THE ROLE OF HIGHER EDUCATION INSTITUTIONS IN INNOVATION
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

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

Innovation System Governance

Market

Education

Research

Higher Education Institutions (HEIs)

Entrepreneurship
Skills development
Feedback
Technology Transfer & Commercialization
Co-investment

Funding, incentives framework, enabling environment

Interaction = Innovation

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”.

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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.

- **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

- Austria
- Azerbaijan
- Finland
- Georgia
- Kazakhstan

UNESCO INSTITUTE FOR STATISTICS

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

<table>
<thead>
<tr>
<th>Sector</th>
<th>60%</th>
<th>50%</th>
<th>40%</th>
<th>30%</th>
<th>20%</th>
<th>10%</th>
<th>0%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Research Institutions</td>
<td>54%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HEIs</td>
<td>41%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private</td>
<td>5%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Research funding allocation, 2016

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

### Research funding allocation to HEIs

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SSC, 2016
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

SDF, 2016
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.

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

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.
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!