The case of the THE World University Ranking (2021)

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Methodology

THE World University Ranking has analyzed universities since 2010 with 13 indicators in five areas. These areas are: teaching (the learning environment); research (volume, income, and reputation); citations (research influence); international outlook (staff, students and research); industry income (knowledge transfer).

According to the official explanation of their methodology, the rankings are calculated as follows:

Teaching (the learning environment): 30%
- reputation survey: 15%
- staff-to-student ratio: 4.5%
- doctorate-to-bachelor's ratio: 2.25%
- doctorates awarded-to-academic staff ratio: 6%
- institutional income: 2.25% (It indicates an institution’s general status and gives a broad sense of the infrastructure and facilities available to students and staff.)

Research (volume, income and reputation): 30%
- reputation survey: 18%
- research income: 6%
- research productivity: 6% (It counts the number of papers published in the academic journals indexed by Elsevier’s Scopus database per scholar, thus reflects the university’s ability to publish papers in quality peer-reviewed journals.)

Citations (research influence): 30%
International outlook (staff, students and research): 7.5%
- International-to-domestic-student ratio: 2.5%
- International-to-domestic-staff ratio: 2.5%
- International collaboration: 2.5% (It calculates the proportion of a university's total research journal publications that have at least one international co-author and reward higher volumes.)

Industry income (knowledge transfer): 2.5%
(This category looks at how much research income an institution earns from industry, thus suggests the extent to which businesses are willing to pay for research and a university’s ability to attract funding in the commercial marketplace.)
Objectives

This analysis will mainly focus on the Top 200 universities, as the THE ranking classifies them individually up to post 200. Thereafter, it groups them in the 50s up to post 400, and then as two groups with 100 universities up to post 600, and finally as two groups of 200 universities up to post 1000.

1. Compare the research, education, teaching, innovation and influence indicators by regions (Asia, Europe, North America, and Oceania) for the THE ranking;

2. Compare the demographic information (student/staff ratio, percentage of international students, ..) about the Top 200 institutions by country and region;

3. Find out how each of the indicators mentioned above correlate to one and another;

Methodology: I used python and R to provide exploratory analysis on these questions.

Source data: www.timeshighereducation.com
Part I - THE Key Performance Indicators
The THE ranking classified 1526 universities from almost 100 countries\(^1\) around the world with a large representation of the United States, Japan and United Kingdom and China (~30%).

Looking at individual performances, Oxford University has claimed the Top spot in the 2021 edition of THE ranking for the fifth consecutive year, followed by Stanford University and Harvard University.

Continental Europe’s best university remains ETH Zurich (14th). Asia’s Top university is Tsinghua University (20th), followed by the National University of Singapore (25th). Universities in Russia continue to rise, with Lomonosov Moscow State University (174).

\(^{1}\) 93 countries are represented
Figure 2: Aggregated values per country (Top 10 countries most represented in the THE) for the following indicators: Teaching, International Outlook, Research, Citations, Industry Income score.

Both in terms of the overall ranking (see below Figure 3 and Figure 5) and the highest positions, the US, the UK and Germany are well ranked.
The United States owns the largest share, contributing around 30% of the institutions ranked in the Top 200. Then comes the United Kingdom, Germany, Australia, and the Netherlands. These five countries are home to more than half of the Top 200 universities in the world. Three of them use English as official, or a de facto official language.

Japan and China are among the best represented countries in the ranking (Figure 1) but they fall behind other nations, such as Germany, Australia and the Netherlands in the Top 200.

This year’s instalment sees no increase in African representation while University of Cape Town is the only one of the continent’s universities to be ranked among the Top 200.
Figure 4: Indicators performance (Top 10 countries among THE Top 200 ranking)
Figure 5. THE Top 100 ranking, Geographic distribution.

- **United States of America** still took the greatest number of universities (37);
- **United Kingdom** had second most on the number of universities (11);
- **Netherlands** and **Germany** both had 7 universities;
- **Australia** and **China** had 6 universities.

We can observe the rise of **Asian Universities in the Top 100** with the representation of 16 universities represented. These 16 institutions are split between mainland **China** (six), **Hong Kong** (3), **Singapore**, **Japan**, **South Korea** (2 each), and **Taiwan** (1).
Table 1. THE ranking 2021 results. Statistics by country (first 10 countries per ranking)

<table>
<thead>
<tr>
<th>Country</th>
<th>Top 20</th>
<th>Top 100</th>
<th>Top 200</th>
<th>Top 300</th>
<th>Top 400</th>
<th>Top 500</th>
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<tr>
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<td>37</td>
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<td>9</td>
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</tr>
<tr>
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<td>-</td>
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<td>5</td>
<td>8</td>
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</tr>
<tr>
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<td>-</td>
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<tr>
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<td>-</td>
<td>-</td>
<td>3</td>
<td>6</td>
<td>10</td>
<td>25</td>
</tr>
</tbody>
</table>
Even though American and British universities are a majority (~50%) in the Top 200 (Figure 3), they are not the ones with the highest median of the average total scores. Instead, we see that Singapore and Japan have the highest median of the average total score. (Figure 6)

So, does this mean that Singaporean and Japanese universities are better than their American and British counterparts? We cannot directly compare Singaporean universities (2 in the Top 200) or Japanese universities (2 in the Top 200) to American or British universities but we can dive deeper to look at how they perform.
Figure 7: Citations, Income, International, Research and Teaching for USA, UK vs Japan and Singapore (THE Top 200 ranking)

The plot consists of 5 sections, one for each category of score: Citations, Income, International, Research and Teaching. Each section has boxplots plotted with the corresponding average scores per indicator for our four countries - USA & UK and Japan & Singapore (THE Ranking)
Figure 8. Number of students across universities (THE Top 200 Ranking)

- **China** has the highest median of the number of students
- **Italy** has the lowest median of the number of students
Figure 9. Gender ratio across countries (THE Top 200 Ranking)

The following plot shows the female to male ratio in universities across countries worldwide:

- **Finland and Austria** have the highest female to male ratio ~2:1 (maximum here)
- **South Korea** has the minimum median female to male ratio ~1:4 (minimum here)
Europe and Oceania are the most represented regions in terms of international students (%). Looking at individual performances, the highest percentage of international students are respectively in London School of Economics (72%), École Polytechnique Fédérale de Lausanne (60%) and Imperial College of London (58%). In Oceania, University of Melbourne (48%) and Australian National University (47%) are the most represented.

We also see a clear rise of the Asian universities which attract more and more international students (See Figure 12).

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2 Source: www.timeshighereducation.com
3 Student population: 50,094
4 Student population: 18,801
Figure 11. International outlook score across all countries (THE Top 200 Ranking)
Asian universities are attracting more and more international students: University of Hong Kong (43%), National University of Singapore (26%), Zhejiang University (23%).

Many countries in Asia have set up ambitious goals to attract more international students. This has also resulted in the emergence of English Taught Programmes (ETP) all over the region. With most of the growing demand for international education coming from Asian countries, they are the countries that could take advantage of the increasing demand for English-taught programmes for lower tuition fees and reputable institutions.
Question 1. Which are the potential most influenced factors affecting university ranking?

This figures present pairwise correlation between five indicators: teaching, research, students staff ratio, international outlook and industry income.

Teaching and research seem to play much more important roles than any other attribute. There is a clear positive correlation. It is also observed that student staff ratio is low in high ranking universities. It is likely a way to keep their education quality high. Interesting, mid and low ranking universities can have big variance on student staff ratio. Both high and low student staff ratio can occur in mid and low ranking universities. Student staff ratio does not appear to be a linear factor that impact university ranking score.

As far industry income and international outlook score are concerned, it seems there is no correlation between this indicators and the ranking.
**Question 2:** How do parameters such as the international outlook correlate to the industry income levels (=knowledge transfer)?

<table>
<thead>
<tr>
<th>Scores (n=1524)</th>
<th>Citations</th>
<th>Industry income</th>
<th>International Outlook</th>
<th>Research</th>
<th>Teaching</th>
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</thead>
<tbody>
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<td>Citations</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Industry income</td>
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<td>1</td>
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<td></td>
<td></td>
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<tr>
<td>International Outlook</td>
<td>0.56</td>
<td>0.18</td>
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</tr>
<tr>
<td>Research</td>
<td>0.58</td>
<td>0.53</td>
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<td>1</td>
<td></td>
</tr>
<tr>
<td>Teaching</td>
<td>0.51</td>
<td>0.44</td>
<td>0.38</td>
<td>0.89</td>
<td>1</td>
</tr>
</tbody>
</table>

As stated earlier, **Research** and **Teaching** scores achieved the strongest correlation (r=0.89), whereas the **Industry Income** and **International Outlook** scores had the weakest correlation (r=0.18).
**Question 3.** How does the teaching score and the industry income score fair for Universities having an extremely high Student-to-Staff ratio?

We have considered all universities with student-to-staff ratio $\geq 50$.

From the first scatter plot, the correlation coefficient of teaching score and student staff ratio comes out to be $-0.31$.

It seems there is a no correlation between the two variables.

From the second scatter plot, the correlation coefficient of income score and student staff ratio comes out to be $0.23$.

Once again, there is no significant correlation between the two variables.
Part II - T.I.M.E. Members
Key Performance Indicators

T.I.M.E.
Top International Managers in Engineering
Given the weights applied to each of the dimensions (30% Research; 30% Citations; 30%; Teaching; 7.5% International Outlook; and 2.5% Industry Income), we may assume that the THE ranking may not be adapted and diminish the potential of Technical Universities’ performance.

A further study should be done to study how global rankings bodies measure the performance of Technical Universities and the side effects produced by the indicators and weights.

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7 Polytechnique of Montréal is part of University of Montréal
Figure 14. Top 500 among the T.I.M.E. Members in the THE Ranking
Figure 15. Radar\textsuperscript{8} evaluation among the T.I.M.E. Members ranked in the Top 200\textsuperscript{9}

\textsuperscript{8} Displayed in alphabetical order

\textsuperscript{9} Indicators: International, Teaching, Research, Citations, Industry Income
Figure 16. Comparison among the T.I.M.E. Members ranked in the Top 100