A Novel Index for Knowledge Triangle: The Entrepreneurial and Innovative University Index of Turkey

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The Role of University for Knowledge Triangle

- The more collaboration, the more matured innovation system
- Universities are at the heart of Knowledge Triangle

First Generation University
- Education \(\rightarrow\) Professionals
- the dissemination and diffusion of knowledge

Second Generation University
- + Research \(\rightarrow\) Scientists
- the generation and accumulation of knowledge

Third Generation University
- ++ Utilization of Knowledge \(\rightarrow\) Entrepreneurs
- the generation, use, application and exploitation of knowledge

Resource: BENCE ZUTI – MIKLÓS LUKOVICS; How to Measure the Local Economic Impact of the Universities’ Third Mission Activities?
Sample decrees adopted in Supreme Council for Science and Technology (SCST) meetings to promote the knowledge triangle at HEIs and PROs.
The Aim of the Entrepreneurial and Innovative University Index

To measure the performance of universities regarding the entrepreneurship and innovation,

To increase the entrepreneurship and innovation oriented competition between the universities,

To contribute the development of entrepreneurial and innovation ecosystem, and thus knowledge triangle

This index is NOT an education ranking or the best university ranking
Construction of Index: Framework, Advisory Group Meetings

**Senior Group***
- 4 Meetings

**Technical Group**
- 3 Meetings
- Meetings with Delegates of 16 Pilot University

**Framework Description**
- Identification of EIUI Framework

**Pilot Study**
- 16 Universities
- 87 sub-fields, 6 scientific fields
- 12 Institutions / Units
- Feedback Meeting

**Finalized Index**

Entrepreneurial and Innovative University Index (EIUI)

Entrepreneurial and Innovative University Index is developed in cooperation with 163 universities and 10 public institutions

Sample Indicators

- Number of firms established by academicians
- Number of firms established by students/graduated students
- Employment in those firms
- Technology Transfer Office (TTO) activities
- Patents
- Licences
- R&D and innovation projects
- Entrepreneurship, innovation lessons/trainings

EIUI is announced to the public every year since 2012

Between 2013-2015, before the university entrance exam results

Index results are announced by Minister of Science, Industry and Technology.

<table>
<thead>
<tr>
<th>Year</th>
<th>1.</th>
<th>2.</th>
<th>3.</th>
<th>4.</th>
<th>5.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>Sabancı University</td>
<td>METU</td>
<td>Bilkent University</td>
<td>ITU</td>
<td>Boğaziçi University</td>
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<tr>
<td>2015</td>
<td>Sabancı University</td>
<td>METU</td>
<td>Boğaziçi University</td>
<td>Bilkent University</td>
<td>Koç University</td>
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<tr>
<td>2014</td>
<td>METU</td>
<td>Sabancı University</td>
<td>Boğaziçi University</td>
<td>Bilkent University</td>
<td>Koç University</td>
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<tr>
<td>2013</td>
<td>METU</td>
<td>Sabancı University</td>
<td>Bilkent University</td>
<td>Boğaziçi University</td>
<td>ITU</td>
</tr>
<tr>
<td>2012</td>
<td>Sabancı University</td>
<td>METU</td>
<td>Bilkent University</td>
<td>Özyeğin University</td>
<td>ITU</td>
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</table>
EIUI has a big impact on printed, visual and social media

Universities and TTOs announce the EIUI results

Students use this index to select the university where he/she will educate

The most entrepreneurial university is Sabancı

TÜBİTAK selected the most innovative universities

Boğaziçi University ranked among the top three in the EIUI

There is an increase in all dimensions

The greatest improvement was achieved in the entrepreneurship and innovation culture, intellectual property pool, cooperation and interaction pillars
The Results and Impacts of EIUI- 2

The top 50 universities are the ones that are able to establish the greatest difference with the average values.

- Universities attain a 20% higher performance in 4 years*
  - Competition is most intense within the top 5 and top 20
  - Last 10 universities are putting extra effort to enter the race

* Based on average values of the top 50 universities in 2012 and 2015
Summary and Proposal

**STI Policy on KT (by SCST)**

Develop related support mechanisms and monitor results are presented.

**Support & Grant & Ecosystem for KT**

Support according to EIUI result.

**Measuring Performance (by EIUI)**

Results are measured by EIUI.

**Enhancing TTOs**

- Technology Transfer Office (TTO)
- Intellectual Property Rights
- Incubation Center

**Fostering R&D Start-ups**

- TUBITAK 1512

**Entrepreneurial and Innovative University Index**

- Intellectual property pool
- Scientific and technological competence
- Economic contribution and commercialization
- Entrepreneur and Innovative University

**Mini Entrepreneurship MBA Education**

- TÜBİTAK

International collaboration to develop such index?
Thanks

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Preparation Process of EIUI

**TÜBİTAK and YOK Coordination Entirely**

- 9 Public Institutions
- 163 Universities
- 49 Technoparks
- 23 Indicators (74 sub-field)

**Data Quality**

- Contact points in 221 Institutions totally
- ~2,000 firms are crosschecked by using Central Registration System (MERSIS) and Commercial Registry Gazette
  - Activeness
  - Establishment date and address
  - Partnership structure
- ~10,000 faculty members are crosschecked by using Council of Higher Education Database (YOKSIS)
  - Data sent by universities are verified with evidence documents

**Help Desk**

- ~4,000 e-mails
- ~1,500 phone calls

**Data Set and Analyses**

- ~1 Million data cells control
- Five year period performance analyses
- Crosschecks, significance tests


23 Indicators (74 sub-field)
METHODOLOGY

• **Data collection**: Public records, universities, technoparks

• **Qualification of data and data validation**: Communication with universities, support desk at TUBITAK

• **Imputting for missing values**: No missing values

• **Identifying and replacing outliers**: Positive outliers are higher than the mean across all universities plus twice the standard deviation

• **Transforming data**: If the indicators are highly volatile in terms of skewness and kurtosis, transformation is applied

• **Applying a normalization method**: Min-Max scores

\[
x_s = \frac{(x - \text{min})}{(\text{max} - \text{min})} \times 100 \quad s = 1, \ldots, 162
\]

• **Calculating composite indicator**:

\[
Y_s = \sum_{i=1}^{23} w(i) x(i) \quad s = 1, \ldots, 162
\]
## Indicators of EIUI - 5 Pillars, 23 Indicators

<table>
<thead>
<tr>
<th>Scientific and Technological Research Competence (20%) – 6 indicators</th>
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</thead>
<tbody>
<tr>
<td>• Number of scientific article &amp; citation</td>
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<tr>
<td>• Number of project &amp; the amount of project funds</td>
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<tr>
<td>• Number of scientific prize</td>
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<tr>
<td>• Number of graduates having PhD degree</td>
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<th>Intellectual Property Pool (15%) – 4 indicators</th>
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<td>• Number of national &amp; international patent applications</td>
</tr>
<tr>
<td>• Number of national patent grants</td>
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<tr>
<td>• Number of utility model/industrial design grants</td>
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<th>Cooperation and Interaction (25%) – 5 indicators</th>
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<tr>
<td>• Number of university-industry collaboration project &amp; the amount of university-industry collaboration project funds</td>
</tr>
<tr>
<td>• Number of international collaboration project &amp; the amount of international collaboration project funds</td>
</tr>
<tr>
<td>• Number of academicians/students who are in circulation</td>
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</tbody>
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<th>Enterpreneurship and Innovation Culture (15%) – 4 indicators</th>
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<tbody>
<tr>
<td>• Number of undergraduate and graduate-level courses</td>
</tr>
<tr>
<td>• Number of training/certification programs</td>
</tr>
<tr>
<td>• The activities of Technology Transfer Office</td>
</tr>
<tr>
<td>• Number of full-time working people for the management</td>
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<th>Economic Contribution and Commercialization (25%) – 4 indicators</th>
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</thead>
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<tr>
<td>• Number of firms that is founded or co-founded by academicians / students - last five years graduates &amp; their employment</td>
</tr>
<tr>
<td>• Number of employment of firms that is founded or co-founded by academicians</td>
</tr>
<tr>
<td>• Number of licensed patent/utility model/industrial design</td>
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