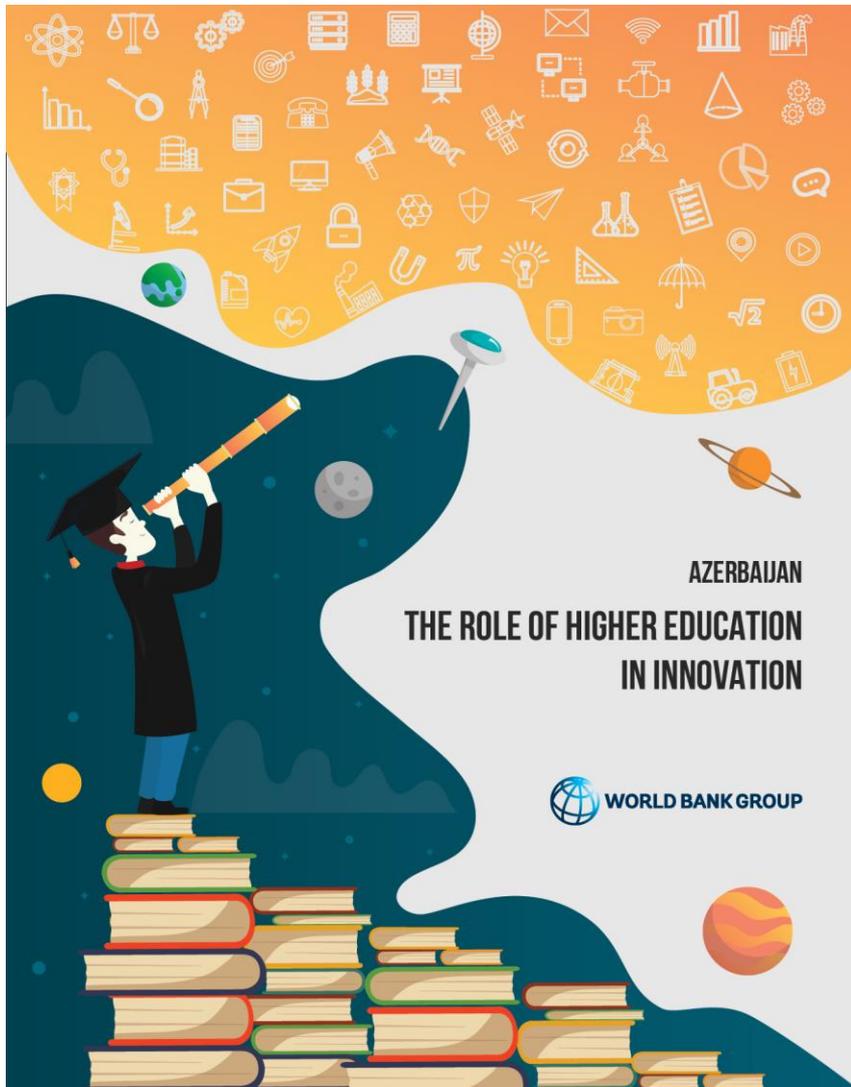


THE ROLE OF HIGHER EDUCATION INSTITUTIONS IN INNOVATION



WORLD BANK GROUP

Azerbaijan Human Capital Forum
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- The World Bank led analytical work on HE and innovation in Azerbaijan, 2017-2018
- Special thanks for the contribution of the representatives of the Ministry of Education and the innovation system stakeholders
- Published in 2018

Presentation overview

Background and Executive Summary

1. Higher Education Sector Overview

2. Expenditure on R&D

3. Research Output

4. HEIs' Third mission: Innovation and Entrepreneurship

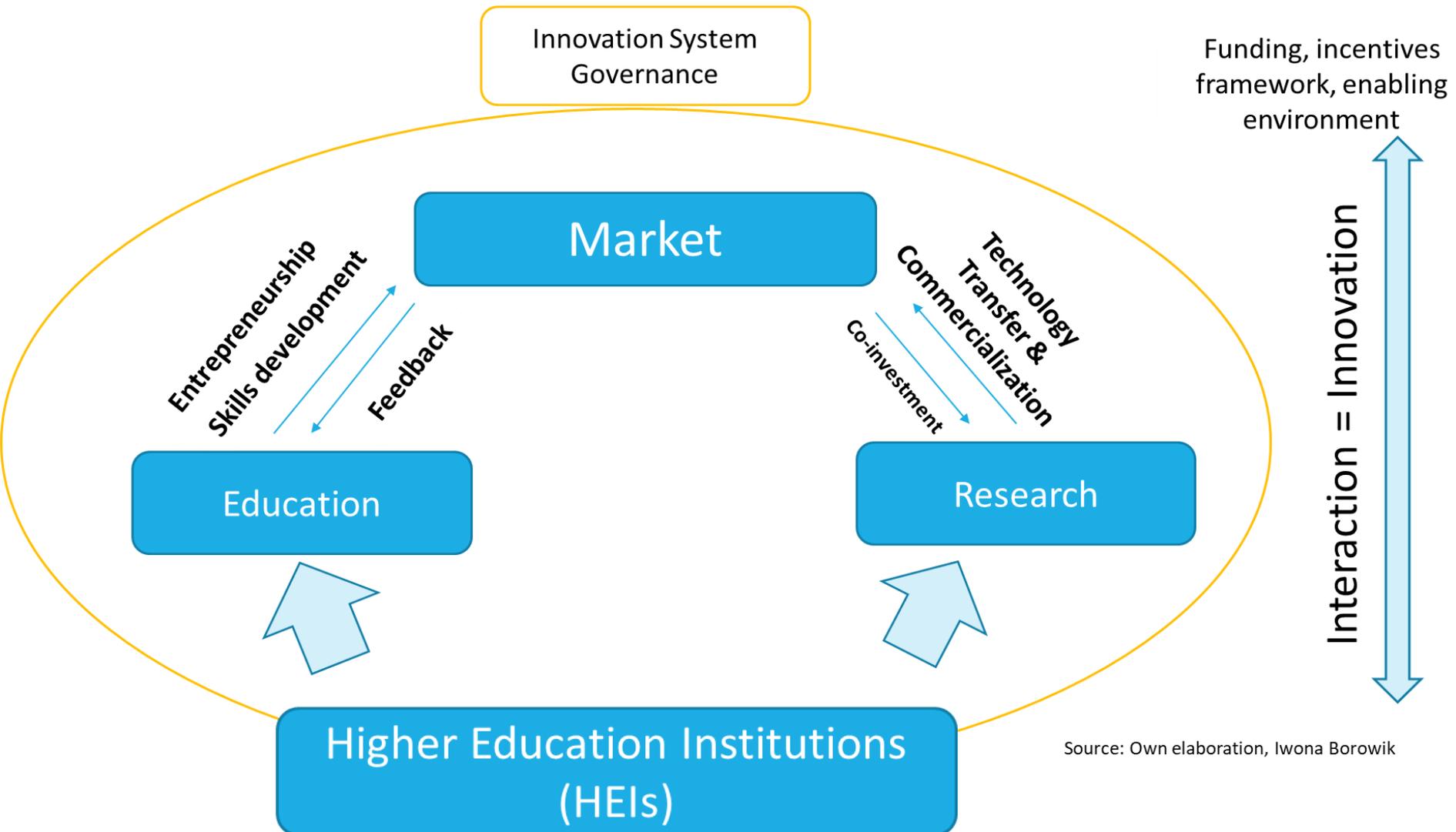
5. Innovation Infrastructure

6. Preliminary Policy Recommendations

HEIs are the backbone of a country's innovation ecosystem

- Responsible for creating high quality human capital
- Hubs of research, education and innovation
- Provide access to infrastructure and talent for innovators
- Provide access to knowledge networks (local, national and global).

Innovation through Higher Education



Source: Own elaboration, Iwona Borowik

Key messages from the analysis informing the policy recommendations

- ❑ Public investment in HE and R&D is relatively low and focuses on basic, rather than applied, research.
- ❑ Targeted reforms are needed to increase the quality and relevance of R&D and improve the efficiency of public investments in science.
- ❑ The funding, evaluation, career management, and quality assurance mechanisms currently in place need to be updated to align with international best practice.
- ❑ Connectivity with international research networks, university-industry linkages, and technology commercialization mechanism can be strengthened.
- ❑ The availability and accessibility of modern research and prototyping equipment is uneven among the various stakeholders of the research and innovation sphere.

Ongoing reforms towards innovation

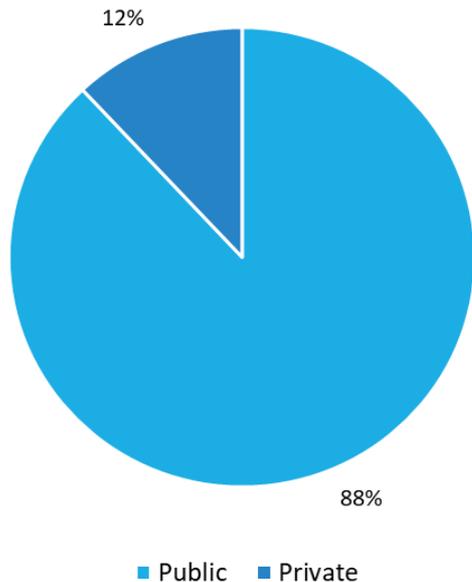
- *Strategic Road Map on National Economy and Key Sectors of the Economy of Azerbaijan* – endorsed in 2016 targeting economic diversification through the development of the innovation ecosystem – was a major step in the right direction.
- The Ministry of Education has initiated collaboration with the world’s leading universities to provide capacity building of human resources for the innovation ecosystem.
- A concept paper on *Building an Innovation Ecosystem* has been developed; among its objectives is to “transform universities into platforms that would bring education, business, and government together for sustainable approach towards innovation ecosystem”.

1. Higher Education Sector Overview

Azerbaijan's Higher Education System

In 2016, there were 163,779 students studying at 53 universities, 88% of them at public institutions

Students in Public and Private HEIs



53 total HEIs

- 45 are in Baku
- 38 are public
- 15 are private

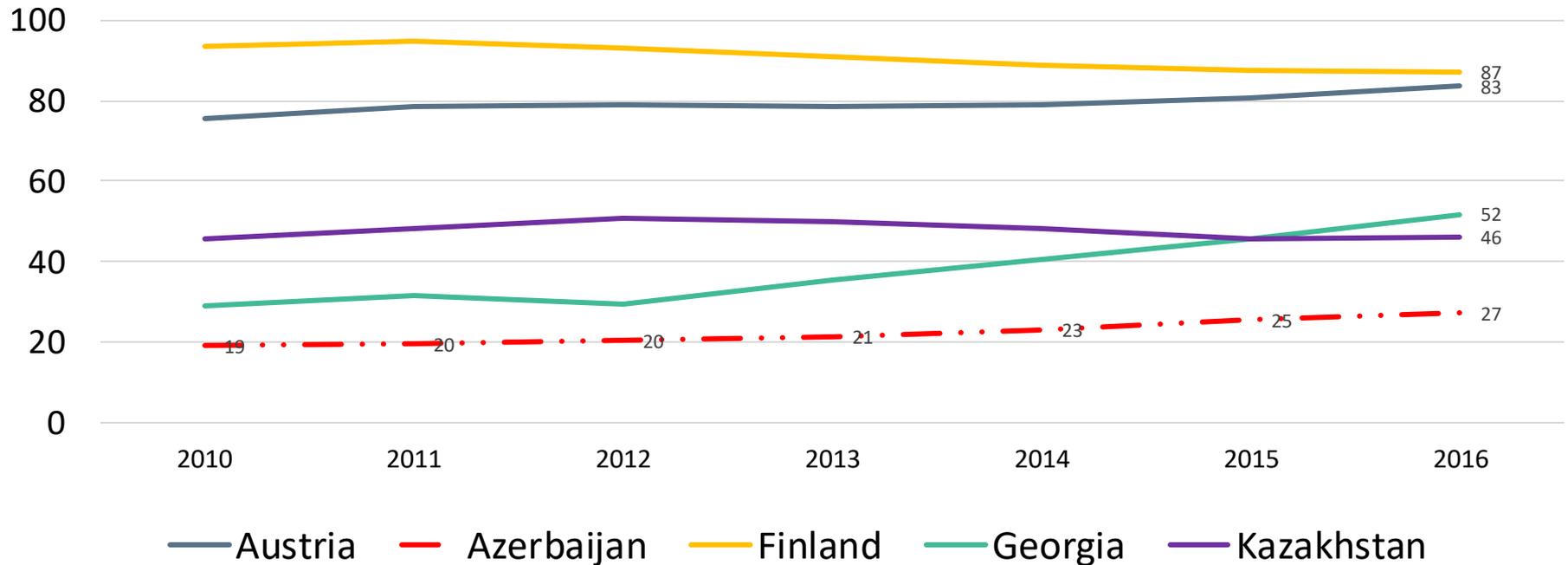
41,224 students were admitted to universities in 2016 (88% to bachelor, 12% to master programs)

3% of GDP was allocated to education in 2018 of public funding
0.3% of GDP is spent on HE

State Statistical Committee 2016

Azerbaijan's Higher Education System

27.2% Gross Enrollment Ratio in tertiary education in 2016

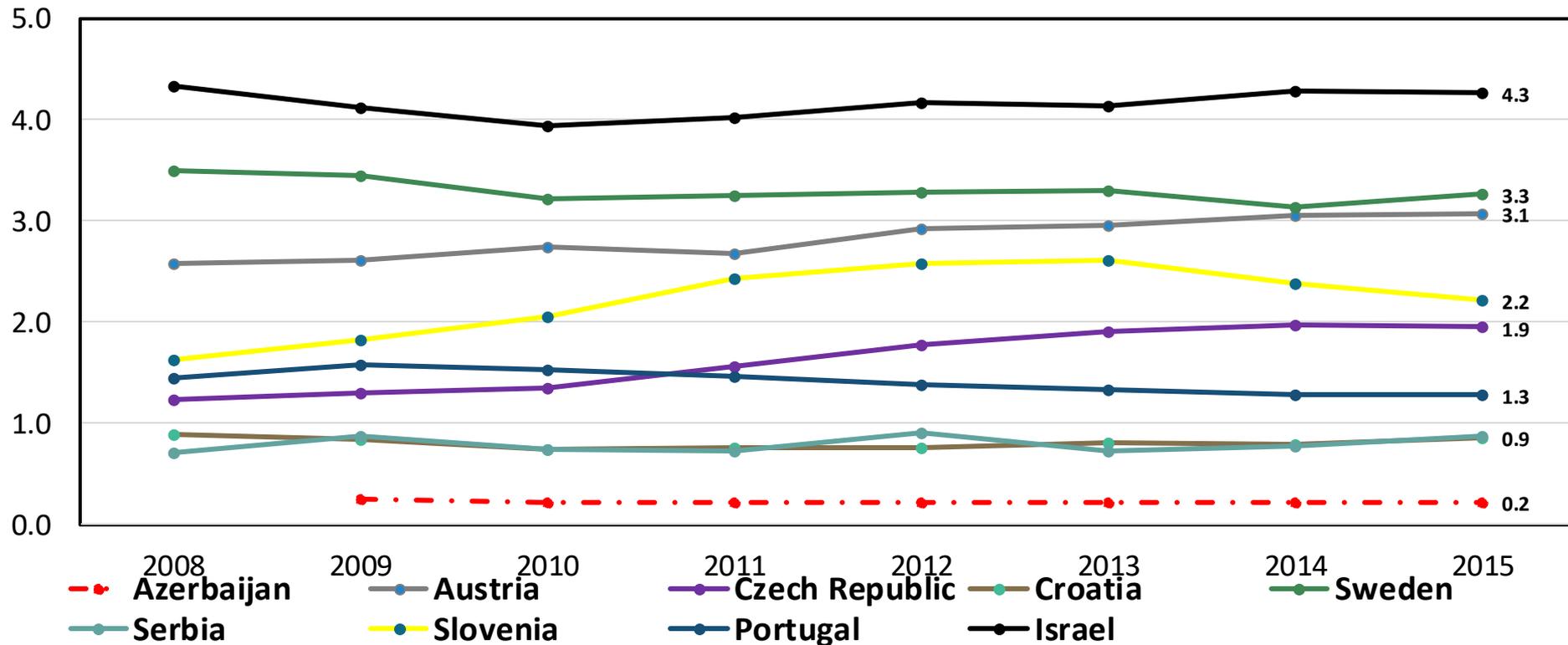


UNESCO INSTITUTE FOR STATISTICS

2. Expenditure on R&D

Gross Expenditure on R&D

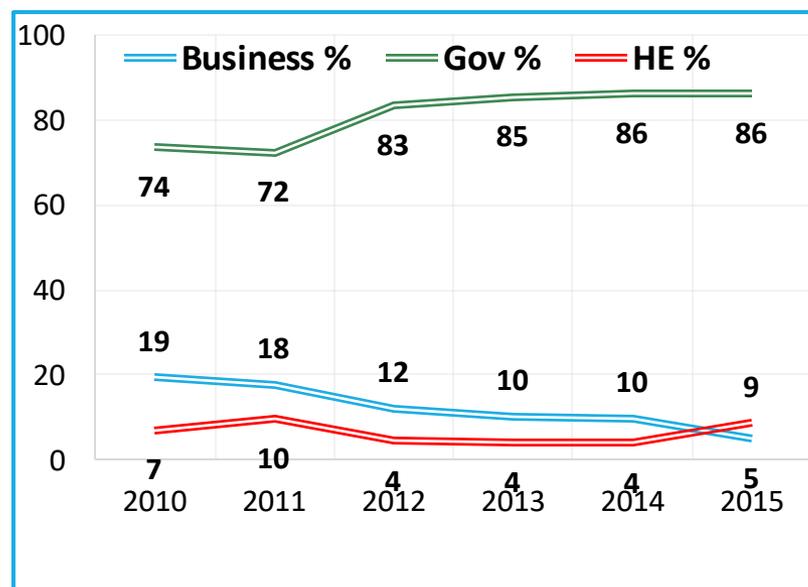
Azerbaijan spends on R&D less as a share of GDP compared to countries of a similar size



Source: WDI

Structure of Gross Expenditure on R&D (2015)

HEIs account for 9% of Gross Expenditure on R&D, while the private sector accounts for just 5%



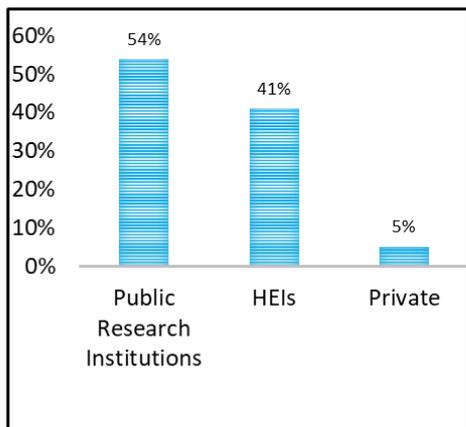
Structure of Gross Expenditure on R&D

%	Austria	Sweden	Portugal	Azerbaijan
Business	71	70	47	5
HEIs	24	27	46	9
Government	4	3	6	86
Private/ non-profit	0	0	1	0

Employment and Research Funding Structure

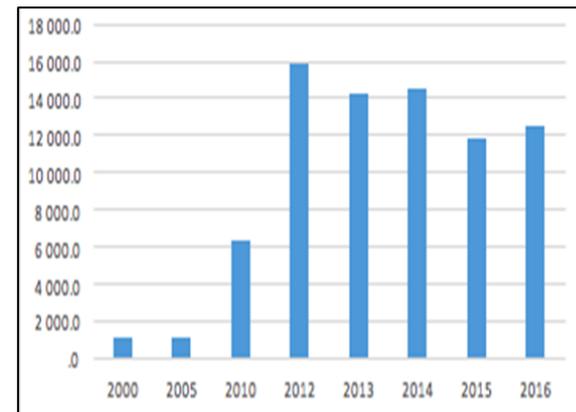
- Over 22,000 employees work in the research sector
- Balanced distribution of researchers between research institutions and HEIs
- Yet, high differences in funding between education and science

Distribution of researchers by sector Research funding allocation, 2016



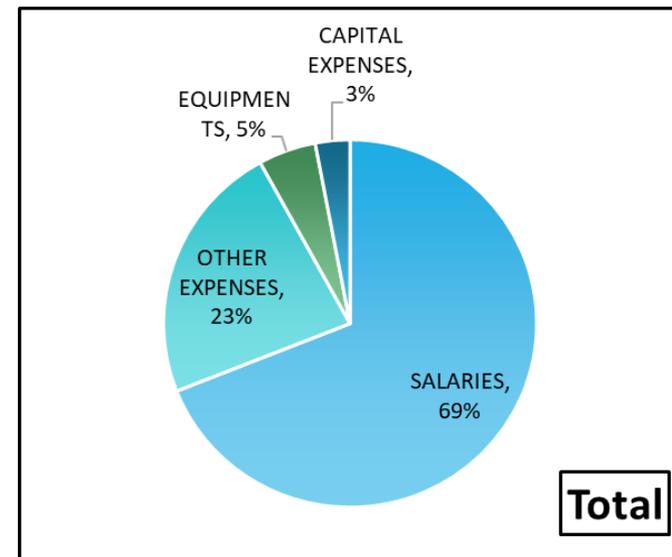
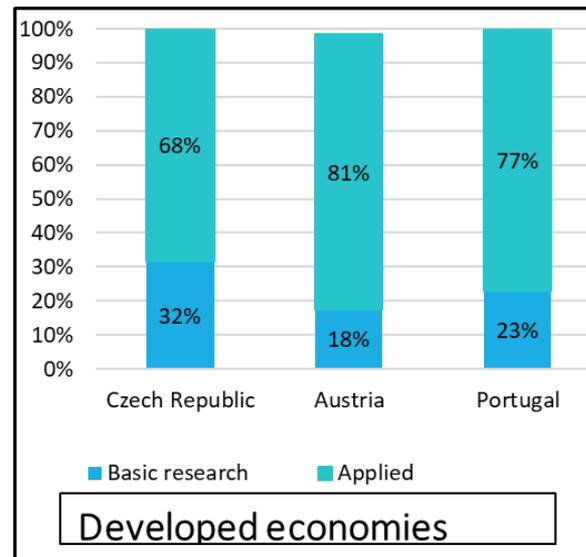
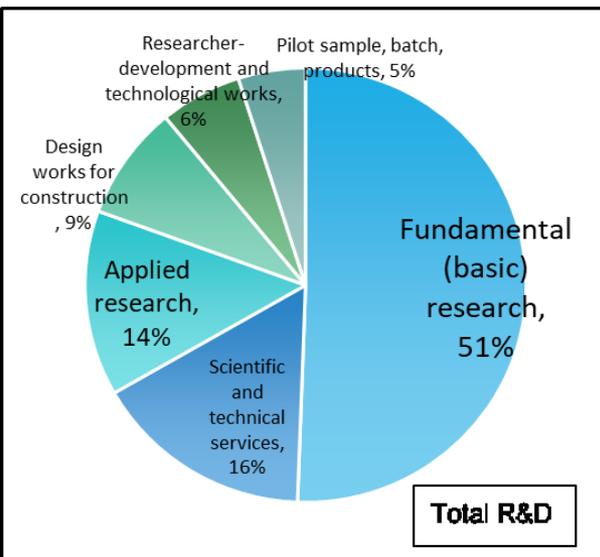
Type of institution	Thousand manat	Percent of total
Scientific-research Organizations	100 090	84 %
<i>Of which, ANAS:</i>	<i>55 517</i>	<i>47%</i>
Higher education institutions	12 576	11%
Other	5 897	5%
Total	118 565.0	100%

Research funding allocation to HEIs



R&D funding in Azerbaijan and developed economies

- R&D is primarily funded through institutional financing (a negligible role of competitive funding)
- Majority of funds go to fundamental research
- About 70% cover salaries



3. Research Output

Publications, citations, patents

Quality of Research is Relatively Low Compared to Other Countries – H Index Ranking

Only a fraction of research produced in Azerbaijan has a significant impact on knowledge creation and diffusion

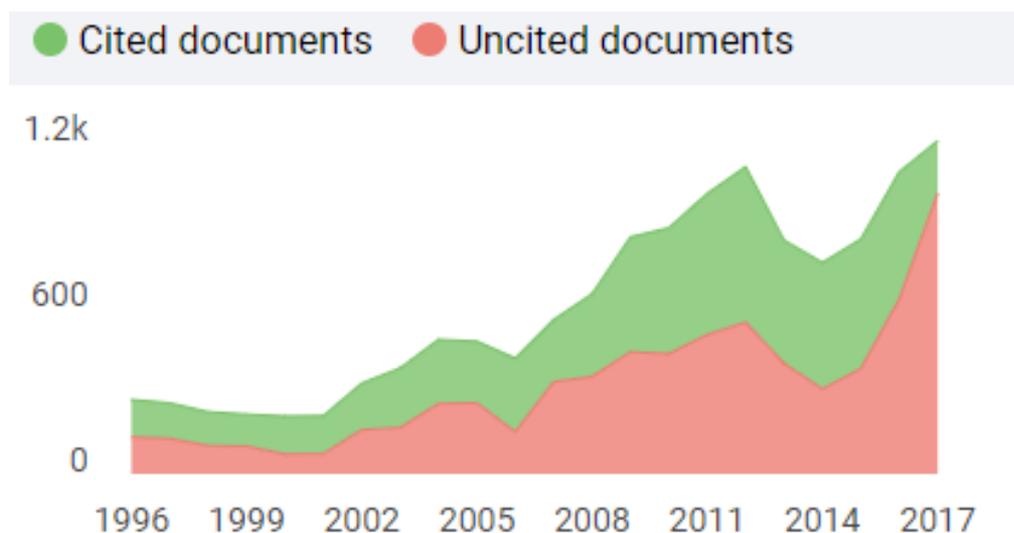
Rank	Country	Citable documents	Citations	Self-citations	Citations per document	H index	Population
1	United States	546605	426316	224281	0.68	2077	326
2	United Kingdom	162965	144860	45752	0.76	1281	66.5
11	Sweden	36130	33053	7365	0.83	778	~10
16	Israel	18372	15120	3069	0.74	624	8.4
63	Serbia	7047	3525	868	0.46	172	8.7
73	Belarus	1901	1192	397	0.6	158	~9.5
77	Georgia	1493	1735	319	1.06	155	~4
101	Moldova	463	370	61	0.76	97	~4
113	Azerbaijan	1053	478	148	0.44	87	~10
122	Uzbekistan	516	166	31	0.31	83	~32
125	Kazakhstan	3194	906	330	0.28	81	~18

Source: SCImago, 2017

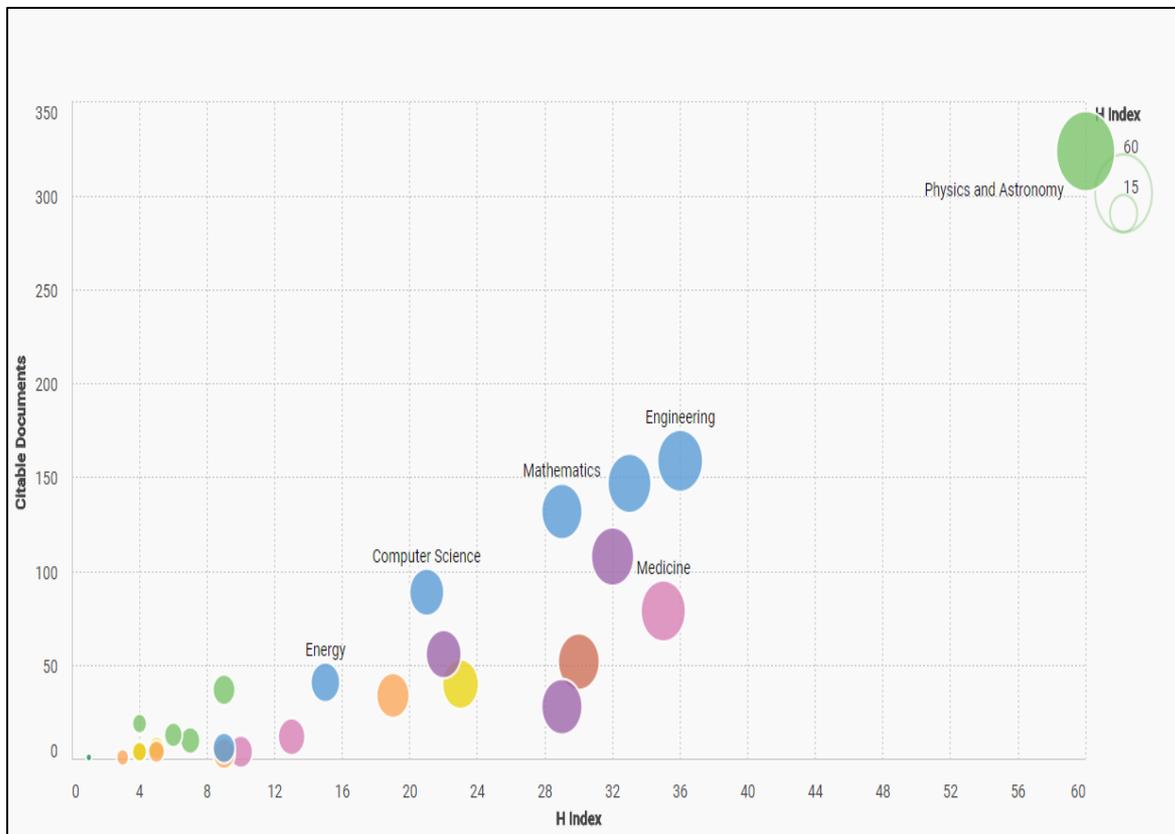
Limited Quantity of Research Spillovers

Large number of uncited documents:

- In 2017, out of 1093 citable documents, only 172 (15%) were cited
- In citable documents, Azerbaijan ranks 91 out of 239 countries



Areas of Science in Azerbaijan with the Best Scientific Output for 2015-2016



Azerbaijan's R&D reveals relative strengths in several fields— the same fields as the ones receiving the bulk of public R&D funds

The basis for evaluation of R&D areas for:

- Selection of Azerbaijani R&D priority sectors
- A source for technological development

Technology Transfer (TT) and Innovation Promotion in Azerbaijan

THE STATE

- Traditional technology transfer facilities are not widely developed in Azerbaijan
- Implementation of the existing legal framework does not efficiently promote intellectual property (IP) rights (*new innovation law is pending*)
- Lack of effective coordination and communication between R&D sector and the private sector

HEIs

- No university in Azerbaijan has dedicated funding or specialists to carry out expensive IP registration (i.e., international patents)
- TTOs at HEIs perform little in the way of actual commercialization of research
- Universities and research institutes, which have potential to produce valuable IP, do not have a sufficient uniform and predictable framework for disclosure, allocation of IP rights, mechanisms for compensation, or experience to properly manage and commercialize their innovations

4. HEI's Third mission: Innovation and Entrepreneurship

Positive developments in enhancing entrepreneurship in Azerbaijan

- A number of initiatives promoting entrepreneurship have developed since 2009
 - About 18 incubation centers are currently in operation.
- There exist many ideas among students and opportunities on the market for innovative start-ups
 - High interest in idea competitions
- Incubators and innovation centers provide various services facilitating business development:
 - For example: provision of space, incubation programs; training (coding, media, skills development); connecting entrepreneurs with mentors (including from Israel, Ukraine, and other countries); facilitating international networking; and so forth.

Improving the development of entrepreneurial skills at HEIs is key

- Enhancing soft skills among students (team work, management and presentation skills, etc.)
- Improving knowledge of English in order to understand the state of international know-how and existing technology trends and to facilitate international cooperation (e.g. in joint start-up projects)
- Shifting cultural attitudes toward setting up own businesses and risk-taking, acceptance of failure
- Updating IT skills taught at universities to meet global standards

5. Innovation Infrastructure

Innovation Infrastructure in Azerbaijan

- Research infrastructure is in many cases outdated and the modern one unevenly redistributed across HEIs
- Modern research infrastructure is often underutilized due to restrictive internal procedures at HEIs that limit the access to the infrastructure by outside users
- There is lack of prototyping equipment that forces entrepreneurs to import components from abroad
- A lack of knowledge about the existing equipment within the country inhibits its use for prototyping or production

6. Preliminary Policy Recommendations

1. Increasing R&D Effectiveness
2. Strengthening HEIs' Third Mission and Connection with Industry
3. Enhancing Entrepreneurship and Innovation Infrastructure

1. Increasing R&D Effectiveness (a)

Short Term

Recommendation 1: Expand the use of competitive funding to promote research with high relevance for the development and diversification of the national economy

- See recent examples from Montenegro and Uzbekistan

MONTENEGRO

- Higher Education and Research for Innovation and Competitiveness (HERIC) Project
- Launched in 2012 with funding from the World Bank
- Helped develop new products, patents, labs relevant for the economy
- Improved cooperation between researchers and the business sector, built national and international partnerships

UZBEKISTAN

- Academic Innovation Fund (AIF)
- Launched in 2018 as part of the Modernizing Higher Education Project with seed funding from the World Bank
- Funds HEI-initiated projects in two areas:
 1. Deepening linkages between higher education and industry
 2. Improvement of teaching and learning processes in HEIs

1. Increasing R&D Effectiveness (b)

Short Term

Recommendation 2: Promote research internationalization through student and faculty exchanges, increasing the quality and quantity of Horizon 2020 project proposals, developing an internationalization strategy for HE.

Medium Term

Recommendation 3: Increase overall public investment in R&D, with more funding directed toward HEIs and promotion of applied research. Promote research that is of greater relevance to industry and encourage research partnerships between HEIs, public research institutes, and private enterprises.

Recommendation 4: Review the academic career system and adopt incentive and reward mechanisms in line with international best practices.

1. Increasing R&D Effectiveness (c)

Medium Term

Recommendation 5: Adopt sound evaluation practices and quality assurance mechanisms that promote high quality research in higher education.

- Build quality assurance system aligned with international standards of quality, transparency, and openness.

2. Strengthening HEIs' Third Mission and Connection with Industry (a)

Short Term

Recommendation 6: Review the capacity of existing TTOs and ensure that they assume a broader role in fulfilling the “third mission” of HEIs by developing links with the private sector.

Recommendation 7: Encourage HEIs to offer faculty consultancies, contract research, and educational/training programs of relevance to the private sector.

2. Strengthening HEIs' Third Mission and Connection with Industry (b)

Medium Term

Recommendation 8: Encourage universities to develop a “commercialization agenda” to guide how each HEI intends to support the commercialization of research of its faculty

Recommendation 9: Incentivize innovation and research commercialization at HEIs by adopting international best practices for revenue distribution and academic recruitment/career progression

3. Entrepreneurship and Innovation Infrastructure (a)

Short Term

Recommendation 10: Promote business incubators at HEIs (including strengthening the existing ones) and support the teaching of entrepreneurship skills to university students.

Recommendation 11: Develop a national research equipment registry and promote shared access to innovation infrastructure by different stakeholders within and outside HEIs.

3. Entrepreneurship and Innovation Infrastructure (b)

Medium Term

Recommendation 12: Promote business incubators at HEIs (including strengthening the existing ones) and support the teaching of entrepreneurship skills to university students.

- Consider establishment of business incubators with pre-seed financing. Such incubators could become dynamic tools for fostering new ventures across a variety sectors by linking talent, technology, capital, and know-how in a single facility.

Thank you!