

# Impact measurement of innovation

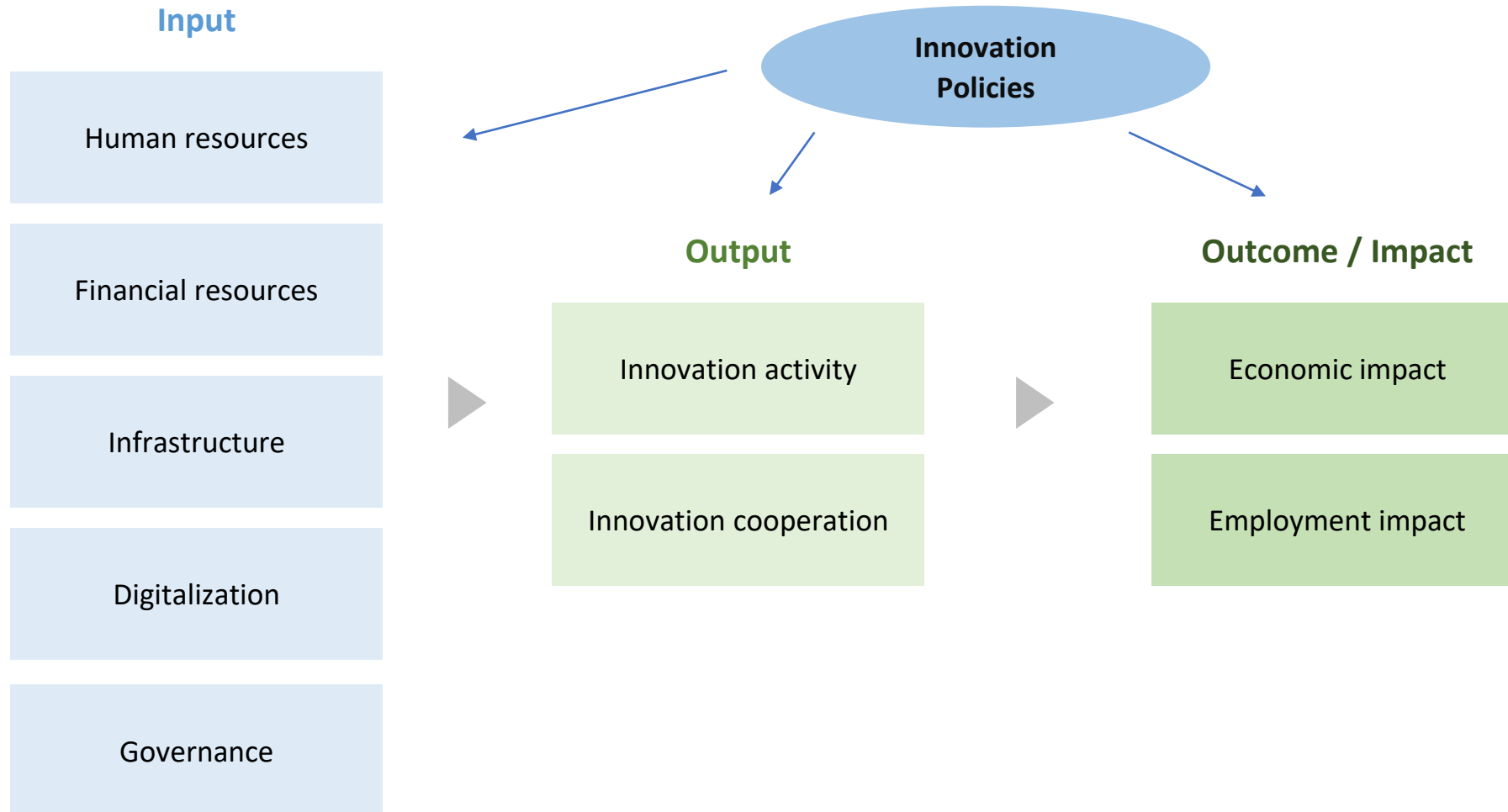


Challenges, approaches and  
ways forward

# Innovation measurement – *Input-Output-Outcome logic*



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# Innovation measurement – Useful indicators



Table X.3 Overview of proposed key innovation policy indicators

Area	Headline indicators and source
<i>Resources</i>	
Human	Number of R&D personnel ( <u>Ukrstat</u> ) Share of researchers' FTE in business enterprises (GII) Research institutions prominence (WEF) Graduates in STEM (GII) Doctorates in STEM (EIS) Attitudes towards entrepreneurial risk (WEF) Critical thinking in teaching (WEF)
Financial	Total expenditure for R&D ( <u>Ukrstat</u> ) Direct and indirect support for business R&D (EIS) Business expenditure on R&D (EIS) Non-R&D innovation expenditure by the business sector (EIS) Venture capital expenditure (EIS)
Infrastructure	Not available
Digitalization	Share of enterprises with high and very high digital intensity index (to be developed) Share of enterprises employing ICT specialists ( <u>Ukrstat</u> ) Share of the ICT sector in total value added ( <u>Ukrstat</u> )
Governance	Intellectual property protection (WEF) Government responsiveness to change (WEF) Time to resolve insolvency (DB) Regulatory quality index (WGI)

# Innovation measurement – Useful indicators



<i>Innovation dynamics</i>	
Activity	Share of innovation active enterprises (Ukrstat) Share of innovative industrial enterprises (Ukrstat) Business sector R&D expenditure and other innovation expenditure (Ukrstat) Business sector investment in intangible assets (Ukrstat) PCT patent applications (Ukrpatent)
Cooperation	Value of technology transfers from the public to the business sector (MES) Business sector R&D expenditure for R&D contracted from others (Ukrstat) Business sector R&D financed by non-resident investors (Ukrstat) The extent to which businesses and universities collaborate (WEF) State of cluster development (WEF) Number of scientific publications co-authored with foreign researchers (MES)

<i>Impact</i>	
Economic	Share of innovation product in total business sector turnover (Ukrstat) Growth of value added and labour productivity in high and medium-high technology manufacturing (Ukrstat) Growth of value added and labour productivity in knowledge-intensive market services (Ukrstat) Growth of value added and labour productivity in creative industries (Ukrstat) Share of medium and high-tech product exports (EIS) Share of knowledge-intensive services exports (EIS)
Employment	Growth of the number of employees in high and medium-high technology manufacturing (Ukrstat) Growth of the number of employees in knowledge-intensive market services (Ukrstat) Growth of the number of employees in creative industries (Ukrstat)

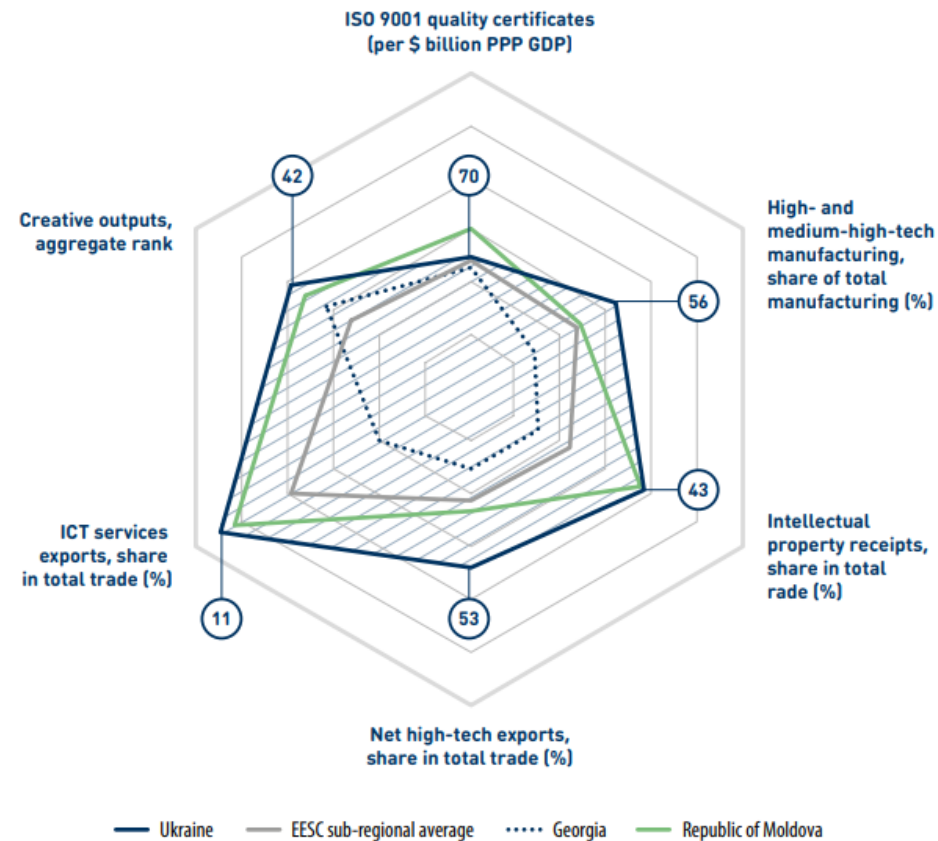
Abbreviations used: GII – Global Innovation Index; WEF – World Economic Forum; EIS – European Innovation Scoreboard; DB – 'Doing Business' by World Bank; WGI – Worldwide Governance indicators by World Bank. For further details on sources, see endnote xi.

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# Innovation measurement – UNECE Innovation Policy Outlook 2020



Figure II.1 · Innovation performance by selected GII indicators, 2019 ranks



# Innovation measurement - Challenges



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**Data availability**



**Costs** and efforts needed to obtain data



**Lack of coordinated** government and multi-stakeholder **approaches**



Difficulties related to the **measurement of input vs output vs outcome** indicators

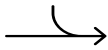


**Timing** (e.g., estimation by when certain innovation impacts could be expected)

# Innovation measurement - Challenges



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Accounting for **external factors**



Challenges related to the **benchmarking** with **other economies** – also implications of EU Acquis



**Overfocus** on **technological innovations**



Unclear **frequency** of **innovation measurement**



Unclear **definition** of **conditions** / timing for the **re-assessment** of **innovation indicators**



**Thank you!**





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# Annex



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# Innovation measurement – Lack of harmonization with EU



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## European Innovation Scoreboard 2023

Framework conditions	Indicators	Sources in General	Sources for Ukraine
Human resources	1.1.1 New <b>doctorate graduates</b> in science, technology, engineering, and mathematics (STEM) per 1000 population aged 25-34	Eurostat	UNESCO, World Bank WDI
	1.1.2 <b>Percentage population aged 25-34 having completed tertiary education</b>	Eurostat	Data not available
	1.1.3 <b>Percentage population aged 25-64 participating in lifelong learning</b>	Eurostat	Data not available

# Innovation measurement – Lack of harmonization with EU



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## European Innovation Scoreboard 2023

Framework conditions	Indicators	Sources in General	Sources for Ukraine
Attractive research systems	1.2.1 International <b>scientific co-publications</b> per million population	Scopus database	tbd
	1.2.2 Scientific publications among the <b>top-10% most cited publications</b> worldwide as percentage of total scientific publications of the country	Scopus database	tbd
	1.2.3 <b>Foreign doctorate students</b> as a percentage of all doctorate students	Eurostat	Ukrstat

# Innovation measurement – Lack of harmonization with EU



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## European Innovation Scoreboard 2023

Framework conditions

Indicators

Sources in General

Sources for Ukraine

Digitalization

*1.3.1 Broadband penetration*

*Eurostat*

*Data not available*

*1.3.2 Individuals who have above basic overall digital skills (% share)*

*Eurostat*

*Data not available*

# Innovation measurement – Lack of harmonization with EU



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## European Innovation Scoreboard 2023

Investments	Indicators	Sources in General	Sources for Ukraine
Finance and support	2.1.1 R&D expenditure in the public sector (percentage of GDP)	Eurostat	UNESCO (2014 – 2018)
	2.1.2 Venture capital expenditures (percentage of GDP)	Invest Europe, Eurostat	Tbd
	2.1.3 Direct government funding and government tax support for business R&D (percentage of GDP)	OECD R&D Tax Incentive Database	Data not available

# Innovation measurement – Lack of harmonization with EU



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## European Innovation Scoreboard 2023

Investments	Indicators	Sources in General	Sources for Ukraine
Firm investments	2.2.1 R&D expenditure in the business sector (percentage of GDP)	Eurostat	UNESCO
	2.2.2 Non-R&D innovation expenditures (percentage of turnover)	Eurostat	Ukrstat (2014)
	2.2.3 Innovation expenditures per person employed	Eurostat	Data not available

# Innovation measurement – Lack of harmonization with EU



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## European Innovation Scoreboard 2023

Investments	Indicators	Sources in General	Sources for Ukraine
Use of information technologies	<i>2.3.1 Enterprises providing training to develop or upgrade ICT skills of their personnel</i>	Eurostat	Ukrstat (2017-2019)
	<i>2.3.2 ICT specialists (as a percentage of total employment)</i>	Eurostat	Data not available



# Innovation measurement – Lack of harmonization with EU



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European Innovation Scoreboard 2023

Innovation activities	Indicators	Sources in General	Sources for Ukraine
Innovators	3.1.1 SMEs introducing product innovations (percentage of SMEs)	Eurostat	Data not available
	3.1.2 SMEs introducing business process innovations (percentage of SMEs)	Eurostat	Data not available

# Innovation measurement – Lack of harmonization with EU



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## European Innovation Scoreboard 2023

Innovation activities	Indicators	Sources in General	Sources for Ukraine
Linkages	3.2.1 Innovative SMEs collaborating with others (percentage of SMEs)	Eurostat	Data not available
	3.2.2 Public-private co-publications per million population	Scopus database	Data not available
	3.2.3 Job-to-job mobility of Human Resources in Science & Technology	Eurostat	Data not available

# Innovation measurement – Lack of harmonization with EU



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## European Innovation Scoreboard 2023

Innovation activities	Indicators	Sources in General	Sources for Ukraine
Intellectual assets	3.3.1 PCT patent applications per billion GDP (in PPS)	OECD, Eurostat	Tbd
	3.3.2 Trademark applications per billion GDP (in PPS)	EUIPO	Tbd
	3.3.3 Design applications per billion GDP (in PPS)	EUIPO	Tbd

# Innovation measurement – Lack of harmonization with EU



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## European Innovation Scoreboard 2023

Impacts	Indicators	Sources in General	Sources for Ukraine
Employment impacts	4.1.1 <i>Employment in knowledge-intensive activities (percentage of total employment)</i>	Eurostat	Bello et al. (2021)
	4.1.2 <i>Employment in innovative enterprises</i>	Eurostat	Data not available

# Innovation measurement – Lack of harmonization with EU



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## European Innovation Scoreboard 2023

Impacts	Indicators	Sources in General	Sources for Ukraine
	<p>4.2.1 Exports of medium and high technology products as a share of total product exports</p>	Eurostat	UN Comtrade database
Sales impacts	<p>4.2.2 Knowledge-intensive services exports as percentage of total services exports</p>	JRC: Innovation Output Indicator	UNCTADstat
	<p>4.2.3 Sales of new-to-market and new-to-enterprise innovations as percentage of turnover</p>	Eurostat	Ukrstat (2011-2015)

# Innovation measurement – Lack of harmonization with EU



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## European Innovation Scoreboard 2023

Impacts	Indicators	Sources in General	Sources for Ukraine
Environmental sustainability	4.3.1 Resource productivity	Eurostat	Data not available
	4.3.2 Air emissions by fine particulate matter (PM2.5) in Industry	Eurostat, Air emissions accounts	Data not available
	4.3.3 Development of environment-related technologies, percentage of all technologies	OECD Green Growth database	Data available for 2012-2019

# Innovation measurement – Lack of harmonization with EU



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Additional challenge – lack of data on place-based innovation:

▶ *(Possible) remedy: Surveys*

▶ *Emphasized case studies*



▶ *Mapping of start-up / scale-up headquarters*

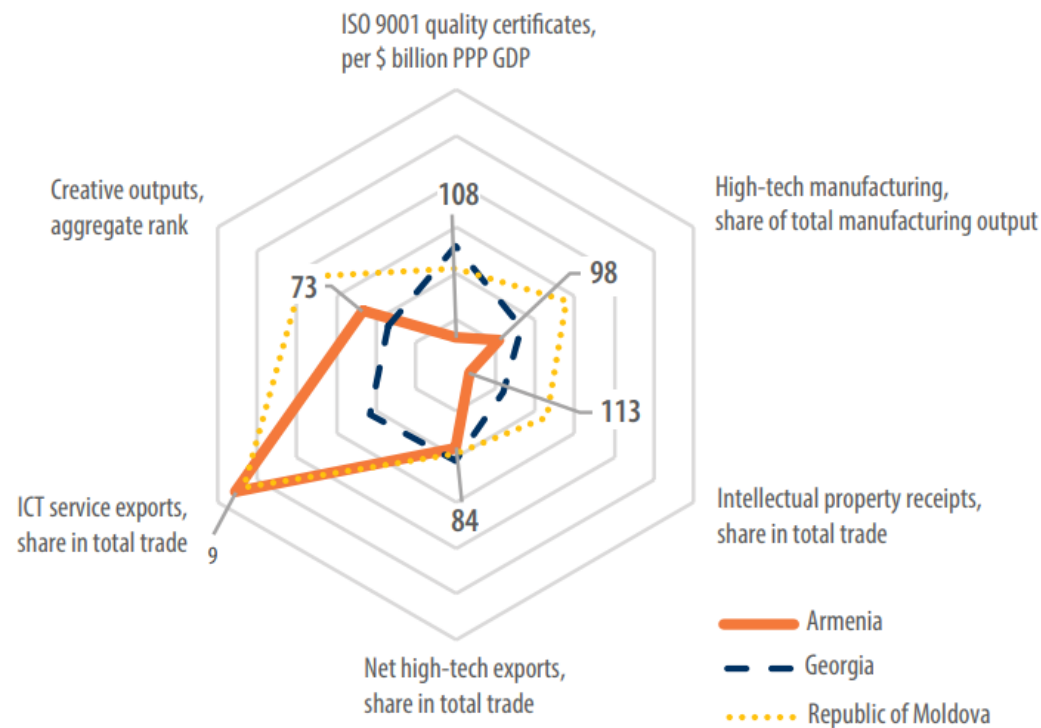
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# Innovation measurement – UNECE Innovation for Sustainable Development Review - Armenia



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**Figure 2.1 Innovation performance by selected Global Innovation Index (GII) indicators, 2022, ranks**



GII = Global Innovation Index, ICT = information and communication technology, ISO = International Standards Organization, PPP = purchasing power parity.  
Source: UNECE, based on data from WIPO (2022).



# Innovation measurement – UNECE Innovation for Sustainable Development Review - Armenia

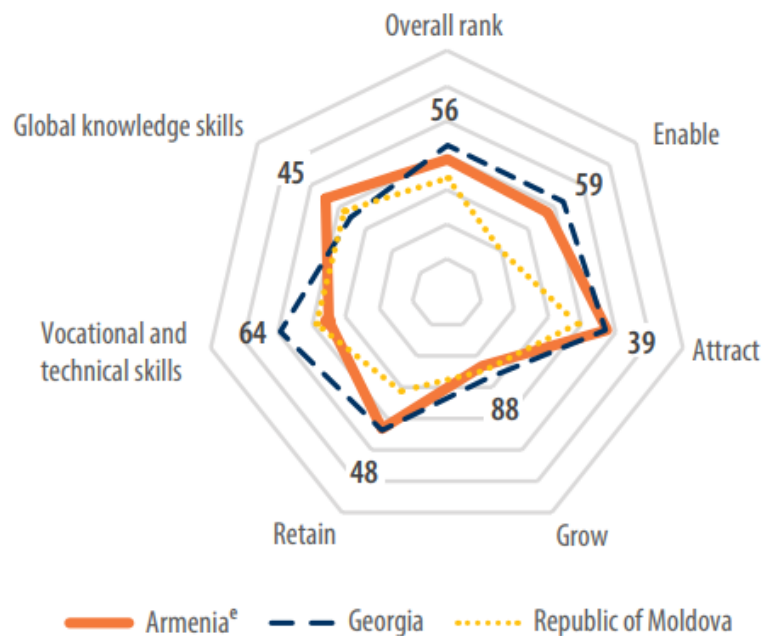


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**Table 2.1**

**Innovation performance overview of Armenia**

**Global Talent Competitiveness Index, 2022**  
(rank out of 133 economies)<sup>a</sup>



**Global Competitiveness Report, 2019<sup>b</sup>**

Indicator	Score <sup>c</sup>	Rank <sup>d</sup>
Institutions	56.2	62
Infrastructure	69.4	60
ICT adoption	62	59
Macroeconomic stability	75	64
Health	80.7	68
Skills	66.8	61
Product market	59.1	44
Labour market	66.4	32
Financial system	60.2	69
Market size	37.5	118
Business dynamism	62.5	57
Innovation capability	39.4	62
<b>Overall score</b>	-	<b>69</b>

GDP = gross domestic product, GII = Global Innovation Index, ICT = information and communication technology, R&D = research and development, QS = Quacquarelli Symonds  
Source: UNECE, based on INSEAD (2022), WIPO (2022), WEF (2019) and World Bank (2023).

# Innovation measurement – UNECE Innovation for Sustainable Development Review - Armenia

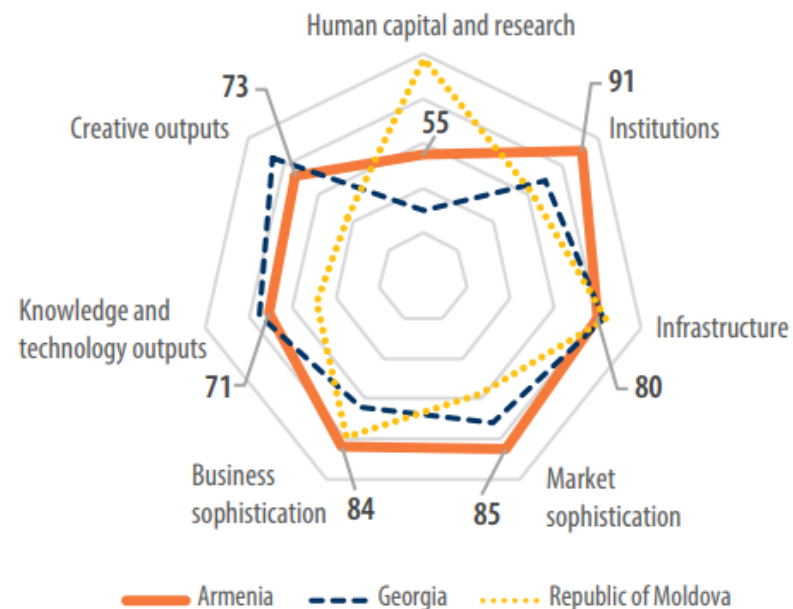


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**Table 2.1**

## Innovation performance overview of Armenia

**Global Innovation Index, 2022**  
(rank out of 132 economies)<sup>1</sup>



**Innovation in the private sector, 2019**

Patent applications, per million population (rank out of 141)	2.7 (53)
Companies embracing disruptive ideas, range from 1 to 7 (rank out of 141)	4 (38)
Growth of innovative companies, range from 1 to 7 (rank out of 141)	4.2 (54)
Attitudes towards entrepreneurial risk, range from 1 to 7 (rank out of 141)	4.5 (28)

**R&D and education**

Graduates in science and engineering (per cent of graduates, 2022)	14.6 (98)
Government expenditure on education (per cent of GDP, 2021)	2.8
QS university ranking, average score top 3 (rank, GII, 2022)	72

GDP = gross domestic product, GII = Global Innovation Index, ICT = information and communication technology, R&D = research and development, QS = Quacquarelli Symonds  
Source: UNECE, based on INSEAD (2022), WIPO (2022), WEF (2019) and World Bank (2023).

# Innovation policy governance in Armenia – UNECE Innovation for Sustainable Development Review - Armenia



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