	39	◇
2.3.3 Global corporate R&D investors, top 3, mn US$	60.6	22	
2.3.4 QS university ranking, top 3*	0.0	71 ○ ◇	
Infrastructure	**55.6**	**31**	◇
3.1 Information and communication technologies (ICTs)	**87.0**	**15**	
3.1.1 ICT access*	99.7	2 ●	
3.1.2 ICT use*	92.6	15	
3.1.3 Government's online service*	81.4	29	
3.1.4 E-participation*	74.4	25	
3.2 General infrastructure	**29.9**	**56**	◇
3.2.1 Electricity output, GWh/mn pop.	2,074.9	80	◇
3.2.2 Logistics performance*	68.2	25	◇
3.2.3 Gross capital formation, % GDP	18.6	106 ○ ◇	
3.3 Ecological sustainability	**49.8**	**23**	
3.3.1 GDP/unit of energy use	20.0	8	
3.3.2 Environmental performance*	90.5	6	
3.3.3 ISO 14001 environment/bn PPP$ GDP	0.9	68	
Market sophistication	**45.2**	**35**	◇
4.1 Credit	**44.2**	**38**	
4.1.1 Finance for startups and scaleups†	49.2	48	◇
4.1.2 Domestic credit to private sector, % GDP	104.9	27	
4.1.3 Loans from microfinance institutions, % GDP	n/a	n/a	
4.2 Investment	**45.3**	**13**	
4.2.1 Market capitalization, % GDP	67.6	25	
4.2.2 Venture capital (VC) investors, deals/bn PPP$ GDP	1.9	2 ●	
4.2.3 VC recipients, deals/bn PPP$ GDP	0.1	26	
4.2.4 VC received, value, % GDP	0.0	21	
4.3 Trade, diversification, and market scale	**46.1**	**95**	◇
4.3.1 Applied tariff rate, weighted avg., %	1.5	20	
4.3.2 Domestic industry diversification	n/a	n/a	
4.3.3 Domestic market scale, bn PPP$	91.1	89 ○	

	Score / Value	Rank	
Business sophistication	**63.8**	**7**	
5.1 Knowledge workers	**70.2**	**6**	
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, %	51.3	25	
5.1.5 Females employed w/advanced degrees, %	27.6	11	
5.2 Innovation linkages	**54.6**	**16**	
5.2.1 University-industry R&D collaboration†	76.8	16	
5.2.2 State of cluster development†	63.9	33	
5.2.3 GERD financed by abroad, % GDP	0.0	50	◇
5.2.4 Joint venture/strategic alliance deals/bn PPP$ GDP	0.1	13	
5.2.5 Patent families/bn PPP$ GDP	3.7	10	
5.3 Knowledge absorption	**66.7**	**3**	
5.3.1 Intellectual property payments, % total trade	4.0	1 ●	
5.3.2 High-tech imports, % total trade	1.7	132 ○ ◇	
5.3.3 ICT services imports, % total trade	4.9	1 ●	
5.3.4 FDI net inflows, % GDP	48.7	2 ●	
5.3.5 Research talent, % in businesses	31.6	40	◇
Knowledge and technology outputs	**31.9**	**38**	◇
6.1 Knowledge creation	**44.1**	**19**	
6.1.1 Patents by origin/bn PPP$ GDP	6.5	14	
6.1.2 PCT patents by origin/bn PPP$ GDP	3.4	8	
6.1.3 Utility models by origin/bn PPP$ GDP	n/a	n/a	
6.1.4 Scientific and technical articles/bn PPP$ GDP	n/a	n/a	
6.1.5 Citable documents H-index	12.7	65	◇
6.2 Knowledge impact	**30.8**	**54**	◇
6.2.1 Labor productivity growth, %	-1.2	119 ○ ◇	
6.2.2 Unicorn valuation, % GDP	2.4	15	
6.2.3 Software spending, % GDP	0.2	78	◇
6.2.4 High-tech manufacturing, %	n/a	n/a	
6.3 Knowledge diffusion	**20.9**	**71**	◇
6.3.1 Intellectual property receipts, % total trade	1.5	17	
6.3.2 Production and export complexity	n/a	n/a	
6.3.3 High-tech exports, % total trade	0.5	88 ○ ◇	
6.3.4 ICT services exports, % total trade	3.3	37	
6.3.5 ISO 9001 quality/bn PPP$ GDP	1.9	87	◇
Creative outputs	**54.2**	**11**	
7.1 Intangible assets	**53.1**	**17**	
7.1.1 Intangible asset intensity, top 15, %	71.6	18	
7.1.2 Trademarks by origin/bn PPP$ GDP	55.6	42	
7.1.3 Global brand value, top 5,000	11.6	14	
7.1.4 Industrial designs by origin/bn PPP$ GDP	3.8	26	
7.2 Creative goods and services	**38.2**	**15**	
7.2.1 Cultural and creative services exports, % total trade	5.6	1 ●	
7.2.2 National feature films/mn pop. 15-69	2.1	45	◇
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	97 ○	
7.3 Online creativity	**72.5**	**5**	
7.3.1 Generic top-level domains (TLDs)/th pop. 15-69	97.1	4 ●	
7.3.2 Country-code TLDs/th pop. 15-69	70.7	8	
7.3.3 GitHub commits/mn pop. 15-69	48.3	21	
7.3.4 Mobile app creation/bn PPP$ GDP	73.7	35	

NOTES: ● indicates a strength; ○ a weakness; ◆ an income group strength; ◇ an income group weakness; * an index; † a survey question, ◔ indicates that the economy's data are older than the base year; see appendices for details, including the year of the data, at https://www.wipo.int/gii-ranking. Square brackets [ ] indicate that the data minimum coverage (DMC) requirements were not met at the sub-pillar or pillar level.

Global Innovation Index 2023



→ 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 three indicators.

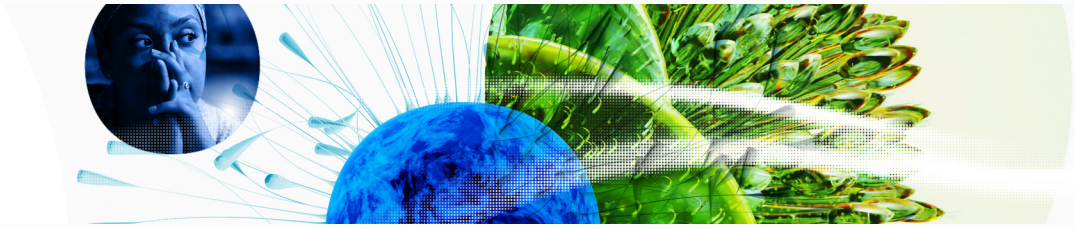
> Missing data for Luxembourg

Code	Indicator name	Economy Year	Model Year	Source
4.1.3	Loans from microfinance institutions, % GDP	n/a	2021	International Monetary Fund, Financial Access Survey (FAS)
4.3.2	Domestic industry diversification	n/a	2020	United Nations Industrial Development Organization
6.1.3	Utility models by origin/bn PPP$ GDP	n/a	2021	World Intellectual Property Organization; International Monetary Fund
6.2.4	High-tech manufacturing, %	n/a	2020	United Nations Industrial Development Organization
6.3.2	Production and export complexity	n/a	2020	Harvard University, Growth Lab
7.2.3	Entertainment and media market/th pop. 15-69	n/a	2022	PwC, GEMO; United Nations, World Population Prospects; International Monetary Fund

> Outdated data for Luxembourg

Code	Indicator name	Economy Year	Model Year	Source
2.1.1	Expenditure on education, % GDP	2019	2021	UNESCO Institute for Statistics
5.1.4	GERD financed by business, %	2019	2020	UNESCO Institute for Statistics; Eurostat; OECD; RICYT
5.2.3	GERD financed by abroad, % GDP	2019	2020	UNESCO Institute for Statistics; Eurostat; OECD; RICYT

Global Innovation Index 2023



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, 2023.

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.