

Horizon 2020 Policy Support Facility



Horizon2020 PSF Specific support to Armenia

Background report

Kick-off meeting
Brussels 16.04.2019

Fast facts

Country / Capital	The Republic of Armenia / Yerevan
Population	2 .93 milion
Area	29.743 sq. km (11.500 sq. miles)
Major languages	Armenian (native), Russian, English
Major religion	Christianity
Life expectancy	71.3 years (men), 77.6 years (women)
Monetary unit	Armenian dram (AMD)
Exchange rate	570.56 AMD/EUR(2018)
GDP per capita, PPP	8,539 EUR (2017)
Main exports	Products: Copper ore, cigarette produce, brandy, precious and non-precious metals, diamonds, textile produce, electricity, foodstuff, Services: IT, tourism
System of law	Continental



Fast facts

Ratings

Moody's rating	B1, positive (March 9, 2018)
Fitch (long-term IDRs) rating	B+, positive (June 15, 2018)

Ranking

Ease of Doing Business	41 (2019, out of 190 countries)
Index of Economic Freedom	47 (2019, out of 180 countries)
Human Capital Index	49 (2017, out of 130 countries)
Global Competitiveness Index	70 (2018-2019, out of 140 countries)
Global Innovation index	68 (2018, out of 126 countries)



In April, 2018 through “Velvet revolution” the opposition leader became prime minister of Armenia.

Priorities of new Government program

- Protection of external and internal security of RA, guarantee of Artsakh’s security and its maintenance
- Competitiveness of the economy
- Protection of human rights
- Democracy and the rule of law
- Consolidation of human, economic, financial, intellectual potential of all Armenians for the RA development goal
- Government accountability and transparency and the rejection of corruption
- Separation of political and business sectors
- Encouraging education and healthy living
- Poverty reduction through employment and education

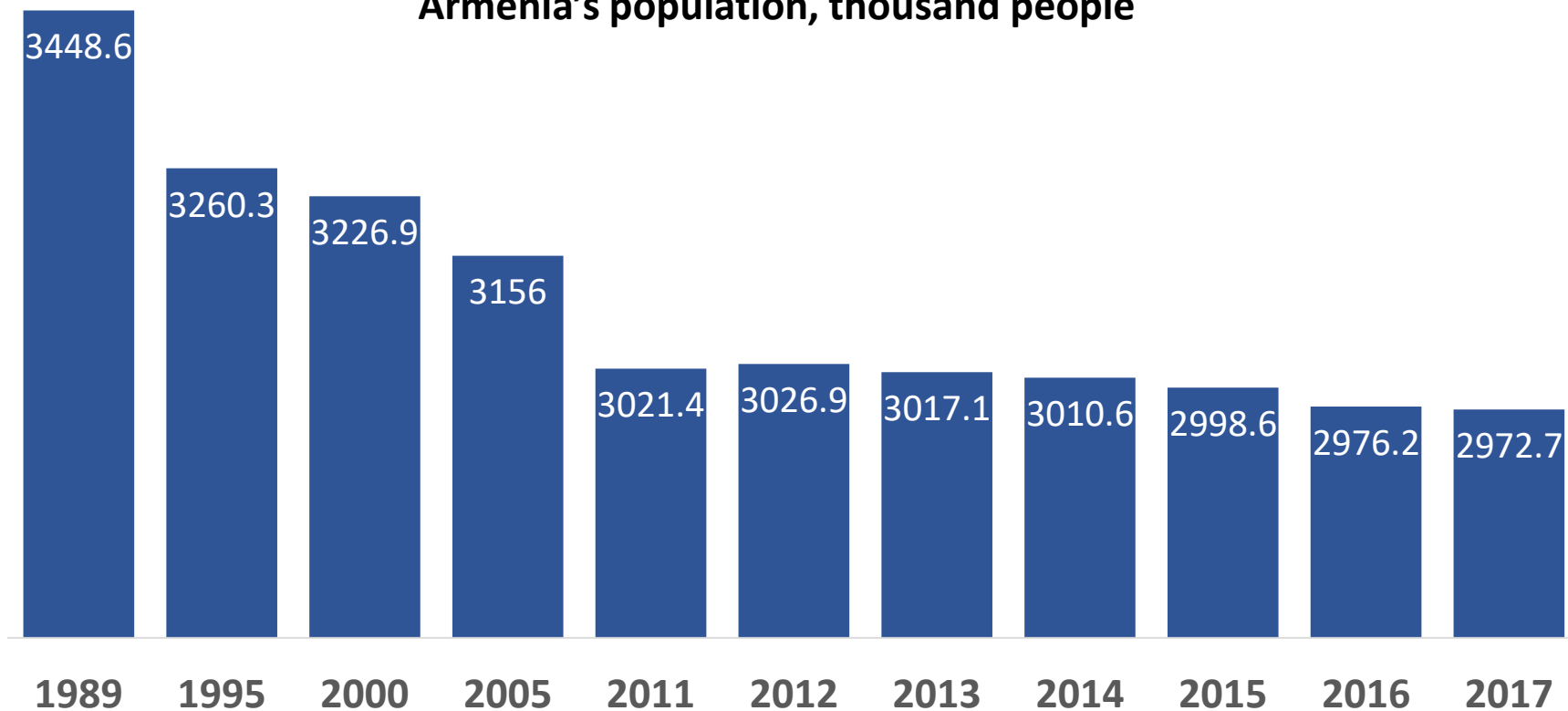


SOCIAL AND ECONOMIC SITUATION IN ARMEINA



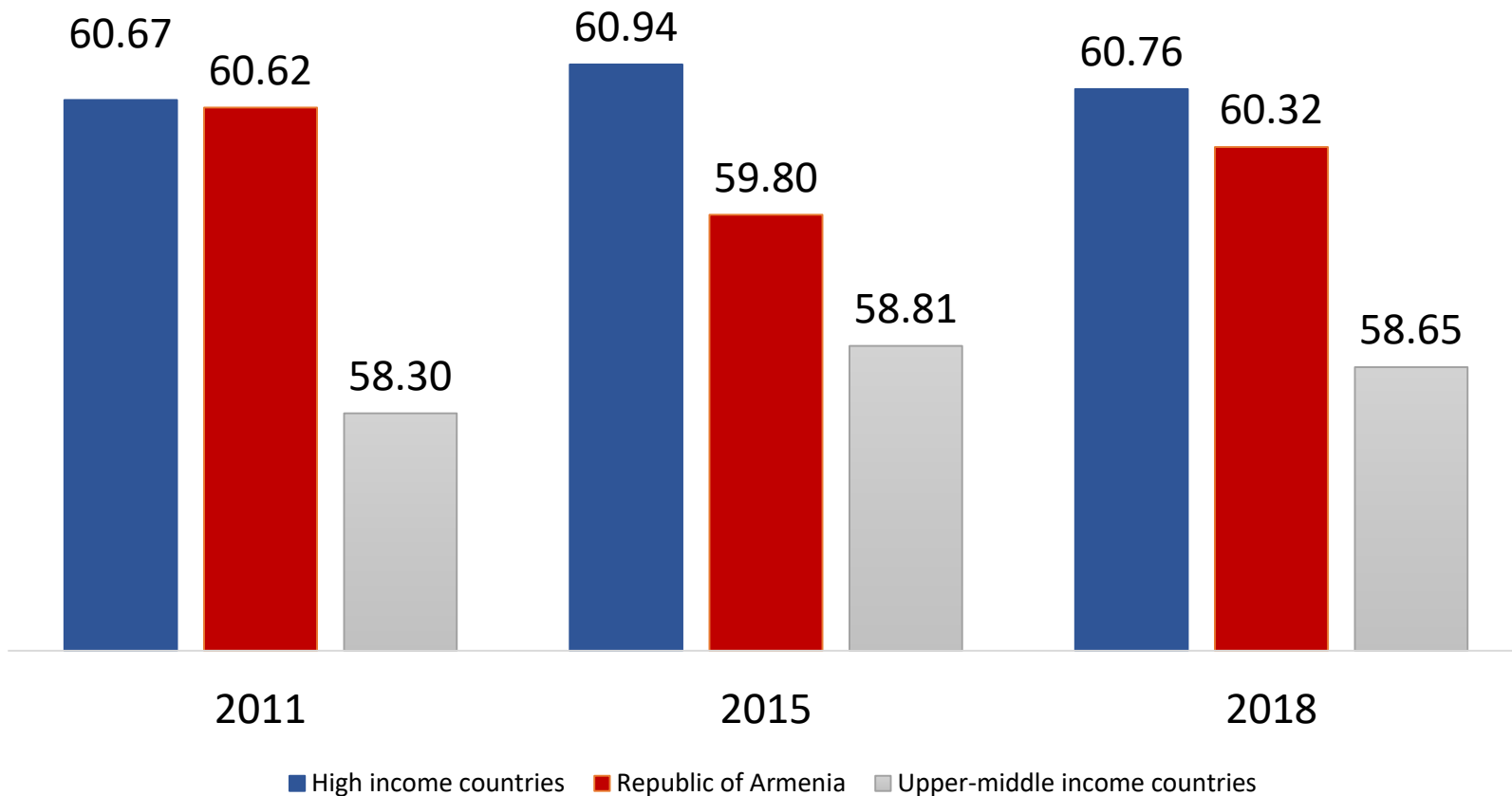
After independence the population has constantly decreased: 2 waves of massive migration in 90s and mid 2000s.

Armenia's population, thousand people



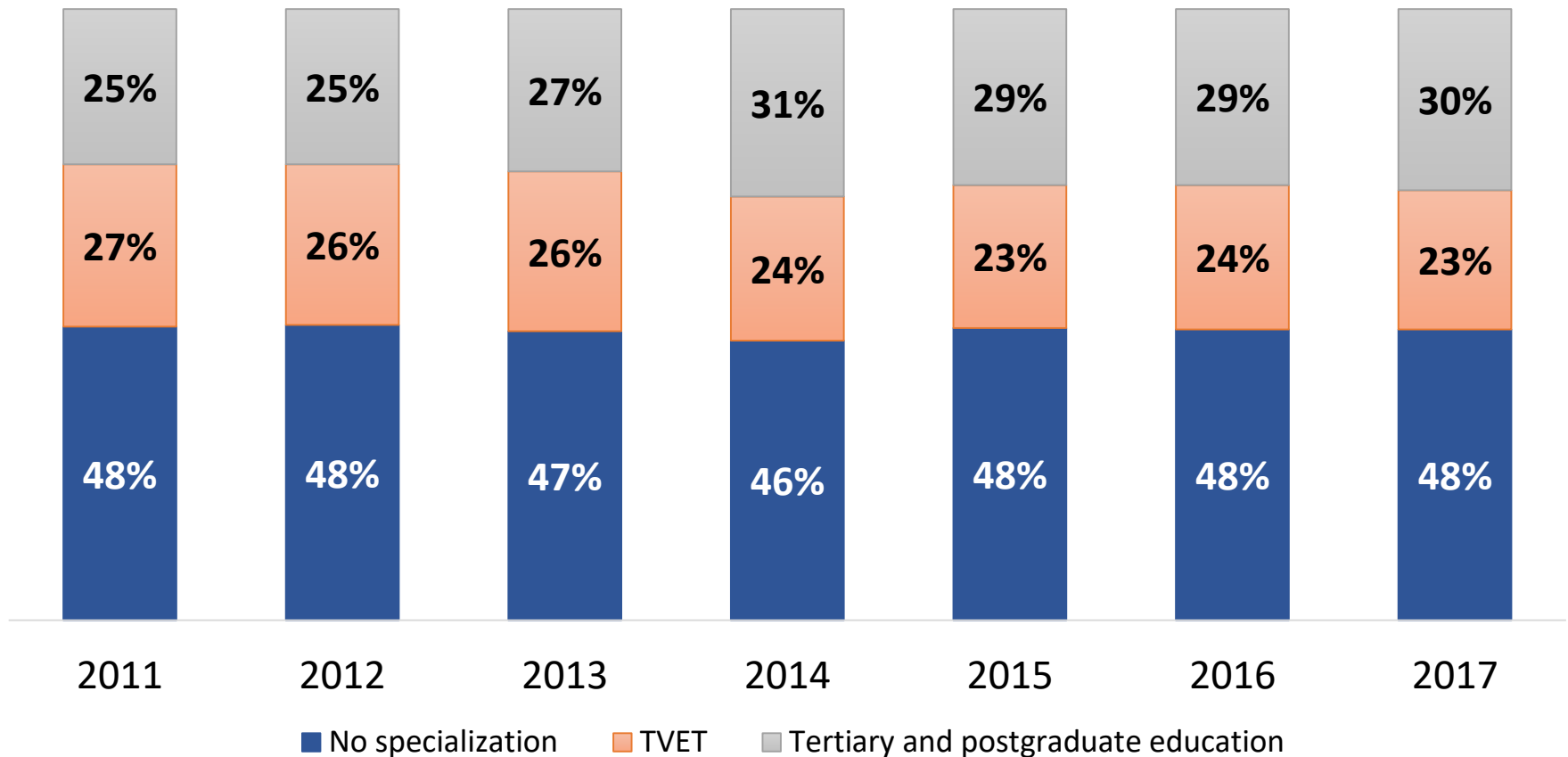
Although being in the group of upper-middle income country, Armenia's rate of economic activity is closer to the average of high-income countries.

Economic activity rate, %



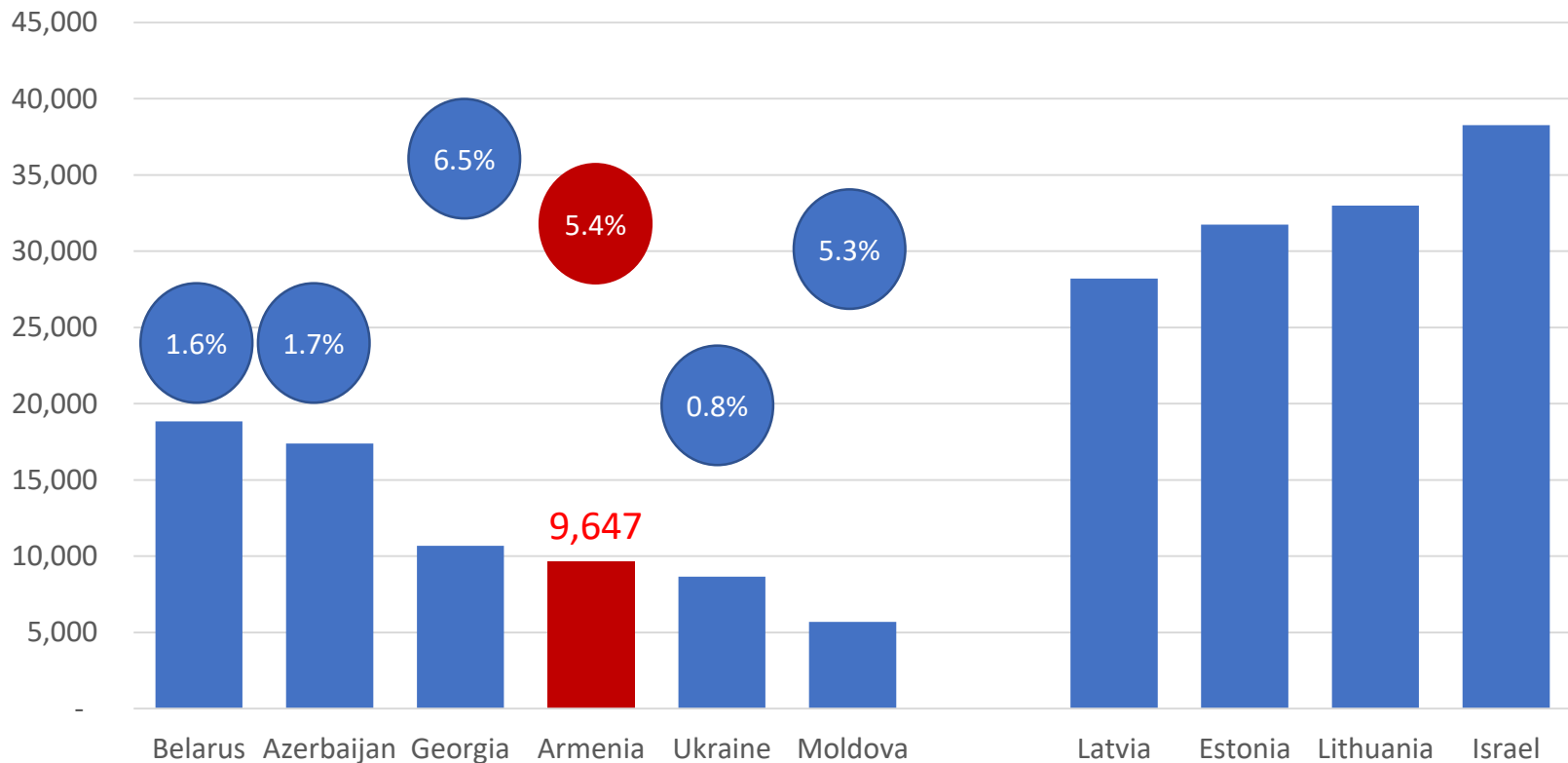
The share of the tertiary and postgraduate students in the economically active population increased primarily in expense of reduced TVET share.

Economically active population by educational level



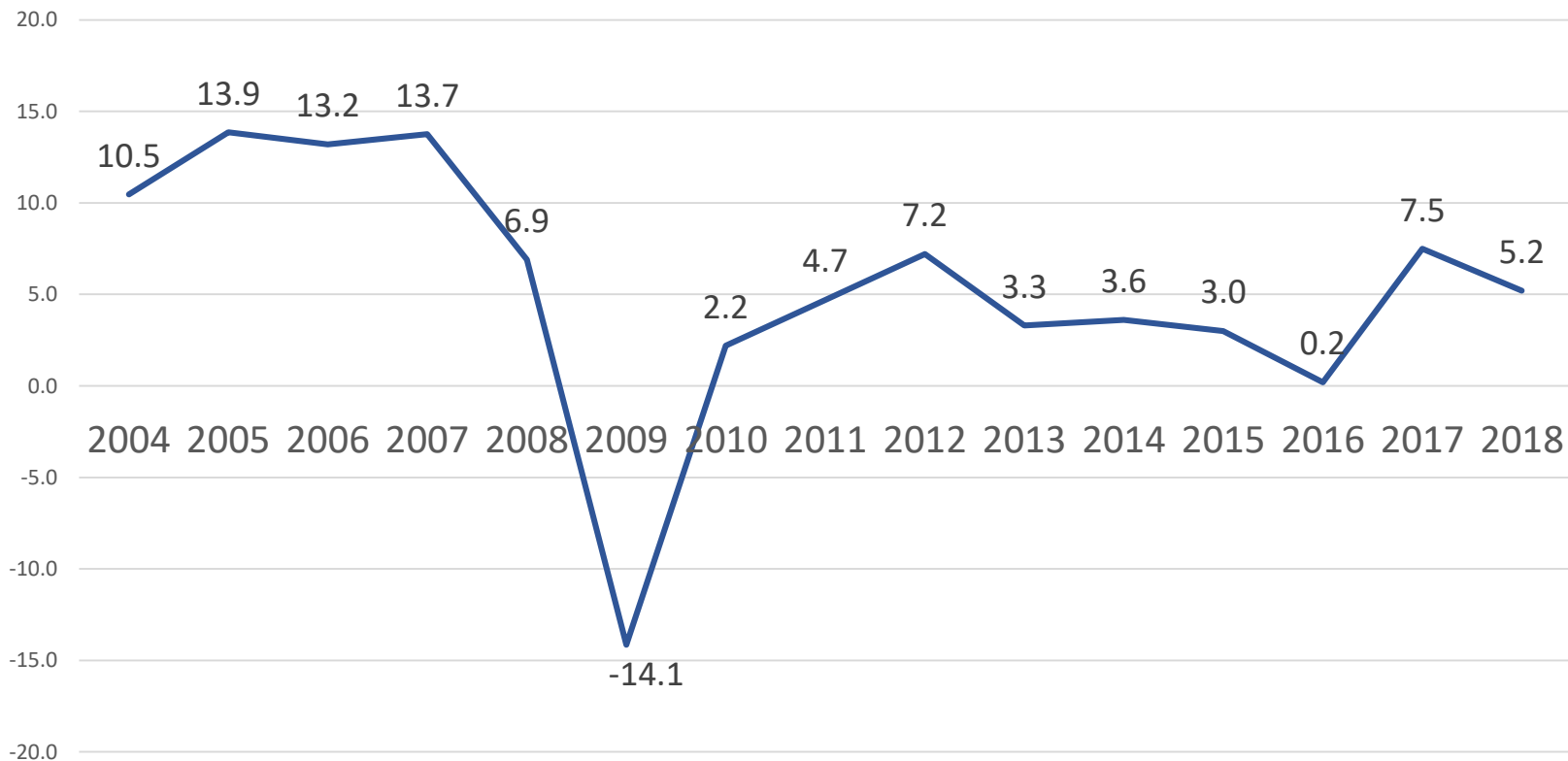
Armenia is 4th by GDP per capita in PPP among EP countries despite recorded high growth during last 6 years.

GDP per capita, PPP, 2017 and CAGR 2011-17



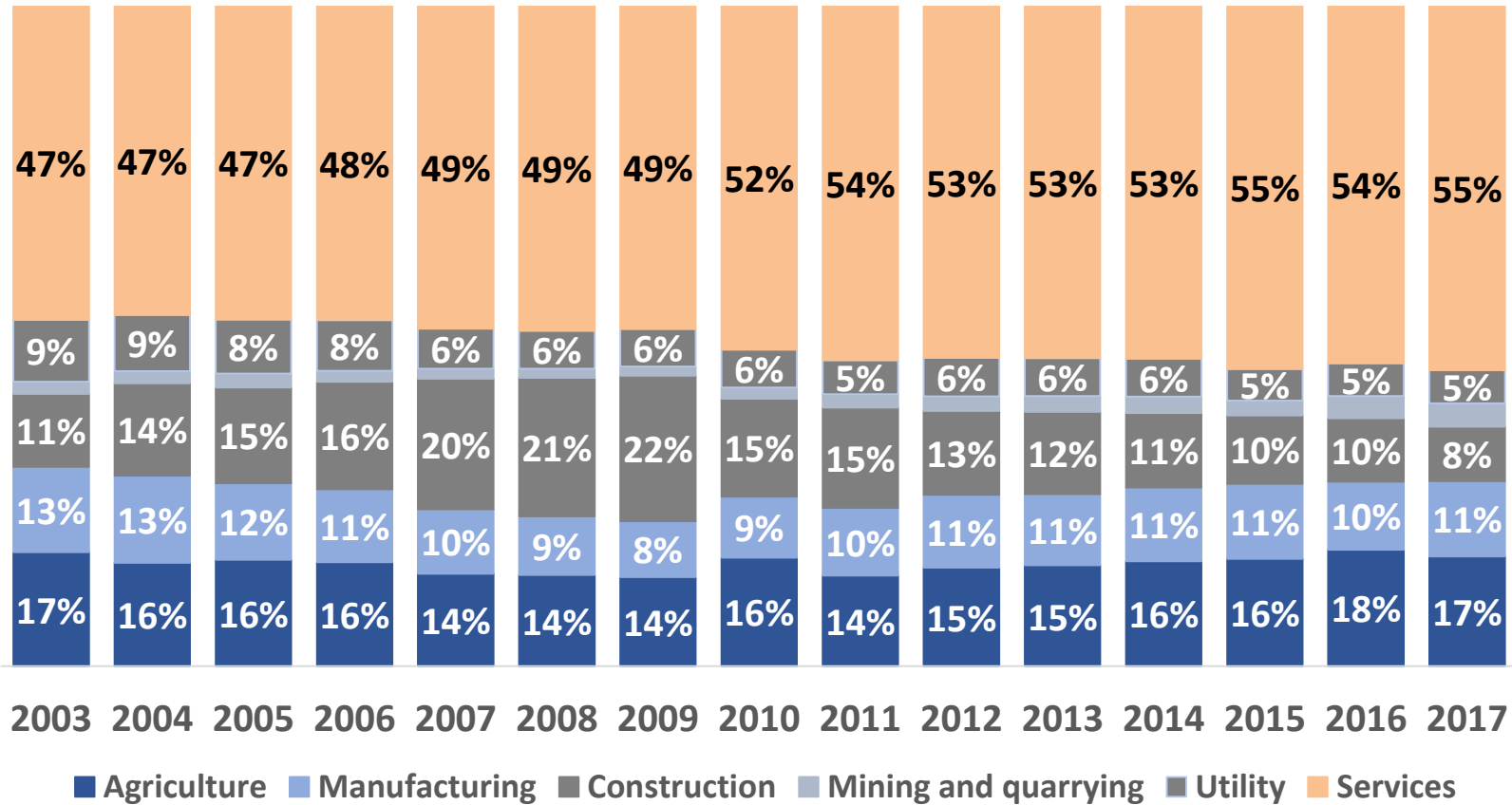
National income increased significantly during the first years of the 2000s and shrank sharply caused by the economical crisis. Even with the current growth rates it hasn't recovered to pre-crisis level yet.

Armenia GDP annual growth %, 2004-2018



Agriculture still plays a relatively important role with high share in GVA and the share of service in GVA significantly increased during 2003-2017.

GVA structure in Armenia, % share



Armenia enlarges the access to foreign markets due to the international cooperation.

International cooperation

January, 2015	Eurasian Economic Union (EAEU)
May, 2015	Trade and Investment Framework Agreement (USA)
November, 2017	Comprehensive and Enhanced Partnership Agreement (EU)



Key challenges

- Geopolitical situation in the region (Armenia-Turkey-Azerbaijan, Iran-US, Georgia-Russia)
- High level of poverty and unemployment
- Spatial disparities of economic activity
- Deteriorating educational and scientific base
- Resource intensity of the exports
- Limited connectivity to export markets
- Worsening demographics



GOVERNANCE OF THE NATIONAL R&I SYSTEM



In the Armenian institutional set-up, innovation and science are two separate policy domains with clearly distinguished roles and responsibilities.

Science	Innovations
The Science Committee of the Ministry of Education and Science	Ministry of Economic Development and Investment <ul style="list-style-type: none">• Enterprise Incubator Foundation• National Centre of Innovation and Entrepreneurship• Small and Medium Entrepreneurship Development Centre of Armenia• Armenian Intellectual Property Agency (AIPA),• National Institutes of Standards• National Institute of Metrology
National Academy of Science	



Government's priorities in Science for 2017-2020

Objectives

- Improvement of the science and technology management system
- Introduction of an efficient system for re-production of personnel
- Promoting research of fundamental and applied nature
- Establishing preconditions to form synergetic system of education, science, technology and innovation,
- Primary development of Armenian studies,
- Development of international scientific cooperation, ensuring smart specialization platform.

Priorities

- Armenology
- Life Sciences
- Secure and Efficient Energy
- Key Enabling Technologies, Information and Communication Technologies
- Space, Earth Sciences, Sustainable Use of Natural Resources
- Basic Researches for Key Problems of Scientific and Socio-Economic Development



National innovation strategy suggests three pathways: technology niche leadership, innovation for export growth and challenge driven innovation.

MAIN CHALLENGES

Weak technology progress & knowledge generation

- Weak science & technology specialisation and under-investment
- Science & education system contributes rarely to development

Low Competitiveness & Business Innovation

- Low level of company innovation activities and ability for absorption
- Limited competitiveness in regional and international markets

Limited Innovation in and for society

- Needs for cost-effective and innovative solutions to 'societal challenges'
- Low understanding & usage of innovation as driver for well-being is limited in society

MAIN APPROCHES

Drive Technology Specialisation

Concentrate efforts to achieve leadership in distinct technology niche

Focused Catch-up

Foster managerial and technological upgrade for high value export sectors

Use innovation as driver

Develop innovation partnerships to solve societal challenges and use this as a driver to change perception of innovation

MAIN IMPACT (2030)

- 3-5 tech clusters with ECEI cluster excellence silver label (baseline none)
- 15,000 MS and 1,100 PhD graduates in priority advanced technologies (baseline n.a.)
- Output of high-tech manufacturing and services -USD 800 million

- Number of innovative active companies triples to 30% (baseline <10%, 2017)
- Productivity level in innovative active and export oriented companies triples (baseline 39,000 USD, 2017.)
- Exports grow about 10 times (baseline USD 585million, 2017)

- Improved performance on resource efficiency, income inequality (baseline n.a.)
- Armenia in top 30 in world for government effectiveness (baseline 79th, 2017).
- Environmental, health and social sectors value added increases

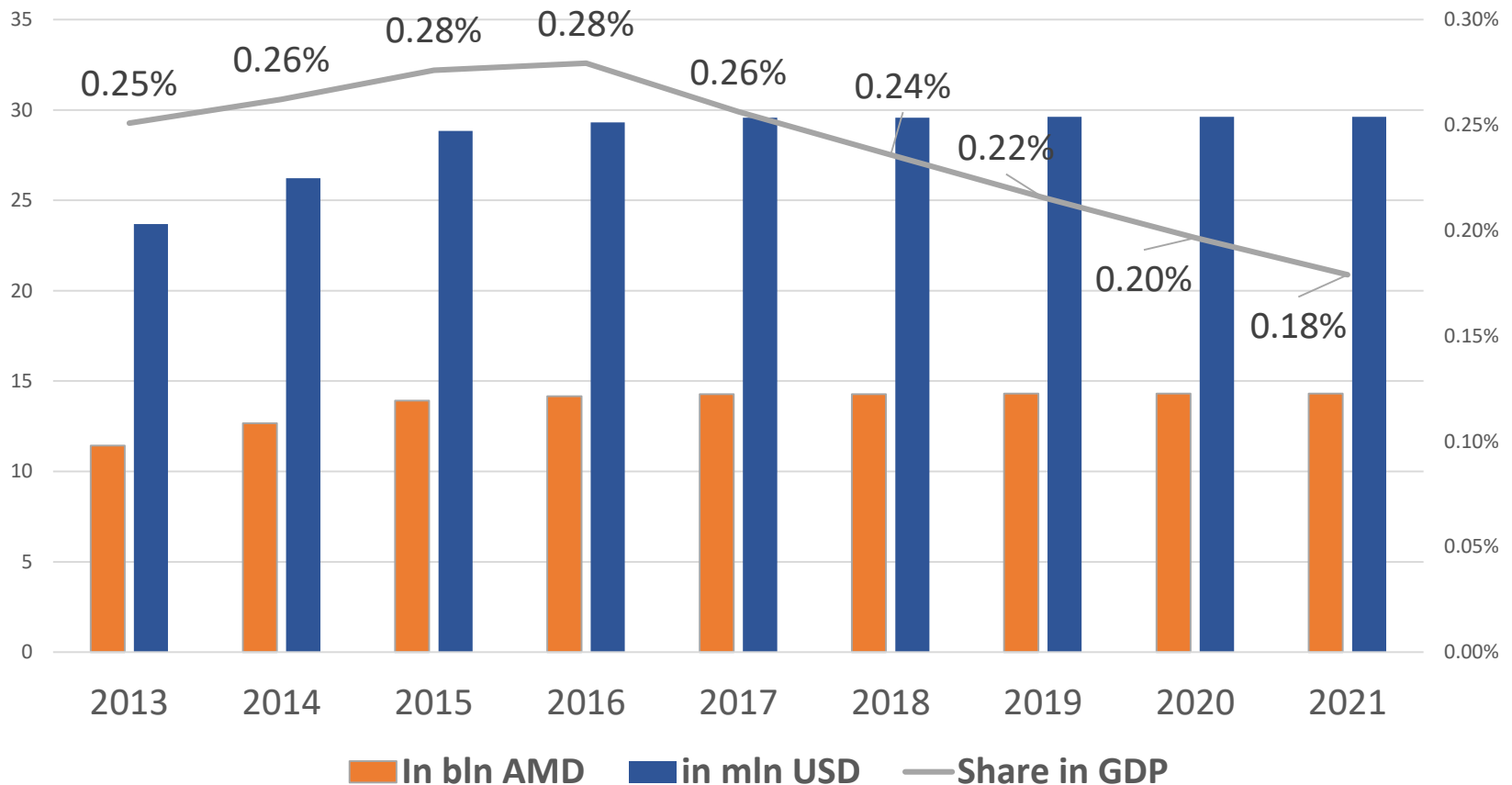


FINANCING OF R&D



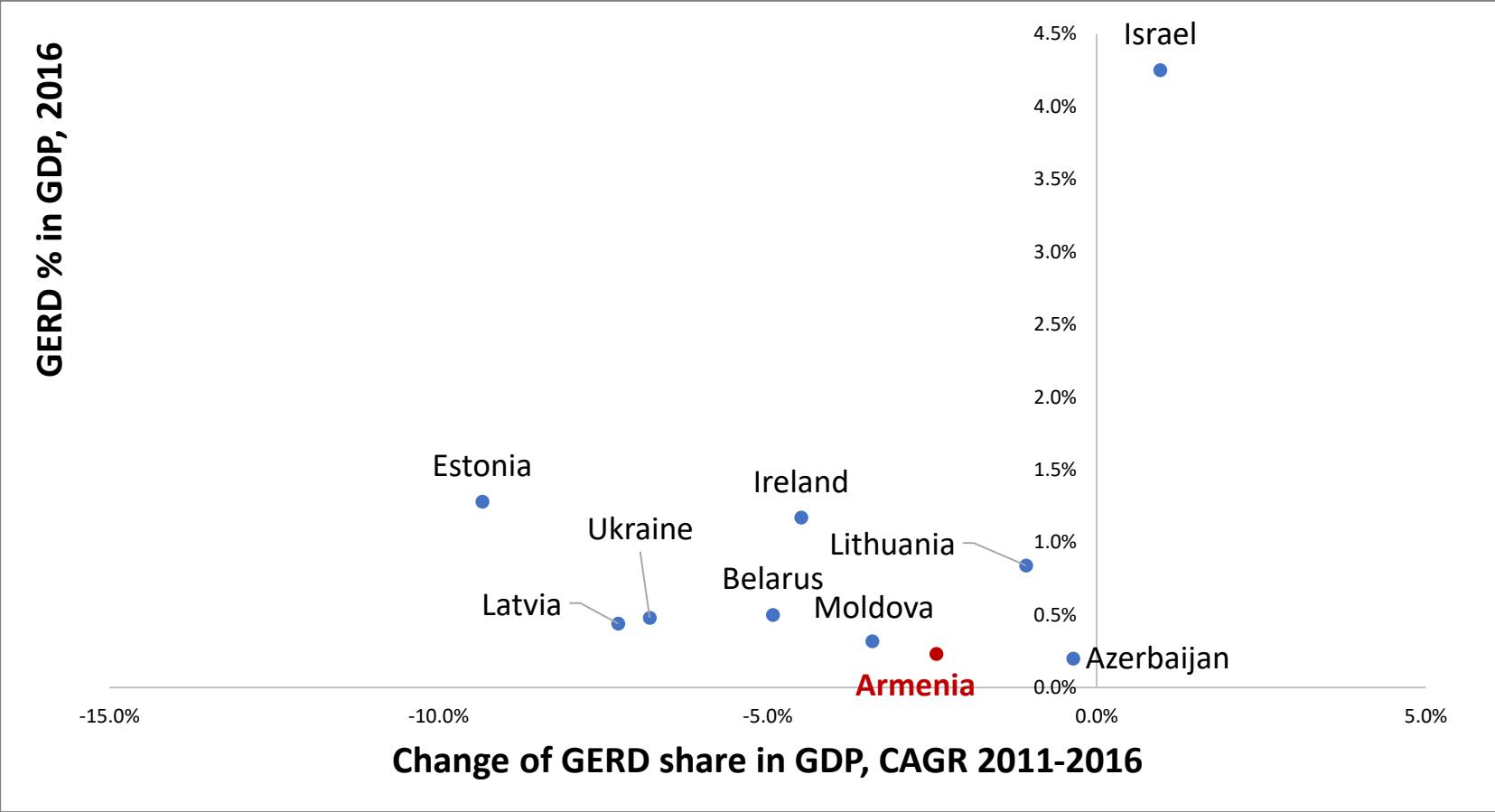
Government expenditure on science grew between 2013 and 2017. No increase is foreseen in next 3 years.

State expenditures for science in AMD and constant 2017 USD and its share in GDP



Expenditures on R&D in Armenia are in the lowest quantile in the peer group, in line with its neighbors. On the same time, the share of the GERD in GDP has decreased during 2011-2016.

GERD to GDP, in %, 2016 vs. CAGR 2011-2016



The largest share of the budget was allocated to cover operational and maintenance costs of public research institutes and ensure their functionality including the premiums for scientific degrees.

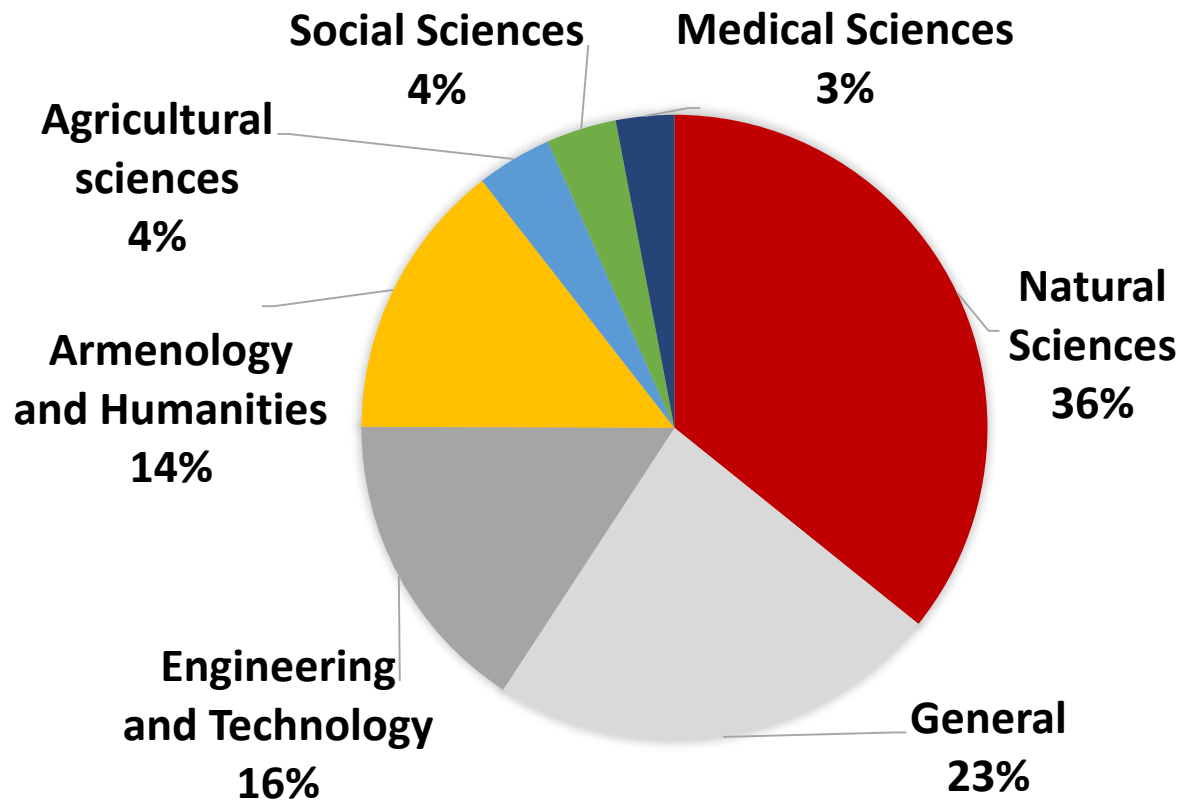
Allocation of state funding volumes according to the types of financing of scientific and scientific-technical activities

	2015	2016	2017	2018	2019	2020	2021
Basic funding including premiums for scientific degree	77.2%	77.3%	76.4%	72.9%	73.3%	73.3%	73.3%
Target program financing	13.2%	13.1%	12.9%	18.0%	18.0%	18.0%	18.0%
Competitive research grants (topic/thematic financing)	9.6%	9.6%	10.7%	9.2%	8.7%	8.7%	8.7%



The 66% of science budget in 2017 was allocated in three fields (natural sciences, engineering & technology and Armenology&humanities).

Armenian science budget (2017) by field of science



R&D PERFORMERS



The small budget is distributed among many institutions.

Distribution of Scientific Institutions engaged in state programs by fields of science and type of institutions as of January 2017

Filed/Type of Institutions	NAS	Private	State	HEI	Grand Total
Chemistry and earth sciences	5	1	6	-	12
Mathematical and technical sciences	4	4	1	-	9
Natural Sciences	8	2	3	-	13
Physics and astrophysics	5	-	3	-	8
Social sciences	12	3	19	-	34
Multidisciplinary	-	-	-	15	15
Total	34	10	32	15	91

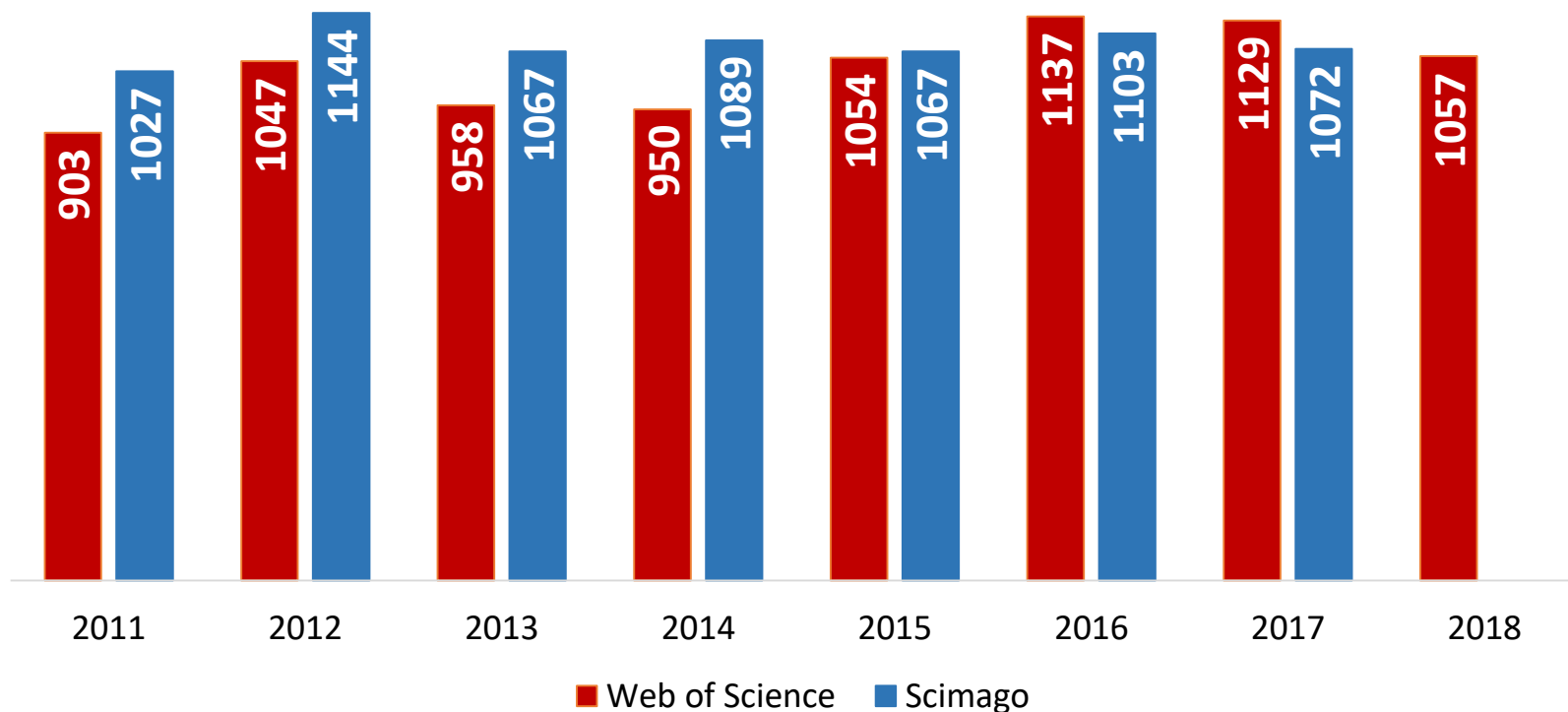


QUALITY OF THE SCIENCE BASE

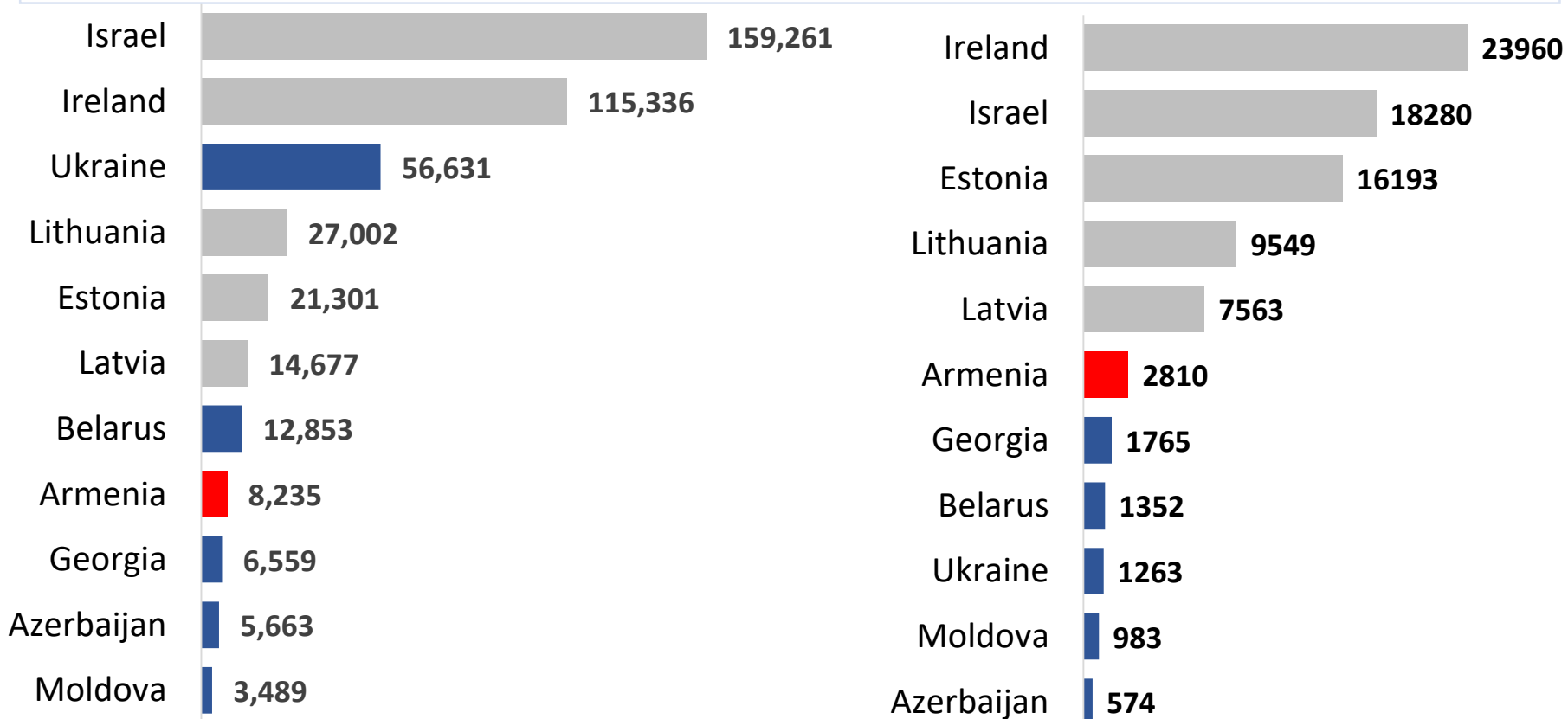


Number of published documents increased by 17% in 2011-2018 (Web of Science).

Number of publications in 2011-2018



Armenia is underperforming Ukraine and Belarus by number of publications, but is the leader among EP countries by number of publications by per million population.



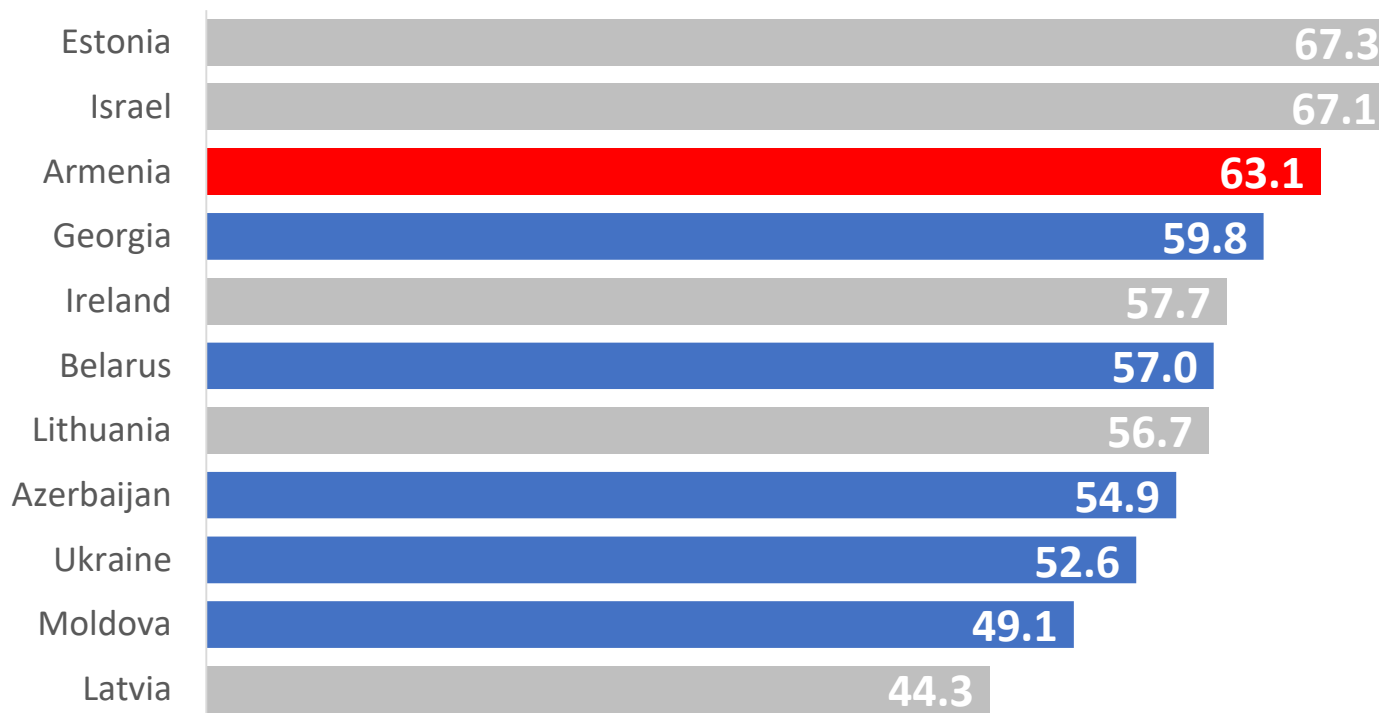
Cumulative publications of Armenia, Israel, Ireland, EP and Baltic countries in 2011-2018

Cumulative publications of Armenia, EP and Baltic countries by per million population in 2011-2018



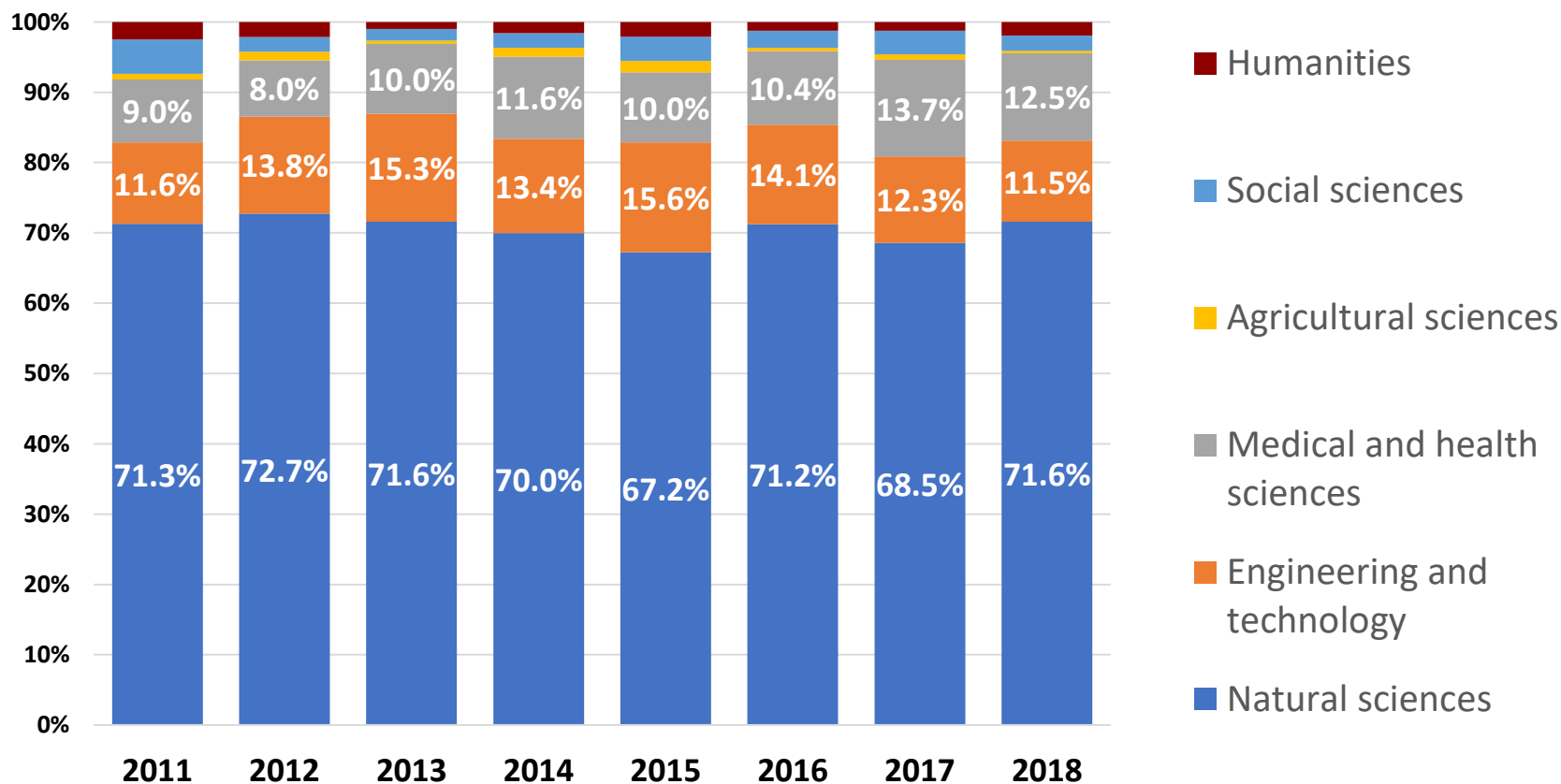
By the share of cited documents Armenia outperforms not only EP countries but also Ireland, Lithuania and Latvia.

Share of cited documents in total publications %, 2016



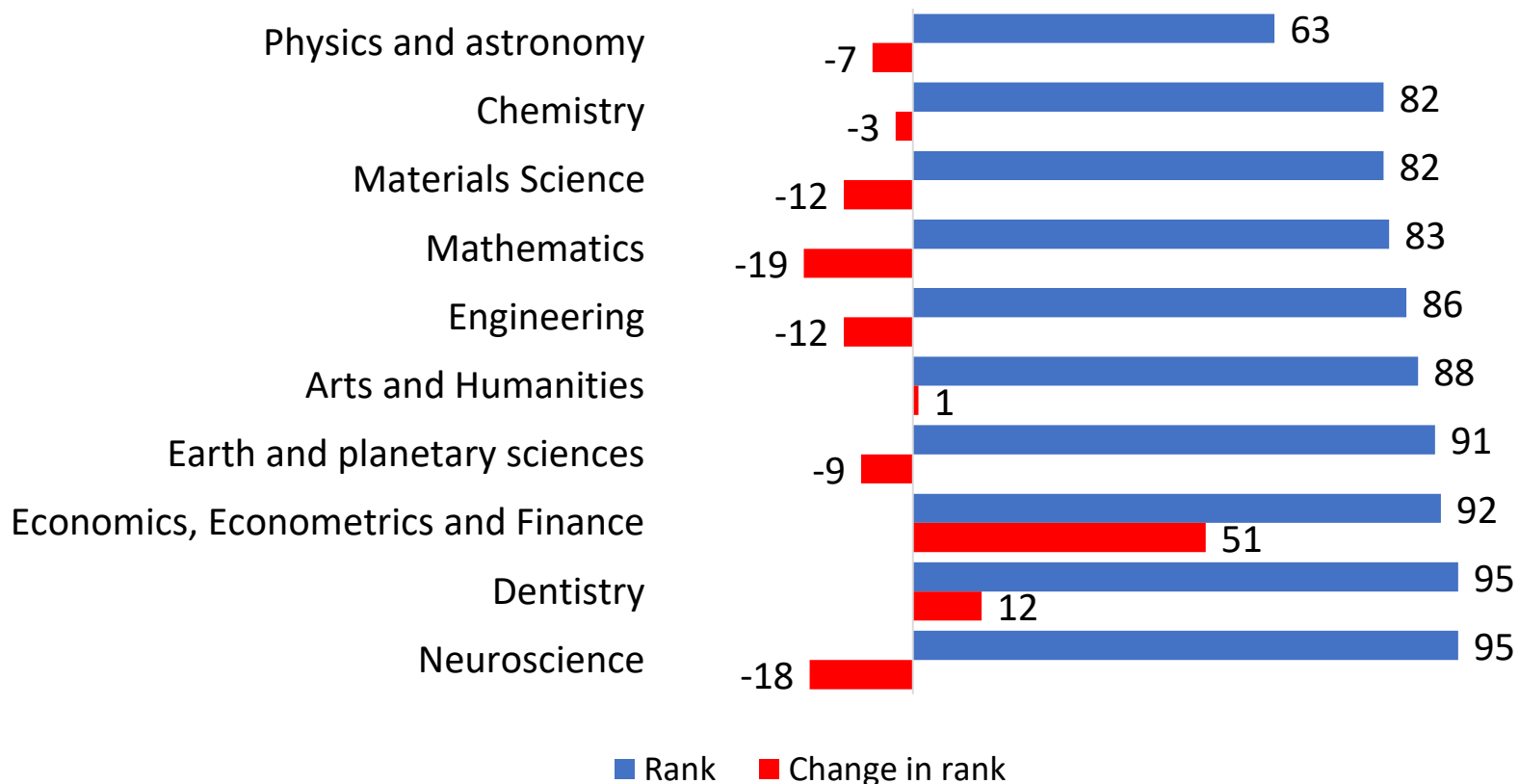
Overwhelming part of publications came from Natural Sciences followed by Medical and health sciences.

Publications in 2011-2018 by research area



According to SCimago database Physics and astronomy has the highest ranking but its position worsened by 7 places compared to 2011. The largest improvement in ranking recorded Economics, Econometrics and Finance.

Ranking of different subject areas in 2017 and their changes during 2011-2017



74% of documents in Physical Sciences and Astronomy, which is the leading subject area in the field of science of Armenia, was cited during 2011-2018.

Subject areas with highest percentage of citations, for 2011-2018 (more than 100 published documents)

Subject area	Published documents	Share of cited documents in total, %
Physics and astronomy	4547	74
Earth and related environmental sciences	205	64
Materials engineering	261	62
Chemical sciences	682	61
Other engineering and technologies	283	61
Environmental engineering	112	56
Biological sciences	626	54
Nano-technology	166	54
Mathematics	606	52
Basic medical research	380	44
Mechanical engineering	241	43
Health sciences	175	38
Electrical eng., electronic eng.	359	30
Clinical medicine	614	29
History and archaeology	109	26
Computer and information sciences	189	24



On average 63% of the publications in the field of Natural Sciences were done through international collaborations.

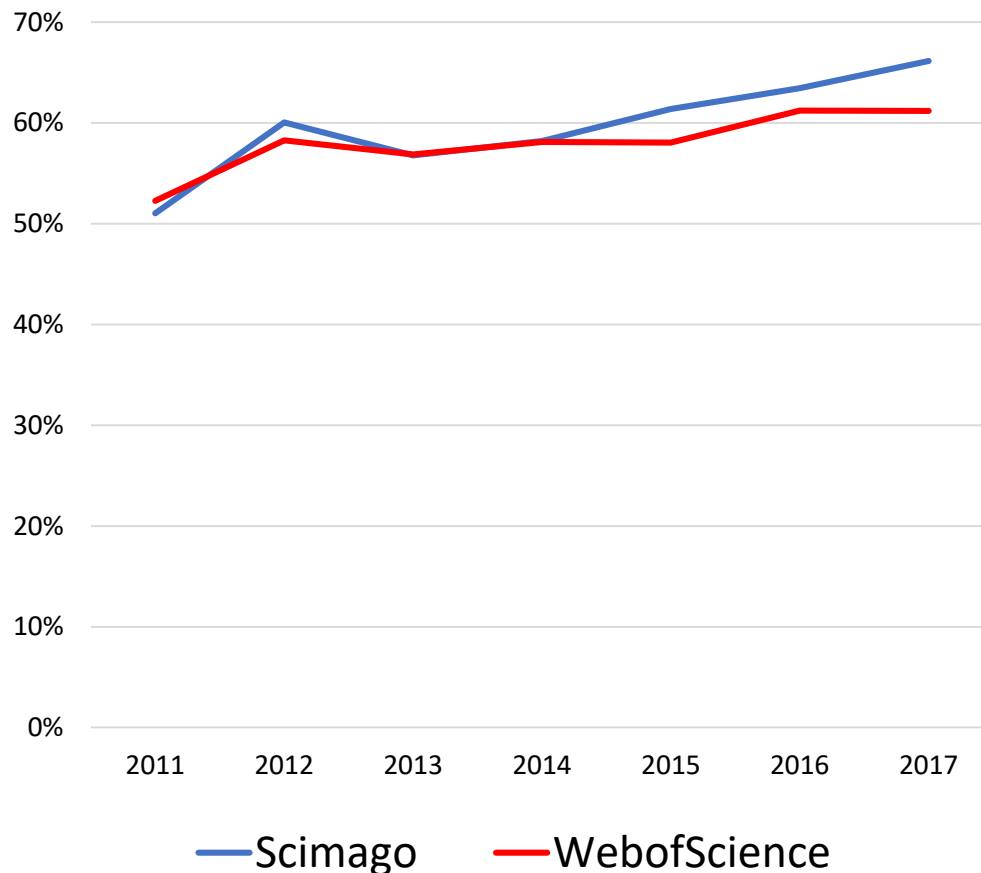
Average International collaborations 2011-2018

Subject areas	Average of documents published	Average of international collaborations	Share of international collaborations
Natural sciences	823	519	63%
Engineering and technology	158	80	51%
Medical and health sciences	125	58	46%
Agricultural sciences	10	6	60%
Social sciences	32	14	44%
Humanities	20	4	20%



Thanks to diaspora links Armenia has a relatively high rate of international collaboration of scientists.

Share of international collaborations, 2011-2017

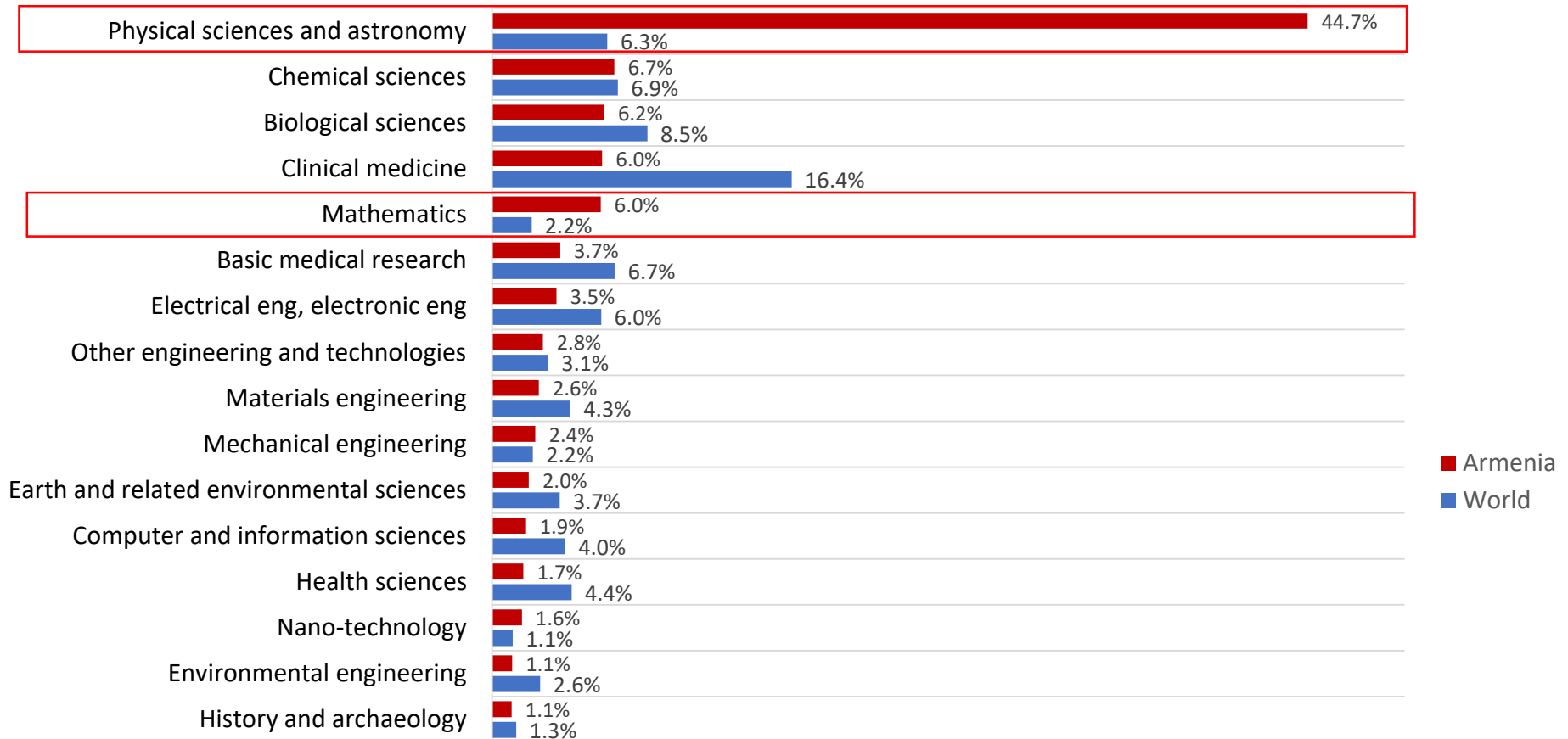


- International publications – increase of almost 77%
- Physics & Astronomy - 65% in total collaborations in 2017
- Armenia's partners - US, Germany, Russia, France and Italy



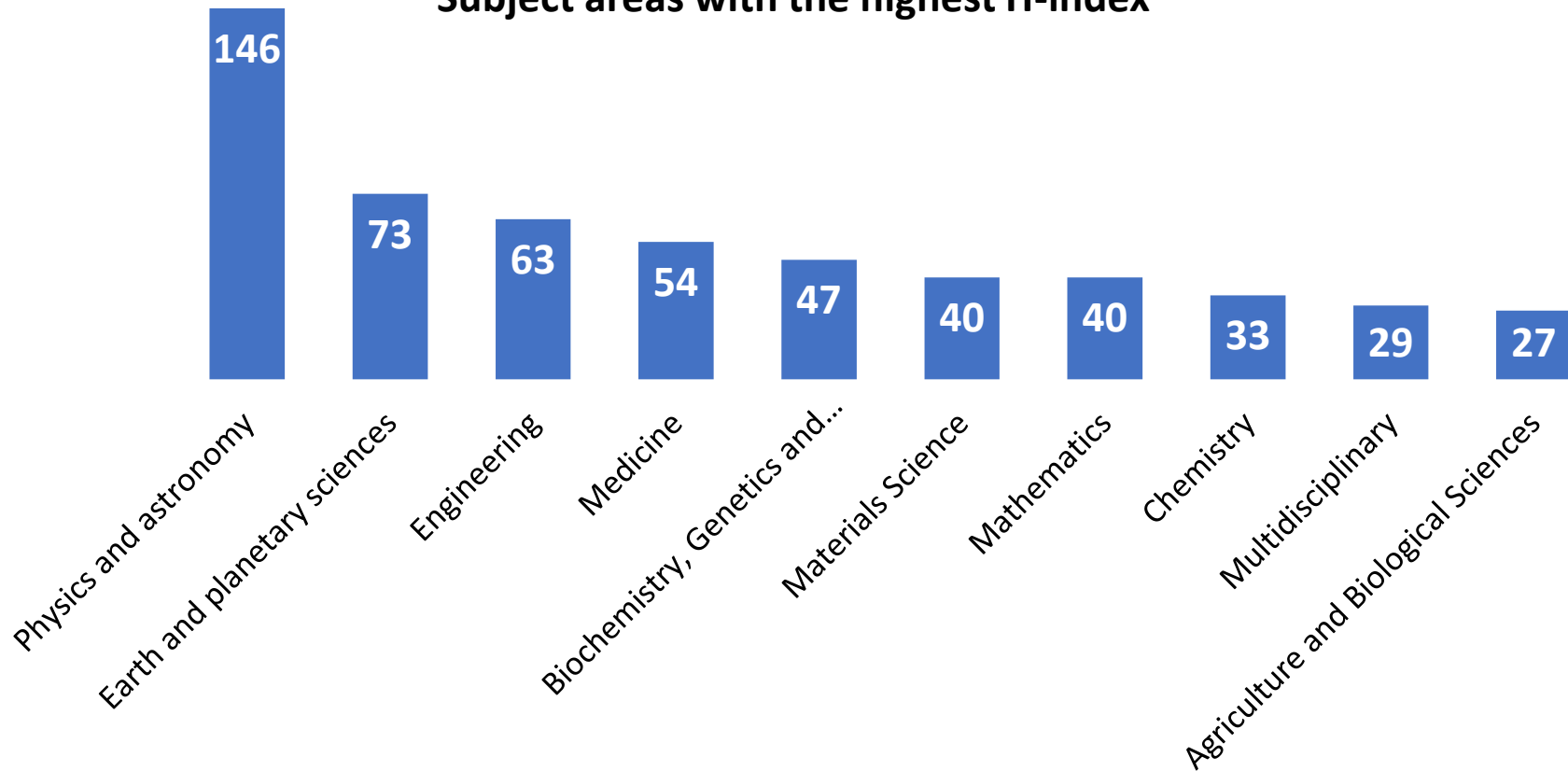
Armenia has a revealed comparative advantage in the field of Physical Sciences & Astronomy and Mathematics compared to the World.

Comparison of Armenia's and World's shares of subject areas, 2011-2018



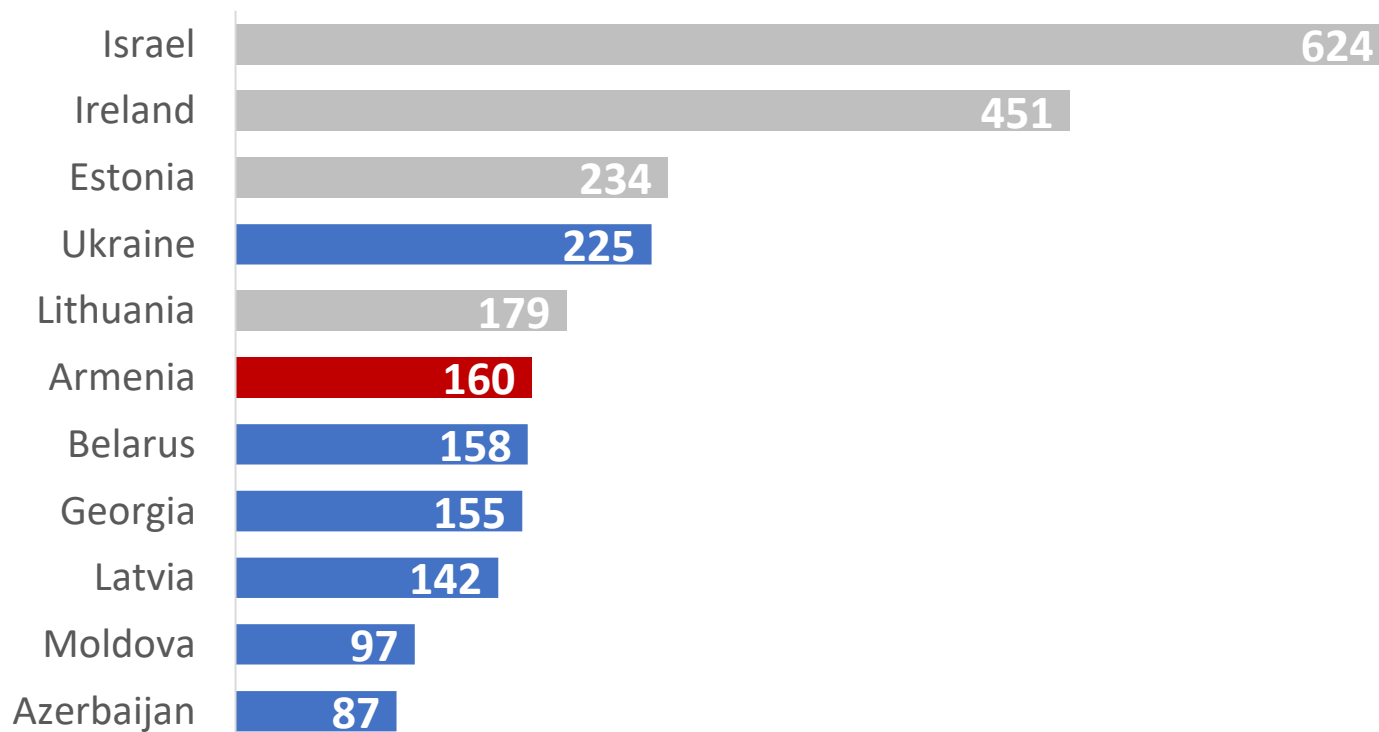
Armenia's best performing field of science by H-Index is Physics and astronomy and one of the worst performing fields is computer science.

Subject areas with the highest H-index



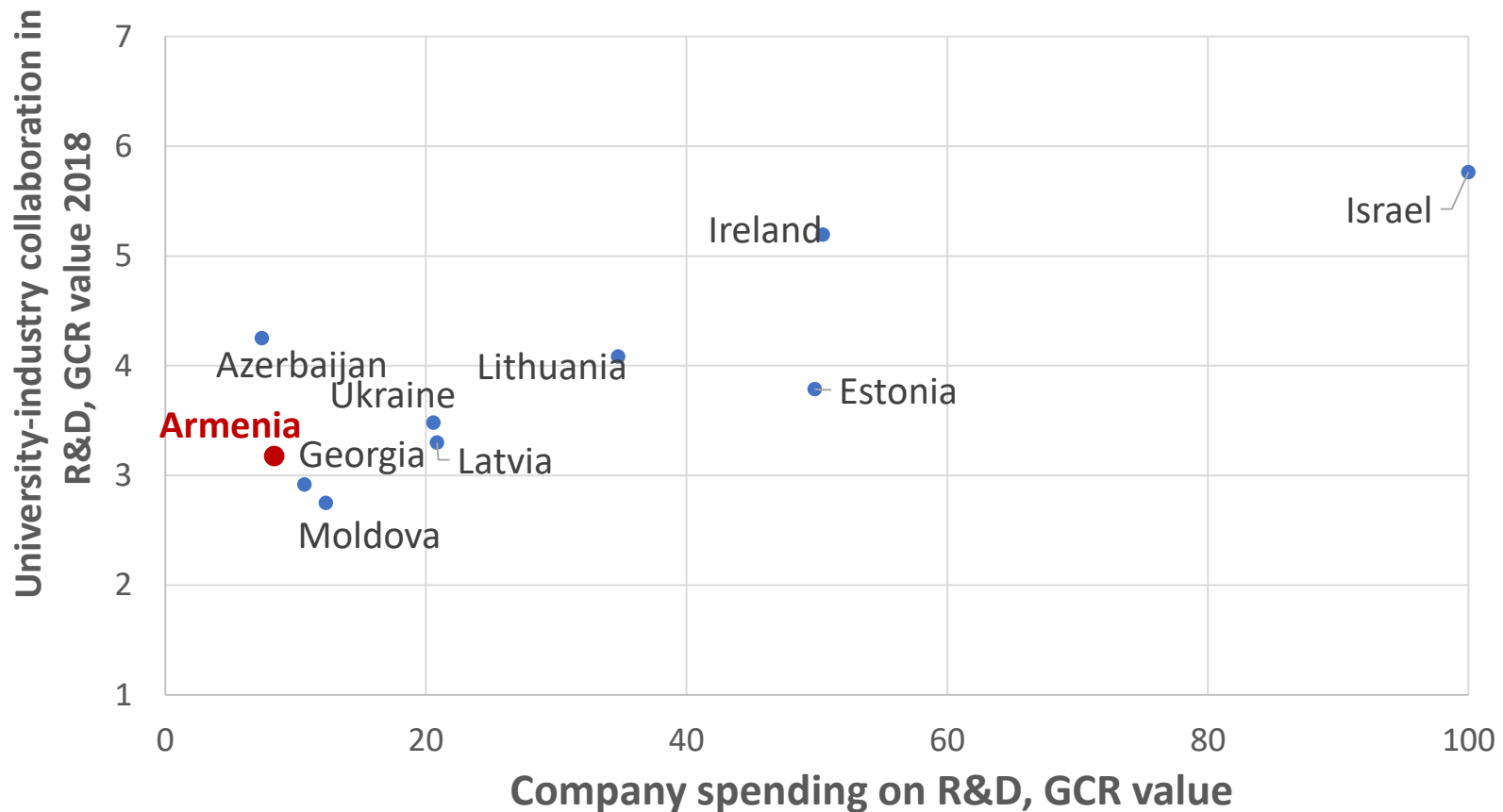
Armenia is the 2nd by H-index among EP countries by its H-index underperforming only Ukraine.

H-indexes of benchmark countries, 2017



Armenia fares only 86nd on R&D expenditure indicator and lags behind many of its competitor countries.

Company spending on R&D vs. university-industry collaboration on R&D, 2018



The numbers of companies and employees are not huge and the utilization of the technologies is still experimental in most companies.

Number of companies and employed engineers in selected disruptive technologies in Armenia, 2017

Technologies	Number of engineers (upper bound estimates)	Number of companies
Machine Learning / AI	100	14
Robotics and Drones	40	5
Internet of Things	50	6
Blockchain	30	2
Big Data and cloud computing	200	12
3D printing	25	4
Augmented and Virtual Reality	25	4
Cybersecurity	40	6



HUMAN RESOURCES



Despite the increase of government expenditure on education to \$290 million in 2019 Armenia underperforms its peers both in the field of general and higher education.

Gov.expenditures on education of benchmark countries

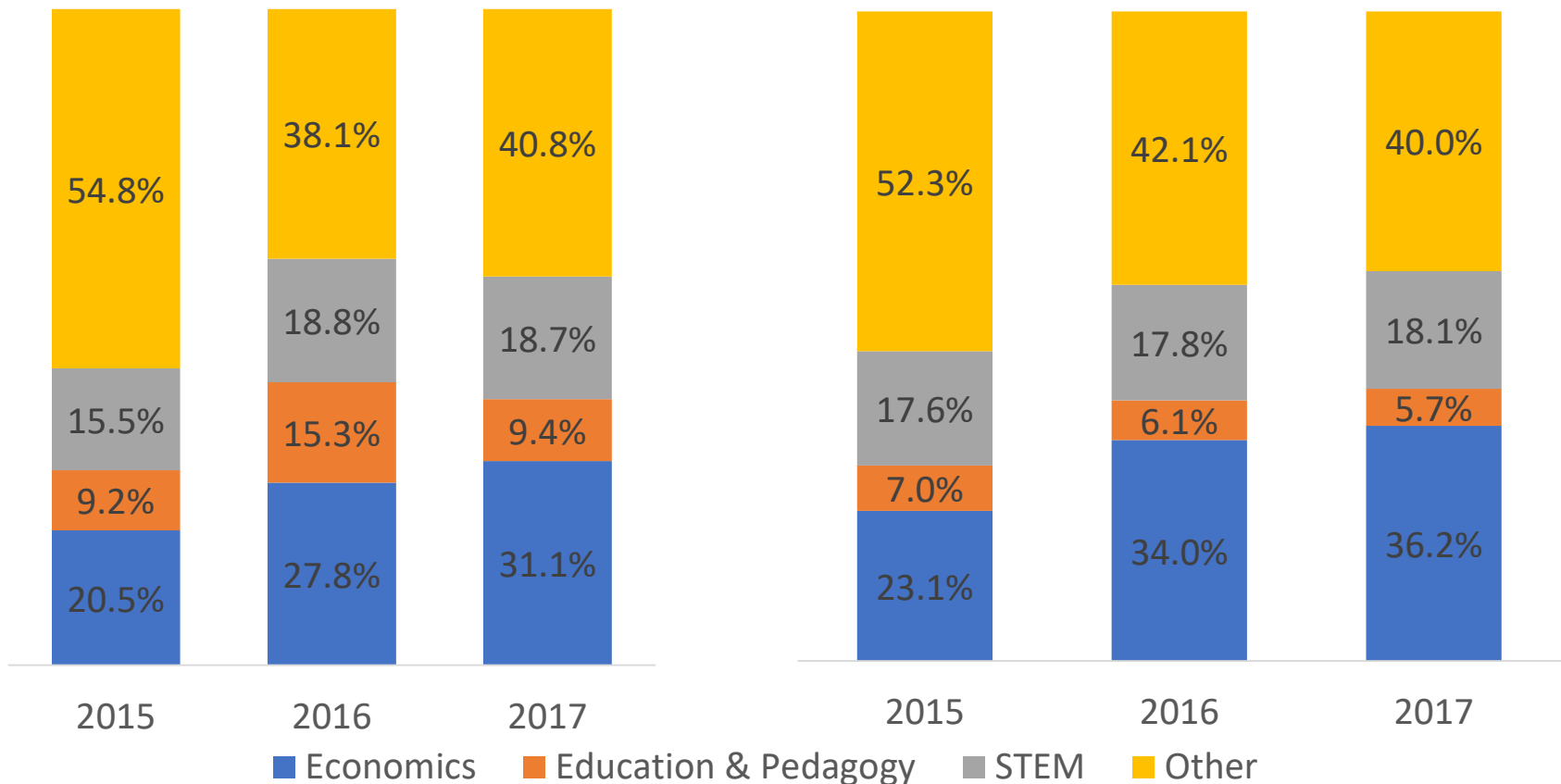
Country	Expenditure on education % of GDP	Expenditure on higher education % of GDP	Year
Armenia	2.3	0.22	2017
Azerbaijan	2.9	0.5	2016
Belarus	4.8	0.79	2017
Georgia	3.8	0.39	2017
Estonia	5.2	1.41	2015
Israel	5.9	0.95	2015
Ireland	3.8	0.88	2015
Latvia	5.3	1.18	2015
Lithuania	5.2	1.18	2015
Moldova	6.7	0.99	2016
Ukraine	5	1.53	2016
EU28 average	5.1	-	2015



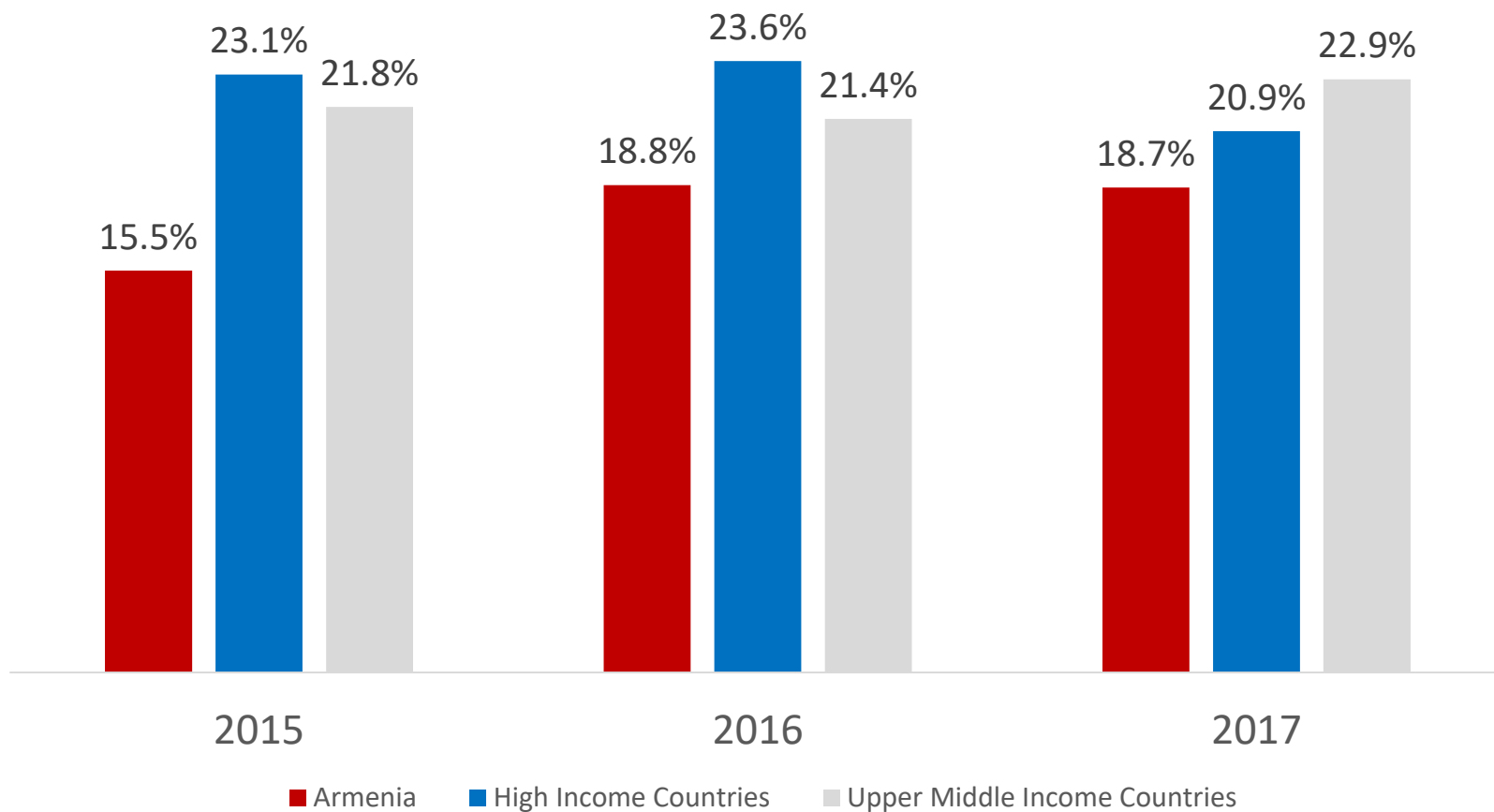
STEM graduates account 18-19% of graduates in Bachelor's and Master's degrees.

Bachelor's degree

Master's degree



Though the interest in STEM field increases in Armenia, we are still behind from the targeted groups of countries' averages.



The number of scientists dropped from 25,344 in 1991 to about 5000-6000 currently. According to the Science Committee of RA the number of people working in the field of science is 6057, out of which 3951 are researchers and 2573 from them have a science degree.

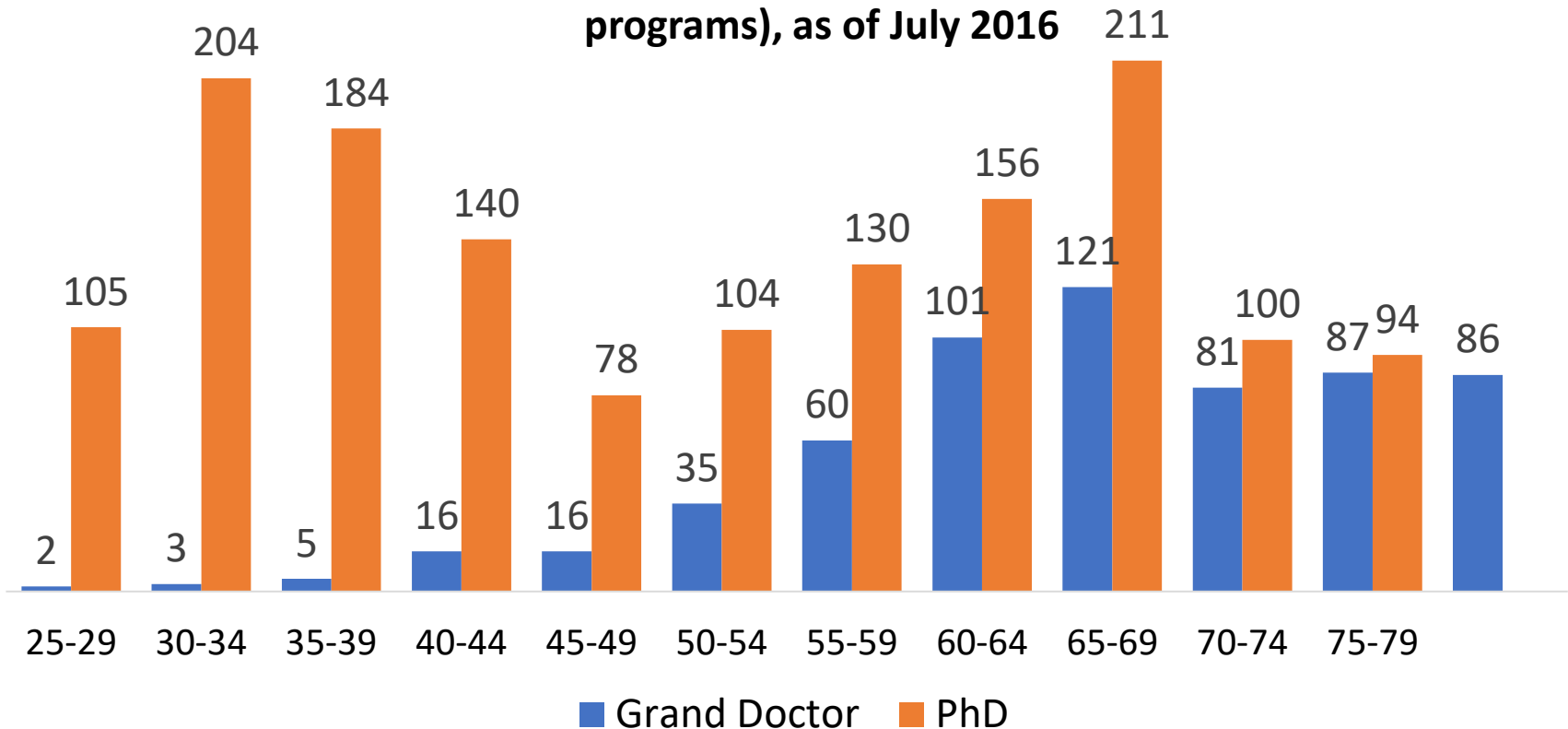
Number of R&D staff by education level (2017)

Education level	Higher education			Vocational education	Other	Total
	Total	Grand Doctor	PhD			
Research-specialists	3544	495	1553	25	19	3588
Technicians	98	-	-	93	28	219
Support staff	208	1	2	207	112	527
Other	283	-	1	44	161	488
Total	4133	496	1556	369	320	4822



Demographic hole in the scientific community(45-49 age group) is a result of the transition period in the 1990s (the collapse of the Soviet Union).

Scientific grade holder's structure by age group (scientists engaged in state programs), as of July 2016



INTERNATIONAL R&D COOPERATION AND MOBILITY



Armenia launched its cooperation with Horizon 2020 in May 2016.

Legal Names of RA institutions	H2020 Participations
National Academy of Sciences of the RA	7
Institute for informatics and automation problems of the national academy of sciences of the RA	4
Small and medium entrepreneurship development national center of Armenia fund	3
Information society technologies center	2
Yerevan State University	2
Yerevan State Medical University after Mkhitar Heratsi	1
Center for Ecological-Noosphere Studies National Academy of Sciences of the RA	1
Caucasus Consulting Group-am	1
ACBA leasing credit organization closed joint stock company	1
Grovf LLC	1
Educational and cultural bridges	1
Center of medical genetics and primary health care	1
"Matenadaran" M.Mashtots institute of ancient manuscripts	1
Scientific and production center Armbiotechnology NAS RA	1
Institute for physical research of national academy of sciences of Armenia	1
A.I. Alikhanyan national science laboratory	1

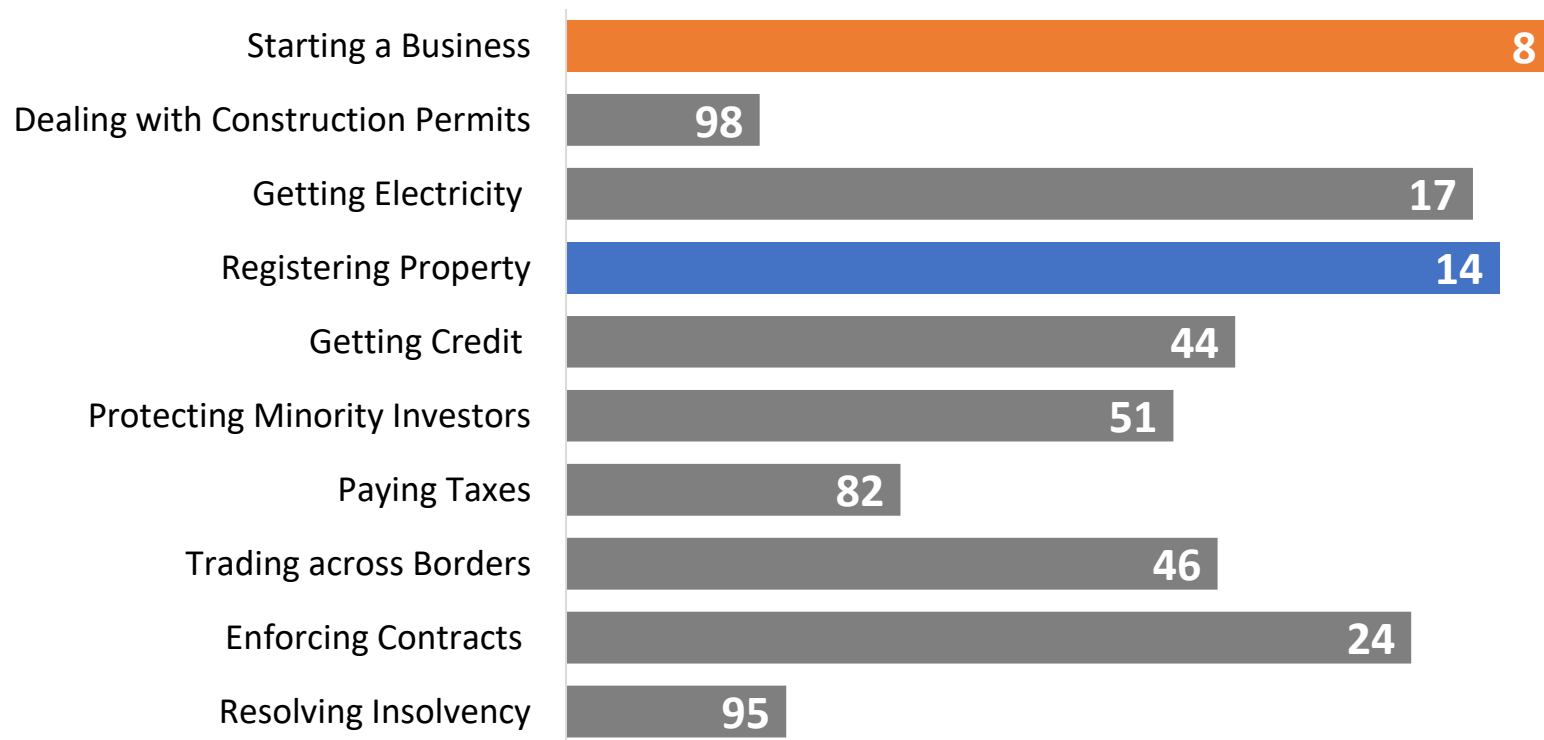


FRAMEWORK CONDITIONS FOR R&I



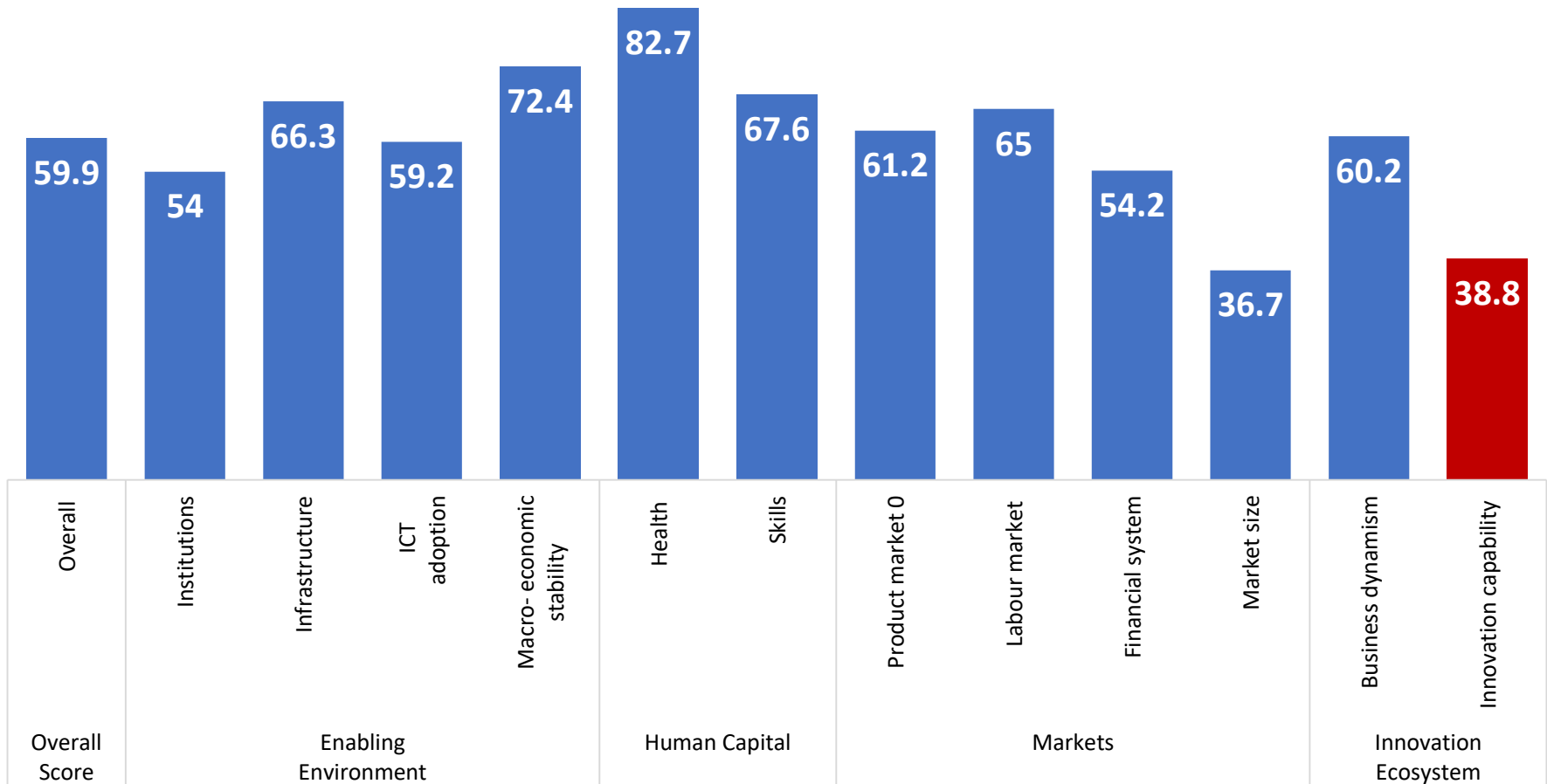
Armenia has made progress in improving its business environment but remains well below neighboring Georgia (6th rank).

Armenia's rankings on Doing Business topics



Armenia shares strong performances on health, macro-economic stability and education and skills while significantly underperforms in Innovation capability.

Armenia's Performance Overview 2018, GCR



Examples of innovation enabling platforms in Armenia

Business incubators and accelerators

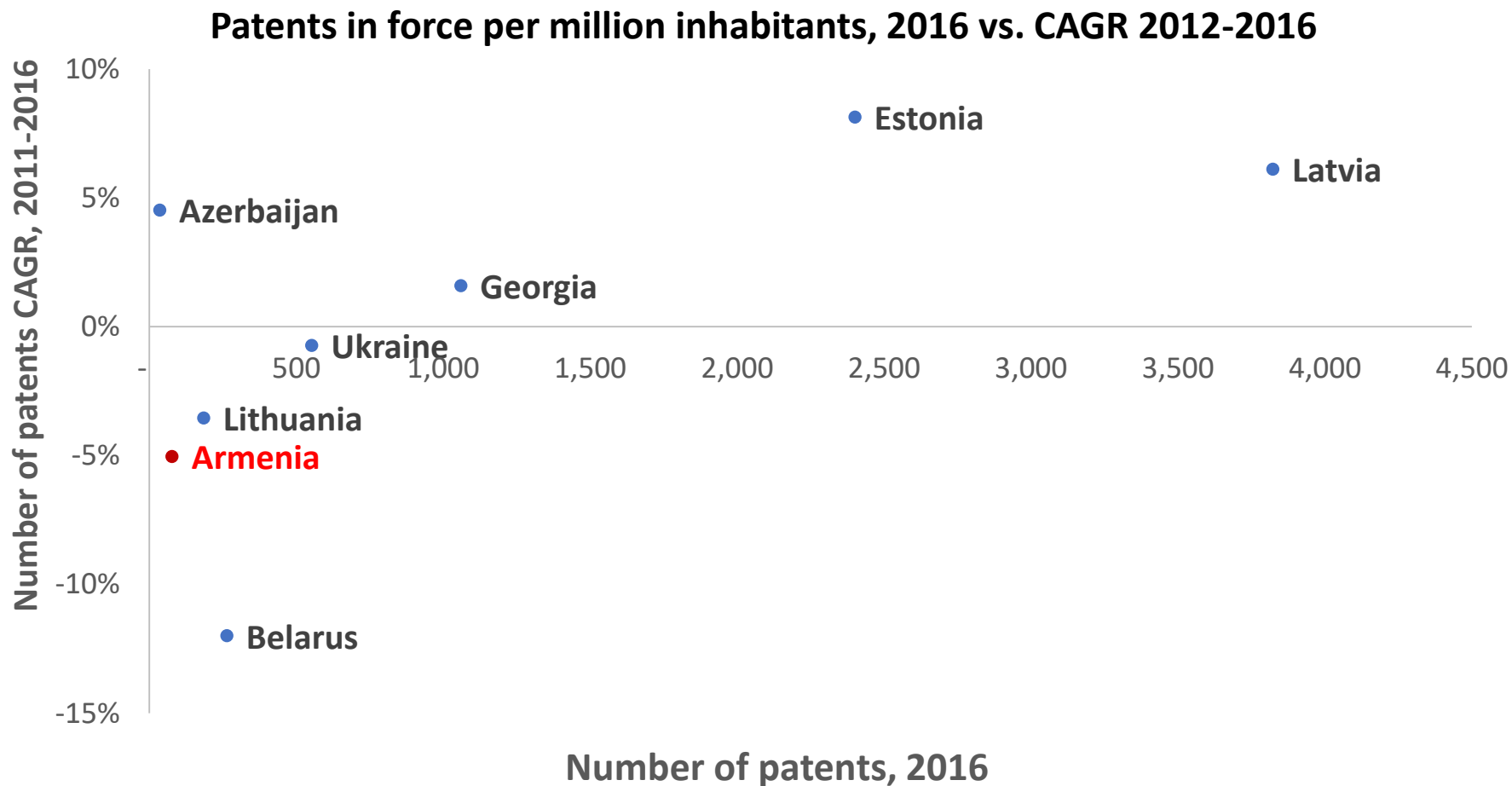
- Gyumri Technology Centre (GTC)
- Vanadzor Technology Centre (VTC)
- Viasphere Technopark
- “IT Park”
- The Tumo Centre for Creative Technology
- Microsoft Innovation Centre
- IBM Innovative Solutions and Technologies Centre (ISTC)
- The Engineering City
- Regional Nokia Mobile Application Laboratory for Eastern Europe
- Armenian National Engineering Laboratories
- The ICT Armenian-Indian Centre for Excellence
- The Convergence Centre for Engineering and Applied Science (in the process of construction)

Diaspora led networks and initiatives

- The Foundation for Armenian Science and Technology
- ArmTech
- ARPA Institute
- The Armenian Engineers and Scientists of America

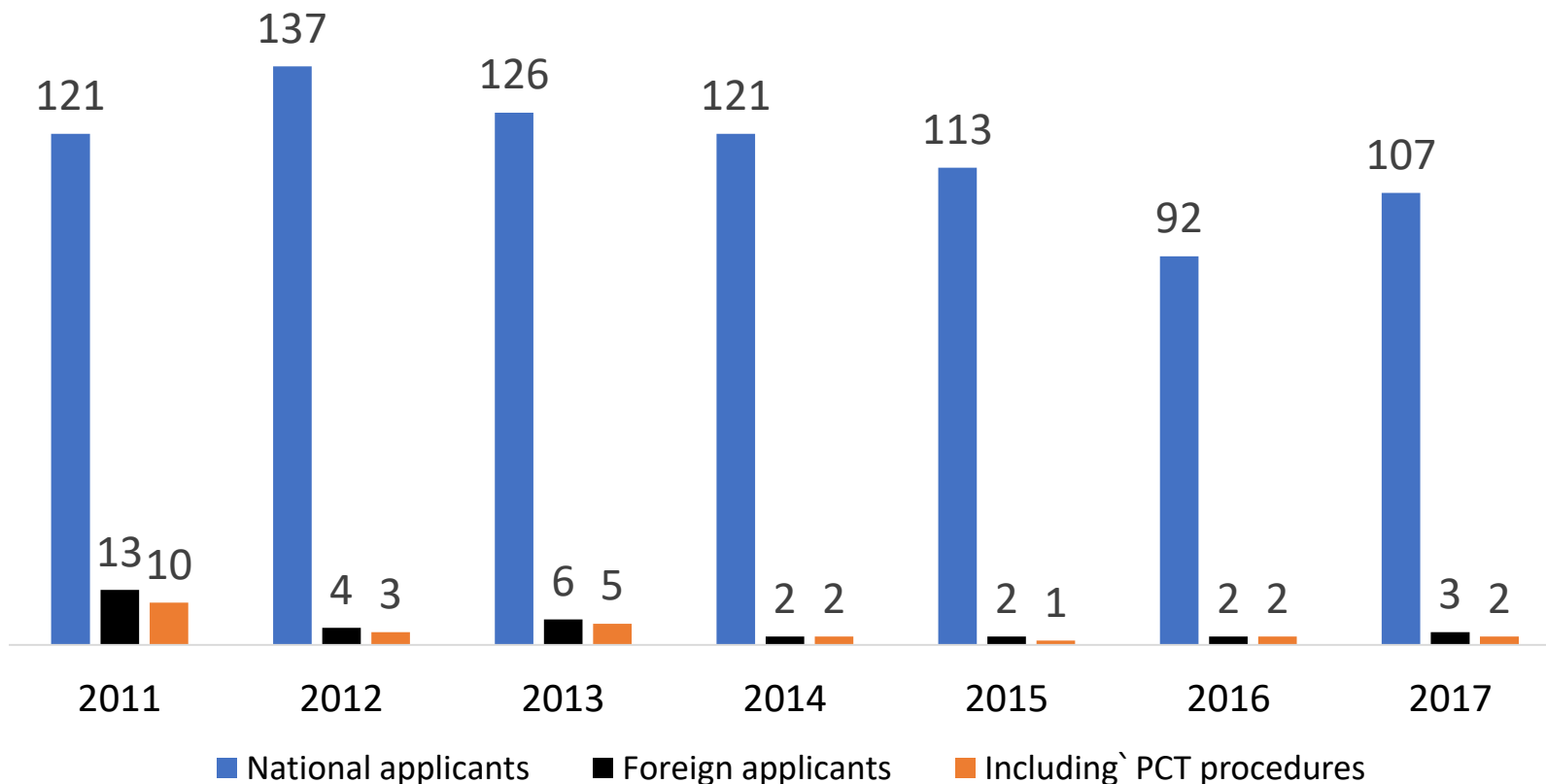


Armenian researchers are less active in patenting.



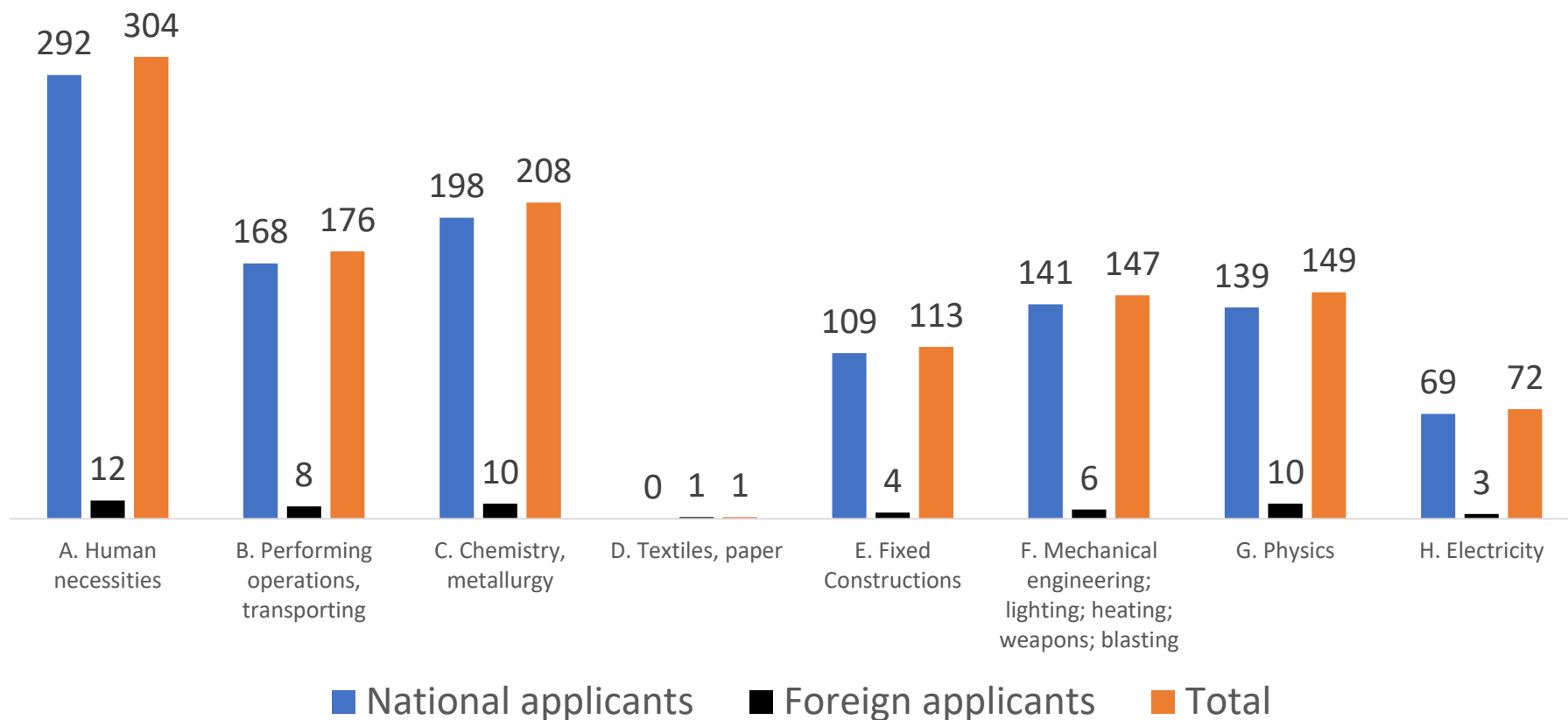
The majority of patent applications are submitted by national applicants.

Number of invention patent applications in Armenia, 2011-2017



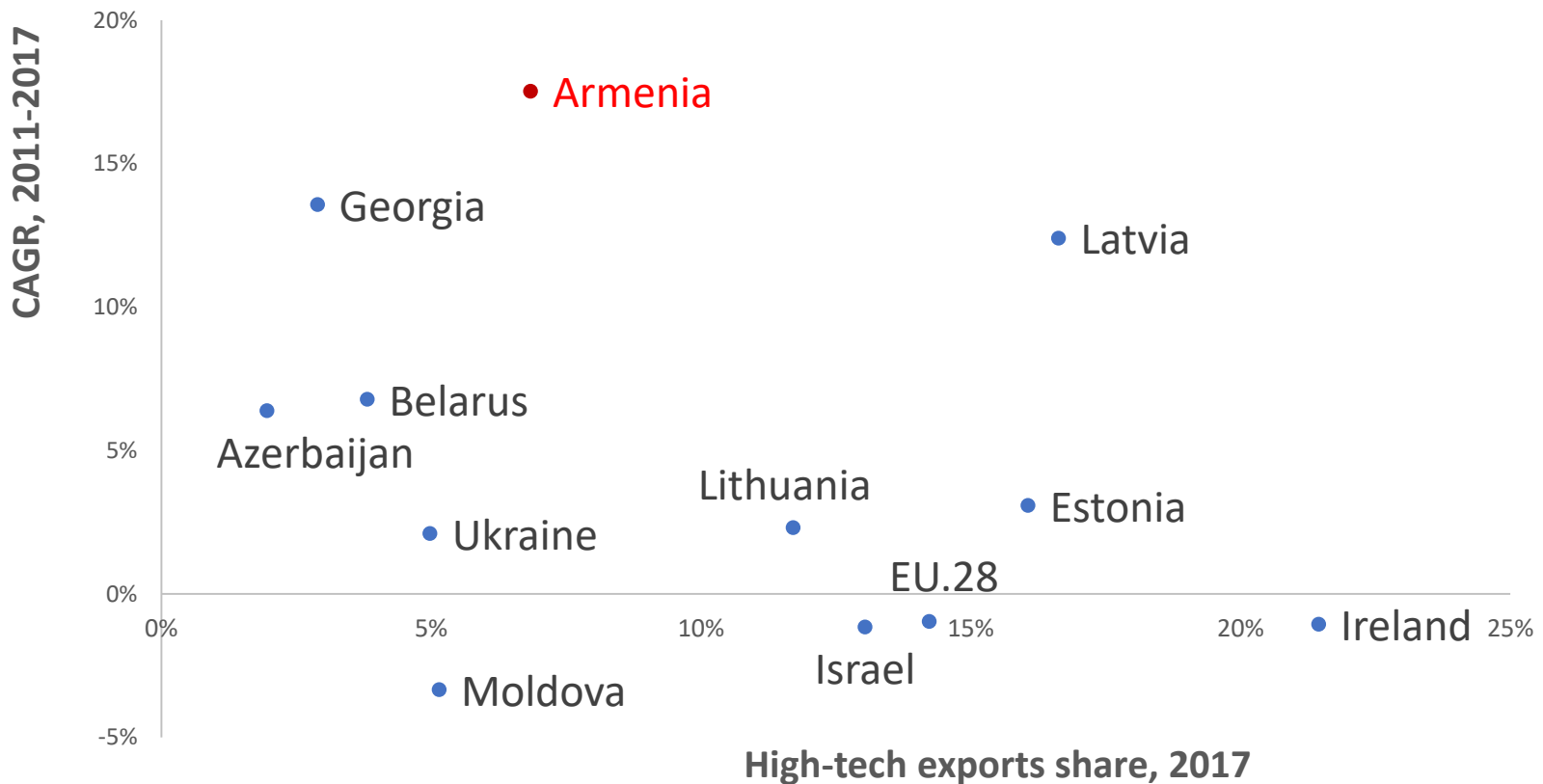
The field of human necessities is the leader both for national and foreign applications.

Number of patent applications in Armenia by the field of technology, 2011-2017



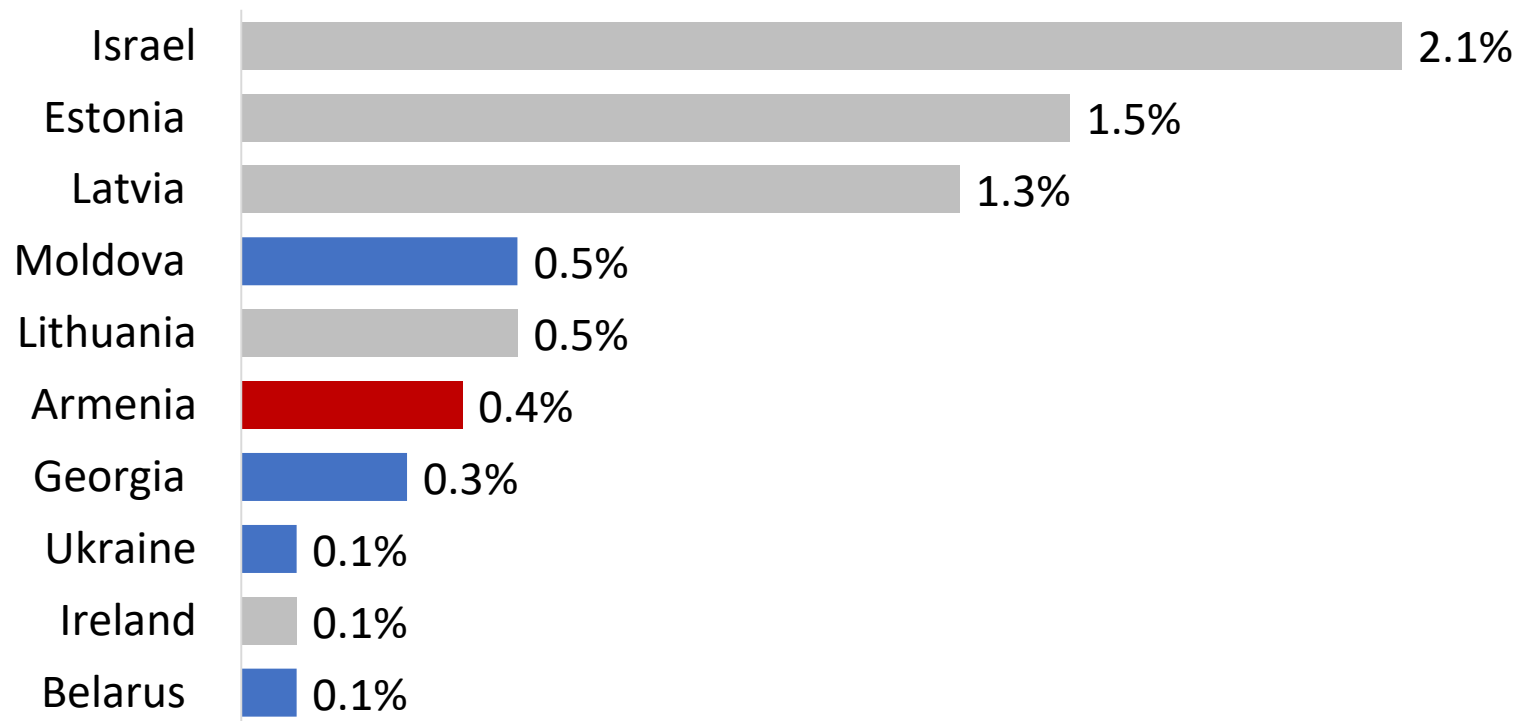
Armenia shows relatively higher level than average results both in terms of high-tech exports and its growth rates during the last 6 years compared with EP peers.

High-Tech Exports (in percentage to total manufactured exports) in 2017 vs. CAGR 2011-2017



Armenia shows moderate results on cultural and creative exports.

Cultural and creative output service exports, Armenia and benchmark countries, 2018



ARMENIA'S INNOVATION CHALLENGES



The current state of the Armenian innovation system is far from optimal, but there are a number of improvements.

- Current developments

- High recognition of innovation on policy level
- Internationally competitive research capabilities in selected fields and relatively strong scientific output results
- Success in building dynamically developing and internationally linked innovation ecosystem in ICT and, to some extent, engineering service sectors
- Networked and experienced diaspora in science, technology and business sectors
- Large-scale educational initiatives and positive attitude towards education
- Embryonic innovation support services (funded by government, donor and diaspora).

- Key challenges

- Underinvestment in science and fragmentation
- Quality of education
- Weak research-industry linkages
- Low absorptive capacity of local private sector
- Absence of innovation strategy and focus

