Correlation between academic performance and CO₂ footprint of business air travel at EPFL: Is flying necessary for academic excellence?

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Dissecting business air travel habits of EPFL researchers: the second in a three-part investigation

1. Analyze air travel habits of EPFL researchers and identify CO₂ footprint reduction potential and measures.

2. Investigate correlation between academic performance and air travel habits of the researchers.

3. Qualitative analysis: survey about researchers’ travel habits and motivation.
We studied the correlation between the air travel CO$_2$ emissions of 411 senior EPFL researchers and their academic performance.

**Air travel database**
- 411 senior researchers
- All EPFL air travel with Carlson Wagonlit Travel (CWT)
- Contains 80% of total air travels (20% is booked by credit card)

**Academic performance database**
- 18 performance indicators
- Based on InCites/Web of Science entries
- Completed with bibliometric data from Scopus and Google Scholar

The correlation was examined for the period between 2014 and 2017.
No academic performance indicator shows any significant correlation with air travel CO₂ emissions

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<thead>
<tr>
<th>Category</th>
<th>Correlation Coefficient</th>
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<tr>
<td>InCites Matches</td>
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<td>Web of Science Documents</td>
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<td>% Docs Cited</td>
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<td>Times Cited</td>
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<td>Category Normalized Citation Impact</td>
<td>-0.29 ± 0.05</td>
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<td>% Documents in Top 10%</td>
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<td>H-Index</td>
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<td>Impact Relative to World</td>
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<td>Scopus Conferences</td>
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<td>Book Chapters 2013-2017 (ENAC only)</td>
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- Correlation is considered **significant** if $|\text{correlation coefficient}| > 0.4$

- The **correlation coefficient** of all considered academic performance indicators with the researchers’ air travel CO₂ emissions is $< 0.3$

- The **highest** correlation of $0.29 \pm 0.05$ is observed for the number of **conference entries** in the Scopus database

- Widely accepted most accurate indicators are **H-index** and **Category Normalized Citation Impact (CNCI)**
Overall correlation correlation between the CO$_2$ emissions and the most important performance indicators is insignificant

Correlation coefficient of $0.12 \pm 0.04$

Correlation coefficient of $0.18 \pm 0.03$
The correlation between category normalized citation impact (CNCI) and CO₂ emission is almost negligible.

Correlation coefficient of 0.12 ± 0.04

*Dot size proportional to number of datapoints in the bin*
We observe a very weak correlation between H-index and CO₂ emission

**Binned per CO₂ emission, averaged over H-index**

**Binned per H-index, averaged over CO₂ emission**

Correlation coefficient of $0.18 \pm 0.03$

*Dot size proportional to number of datapoints in the bin*
CO$_2$ emission increases with seniority for equal academic performance

Binned per CNCI, averaged over CO$_2$ emission

Binned per H-index, averaged over CO$_2$ emission

*Dot size proportional to number of datapoints in the bin
H-index increases slightly with seniority, very weak dependence on CO$_2$ emission

*Dot size proportional to number of datapoints in the bin*
CNCI marginally depends on seniority and CO$_2$ emission

Binned per CO$_2$ emission, averaged over CNCI

*Dot size proportional to number of datapoints in the bin*
Summary

- We demonstrated that there is no significant correlation between scientific impact, measured by 18 different parameters, and CO₂ footprint from air travel for senior EPFL researchers.

- We observe increased CO₂ emissions from more senior Professors for equal academic performance. CO₂ footprint seems to depend more on seniority than academic performance.

- From these results, it can be concluded that a large air travel footprint provides a small to negligible added value for academic performance among senior EPFL researchers.
Appendix: The correlation coefficient R represents how linearly dependent two parameters are

- **Strong correlation**
  - \( R \sim 1 \)

- **Medium correlation**
  - \( R \sim 0.5 \)

- **No correlation**
  - \( R \sim 0 \)

- **Strong neg. correlation**
  - \( R \sim -1 \)

- **Medium neg. correlation**
  - \( R \sim -0.5 \)

- **No correlation**
  - \( R \sim 0 \)