

A large scale comparison of the position of countries in international collaboration and mobility according to their scientific capacities

Zaida Chinchilla-Rodríguez, Lili Miao, Dakota Murray, Nicolás Robinson-García, Rodrigo Costas and Cassidy R. Sugimoto

STI 2017, 6-8 September, Paris, France



Research Agenda

**What is the Relationship between
collaboration and mobility?**

**How does this relate to a nation's scientific and
economic capacity?**

Dimensions of Connectivity

Mobility...serves to both **strengthen the scientific capacity of the countries** and **benefit the scientific careers of individual researchers** (OECD 2008)

Dimensions of Connectivity

International collaboration plays an important role in fostering high-quality knowledge production (Royal Society 2011)

Mobility...serves to both **strengthen the scientific capacity of the countries** and **benefit the scientific careers of individual researchers** (OECD 2008)

Dimensions of Connectivity

International collaboration plays an important role in fostering high-quality knowledge production (Royal Society 2011)

Mobility...serves to both **strengthen the scientific capacity of the countries** and **benefit the scientific careers of individual researchers** (OECD 2008)

...mobility has been advocated as key to **increasing the efficiency and effectiveness of research** (Van Noorden, 2012; Scellato et al. 2015)

Many Institutions Believe

**International partnerships are
important**

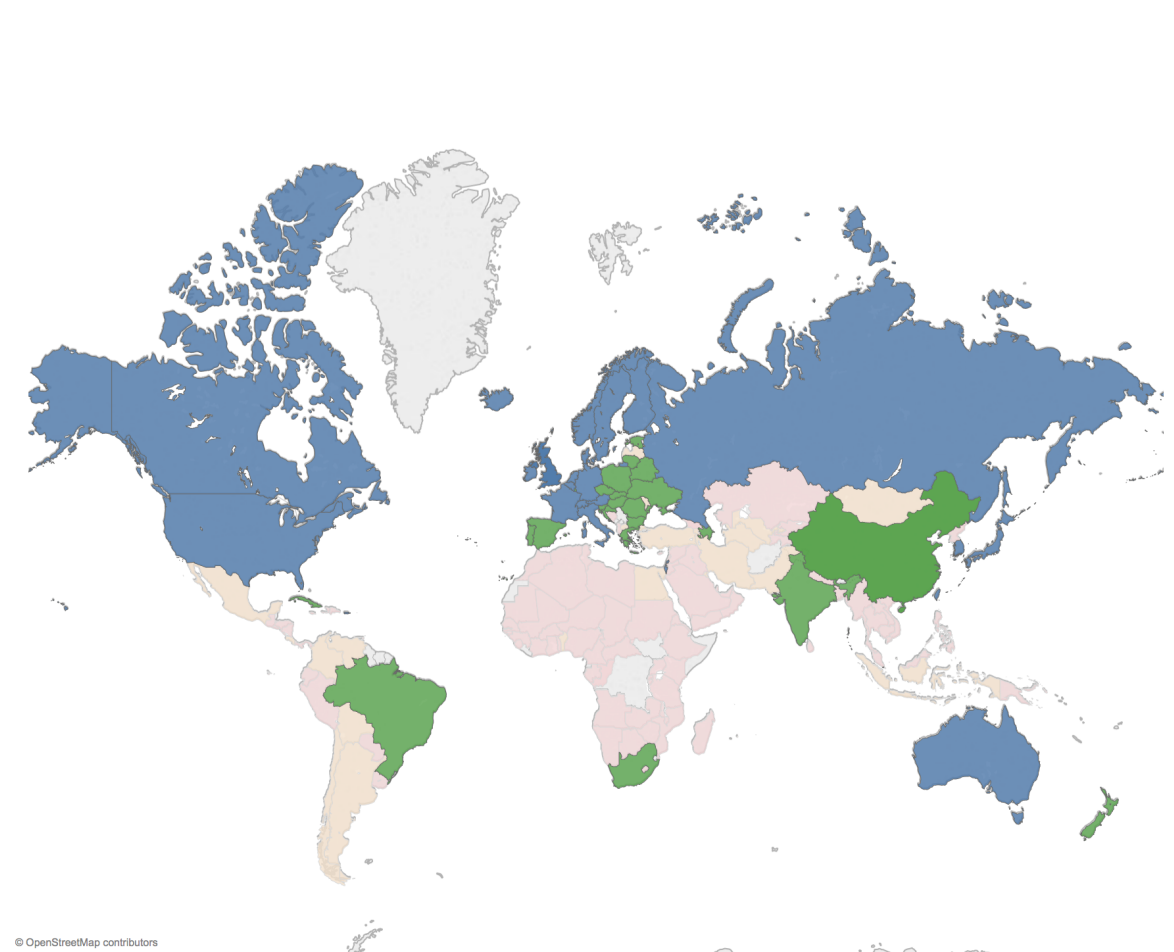
Such partnerships improve science

International Partnership

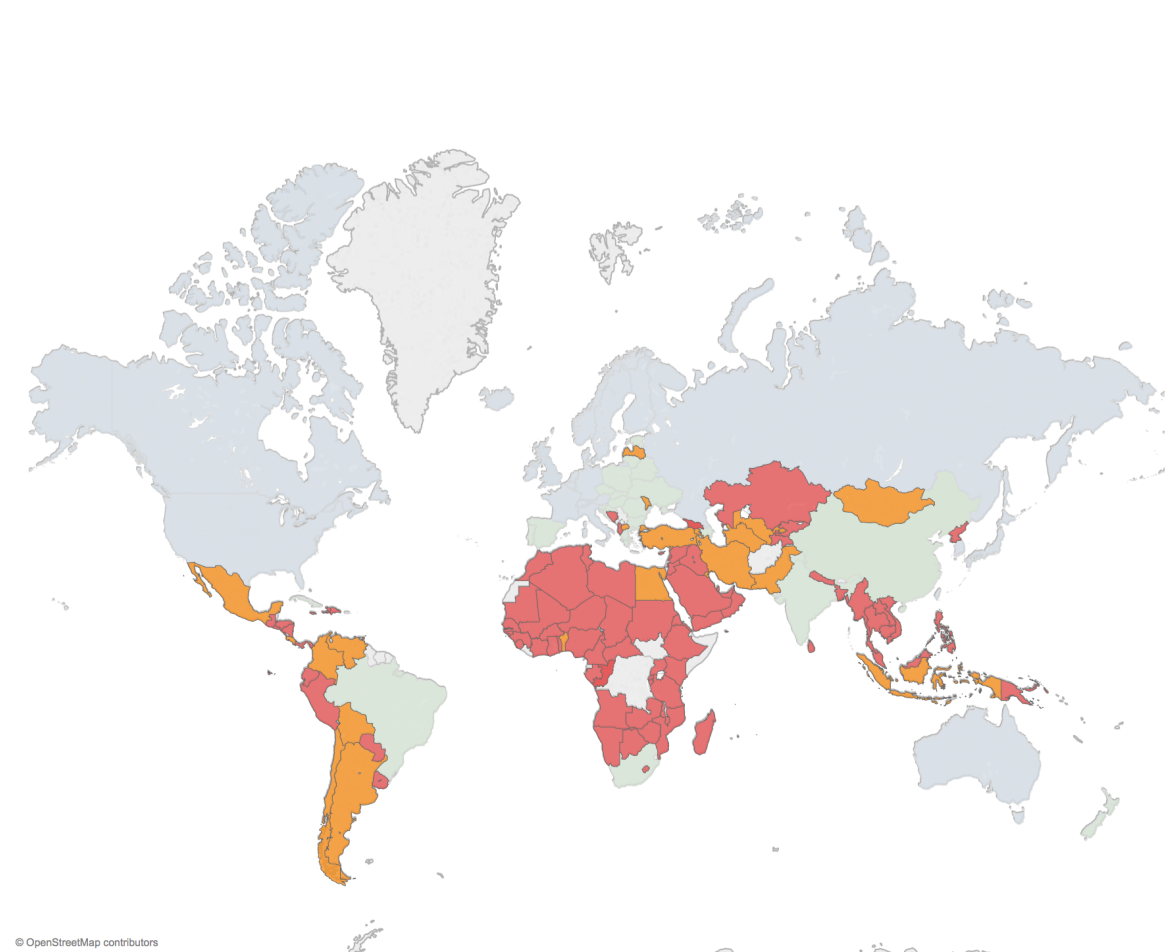
- Traditionally, large-scale analyses have examined only *collaboration or mobility*



Well-studied “elite” countries



Understudied Periphery



Moving away from the elite

- To understand the **global** system of science, we must move **away from the “elite”** and towards a new comprehensive analysis of international scientific partnership



Our Goal

Introduce new indicators and approaches

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Introduce new indicators and approaches

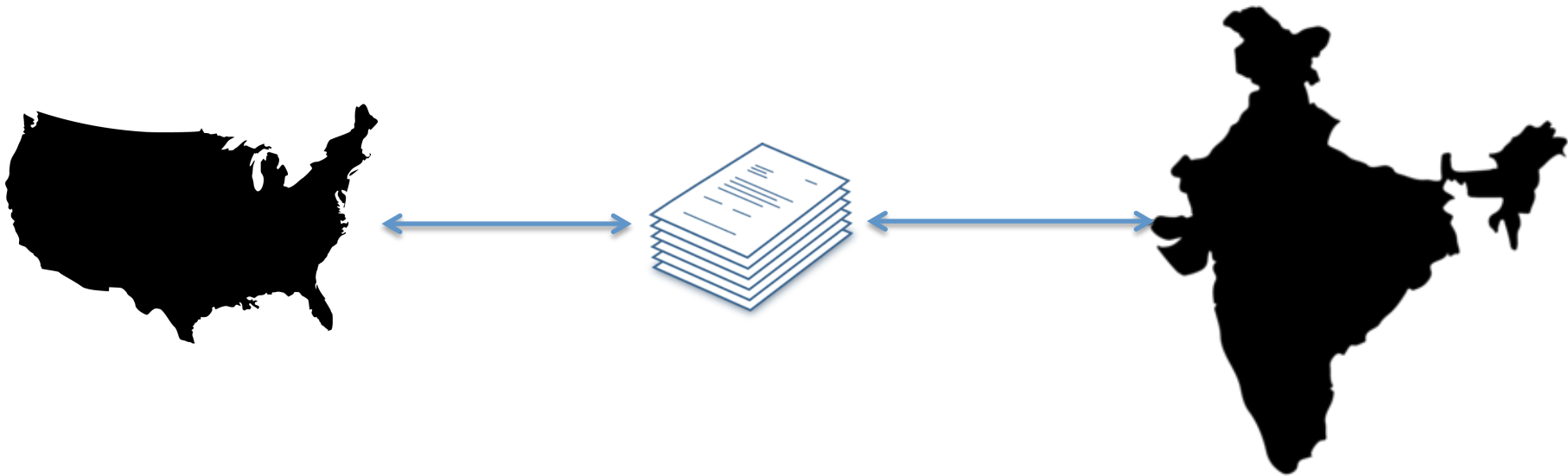
**Demonstrate how they can help to understand
global system of science**

ESTABLISH A TERMINOLOGY

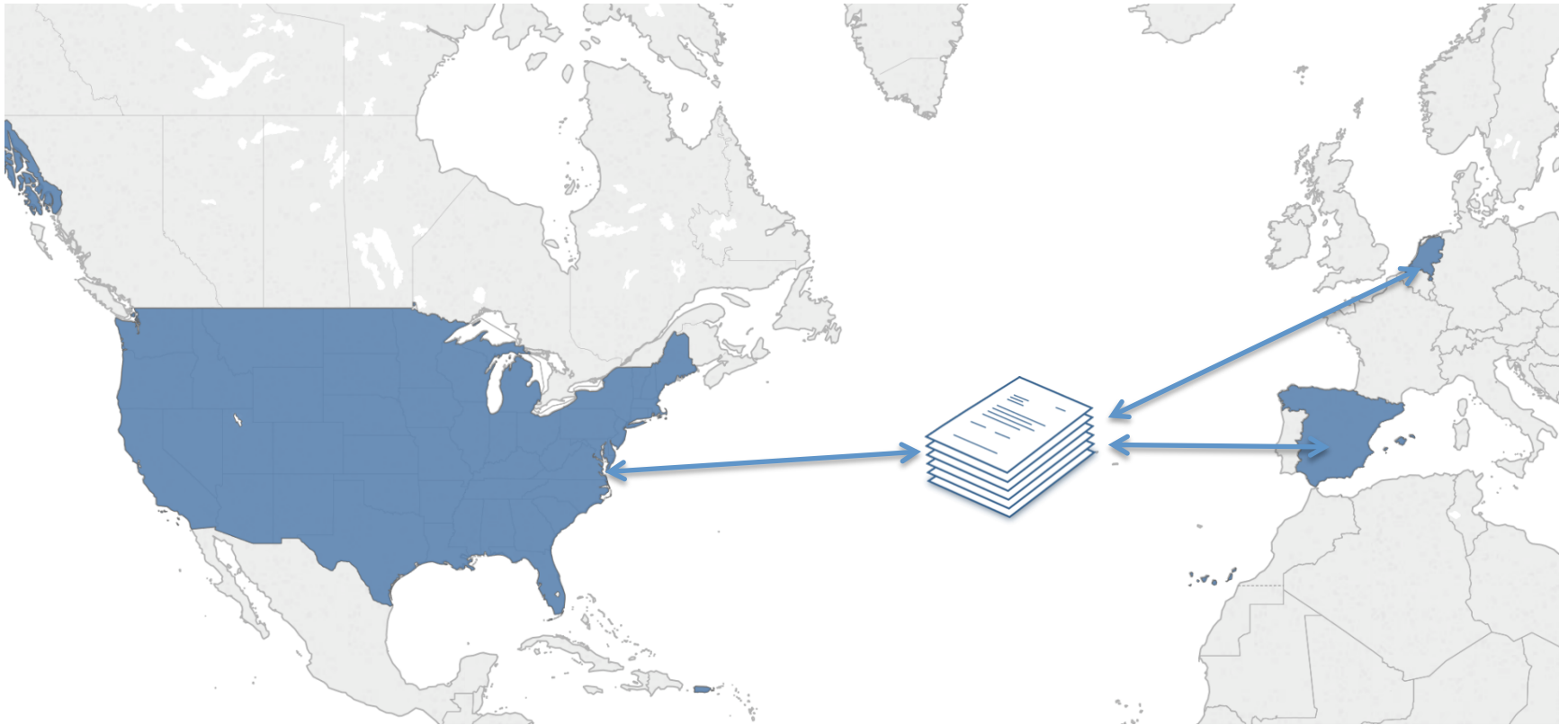
International Partnerships

Collaboration
Co-Affiliation
Migration

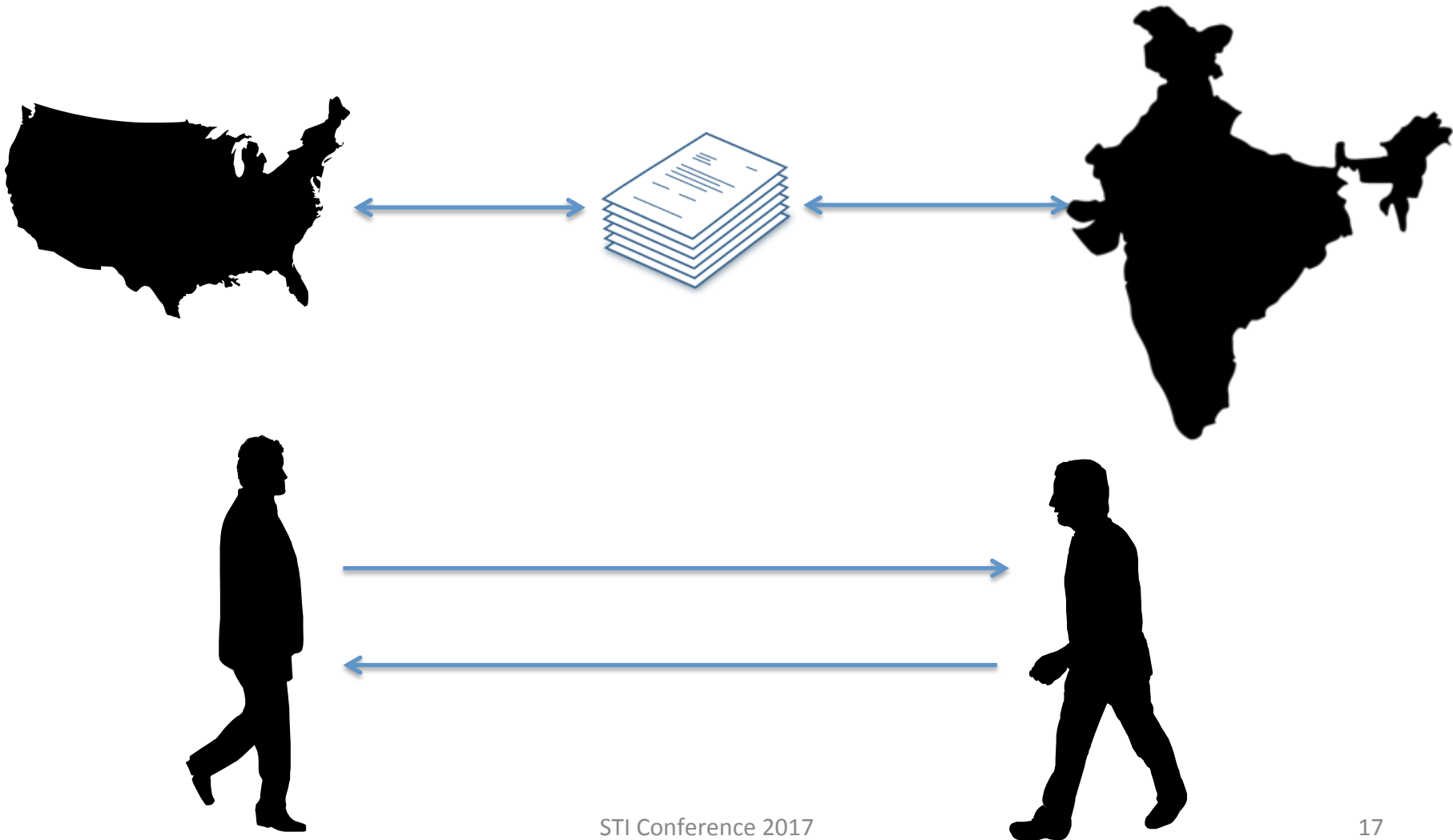
Collaboration



Example: this paper!



Other forms of mobility



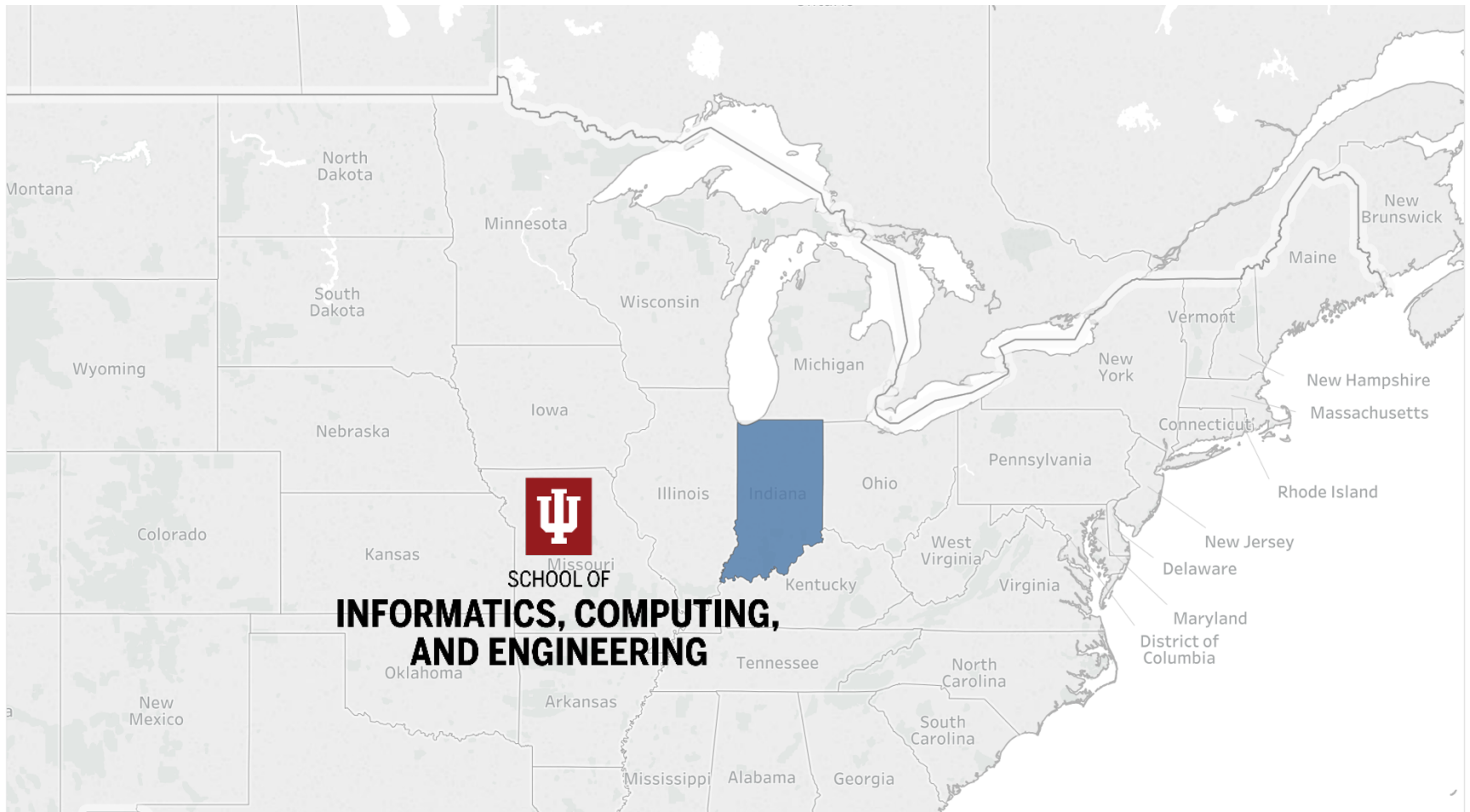
International co-affiliation

Holding more than one affiliation in two countries during a period of study





t0





t1





Linked by co-affiliation



International Migration

**More permanent movements between
affiliations in 2 or more countries**

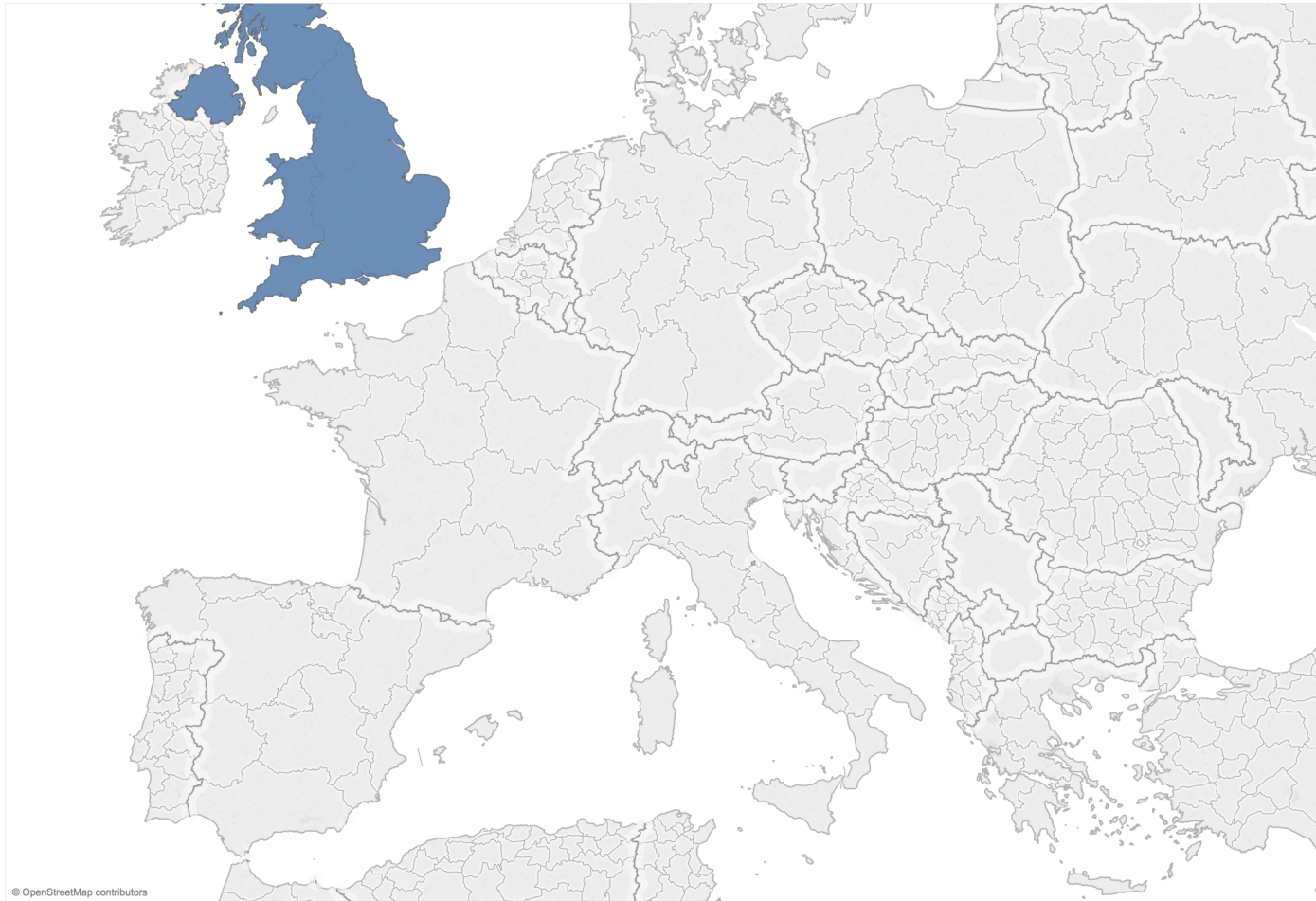
t0



t1



t2

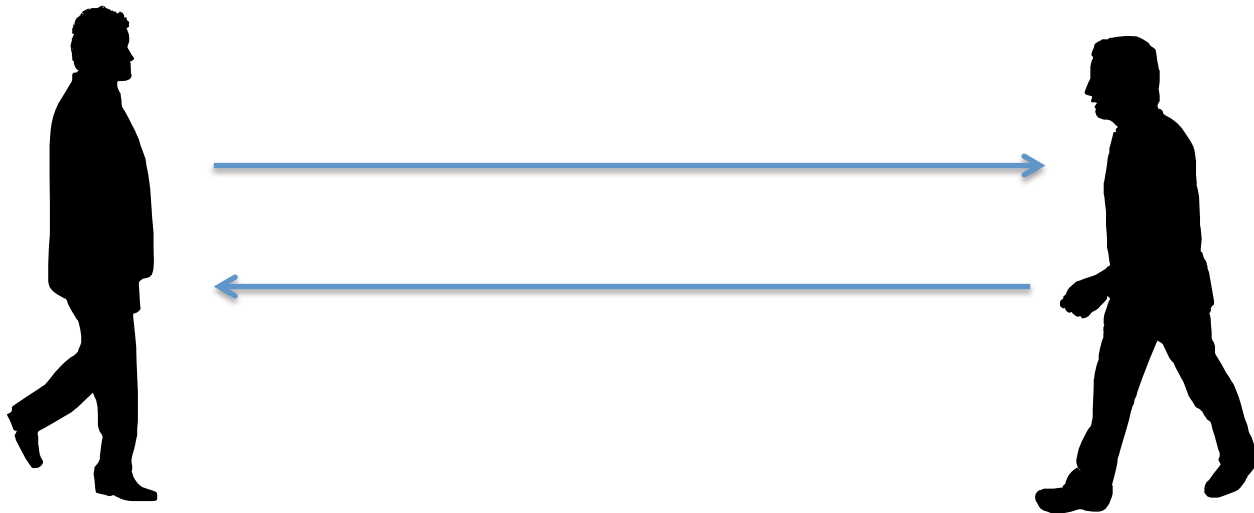


Linked by migration



Scientific Mobility

both co-affiliation and migration



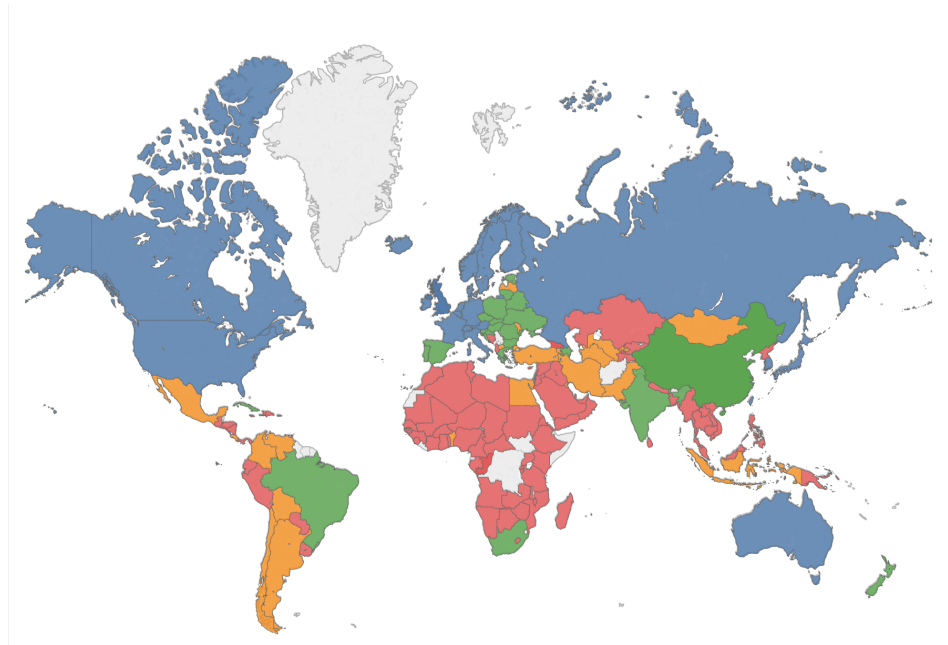
For a more thorough treatment

- **Careers & Mobility (2)**
- Thursday 7 Sept. 11:30 – 13:00 – Session 222 – Room 2
- *Unveiling the multiple faces of mobility: Towards a taxonomy of scientific mobility types based on bibliometric data*
- Nicolas Robinson-Garcia, Cassidy R. Sugimoto, Dakota Murray, Alfredo Yegros-Yegros, Vincent Larivière and Rodrigo Costas.

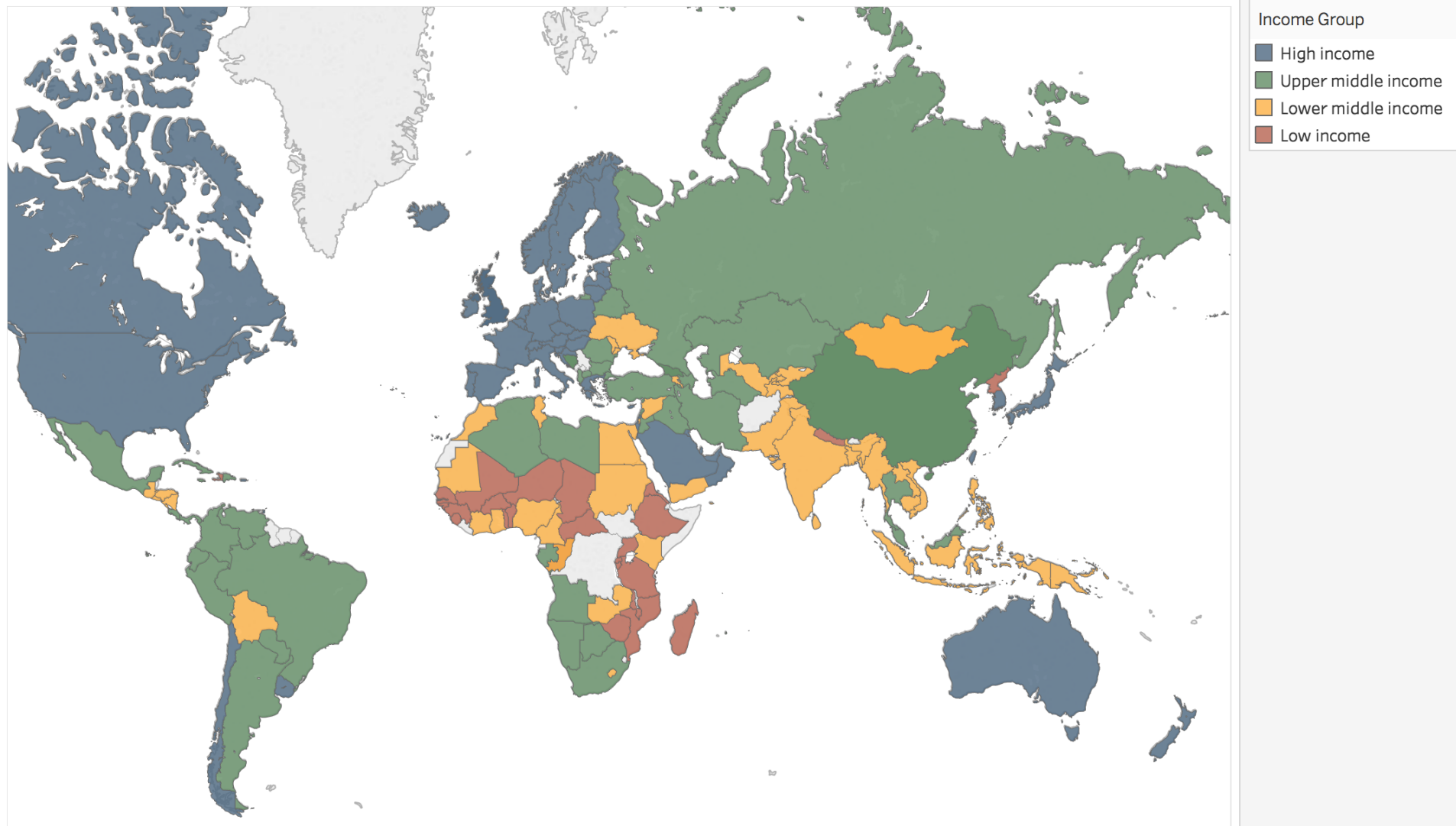
COUNTRY-LEVEL CLASSIFICATIONS

Scientific capacity of nations

- **Scientific Capacity** is the ability to use specialized knowledge and exploit it to conduct research, (Wagner et al 2001).
- Investment, infrastructure, and output



Income level



(World Bank, 2016)

STI Conference 2017

Research Questions

- What is the **relationship** between the international mobility and collaboration of a country?
- What is the **relationship** between the **number of collaborative and mobility links between countries**?
- To what extent do these relationships **vary by the scientific and economic capacity of the country**?

DATA

Web of Science

2008 – 2015

Web of Science

2008 – 2015

First publication in 2008 – 2015

Web of Science

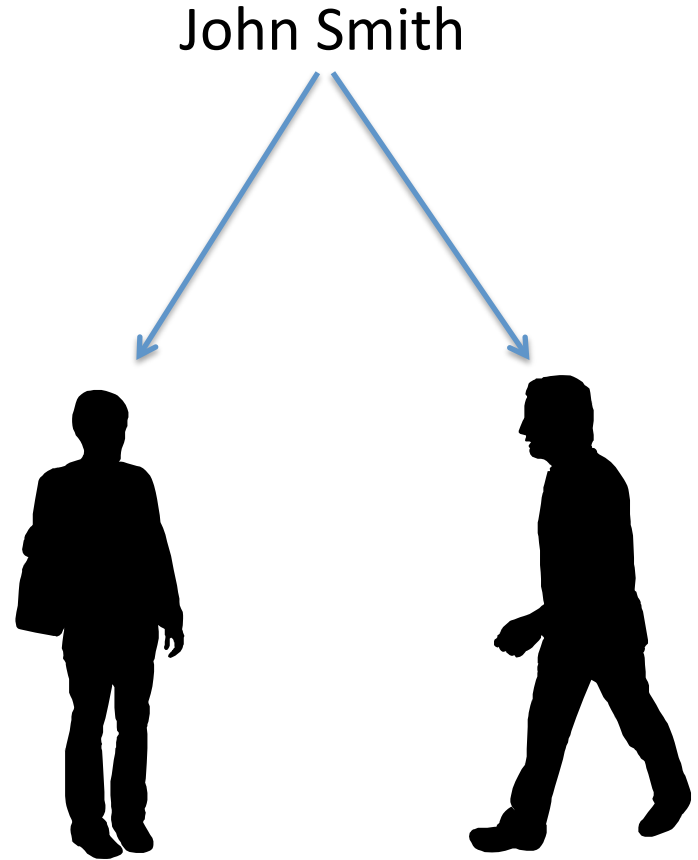
2008 – 2015

First publication in 2008 – 2015



Disambiguation

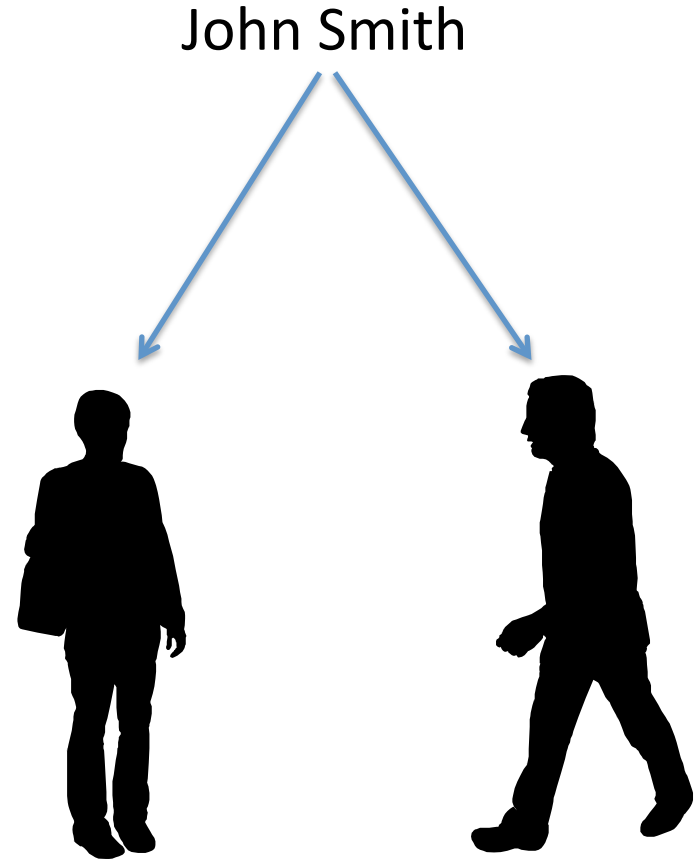
Caron and van Eck (2014)



Disambiguation

Caron and van Eck (2014)

**WoS includes emails
during starting 2008**



Final Dataset

3,251,797



Final Dataset

3,251,797



14,097,939



Final Dataset

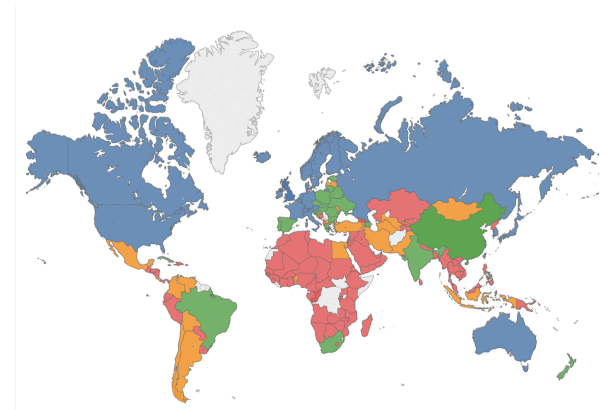
3,251,797



14,097,939



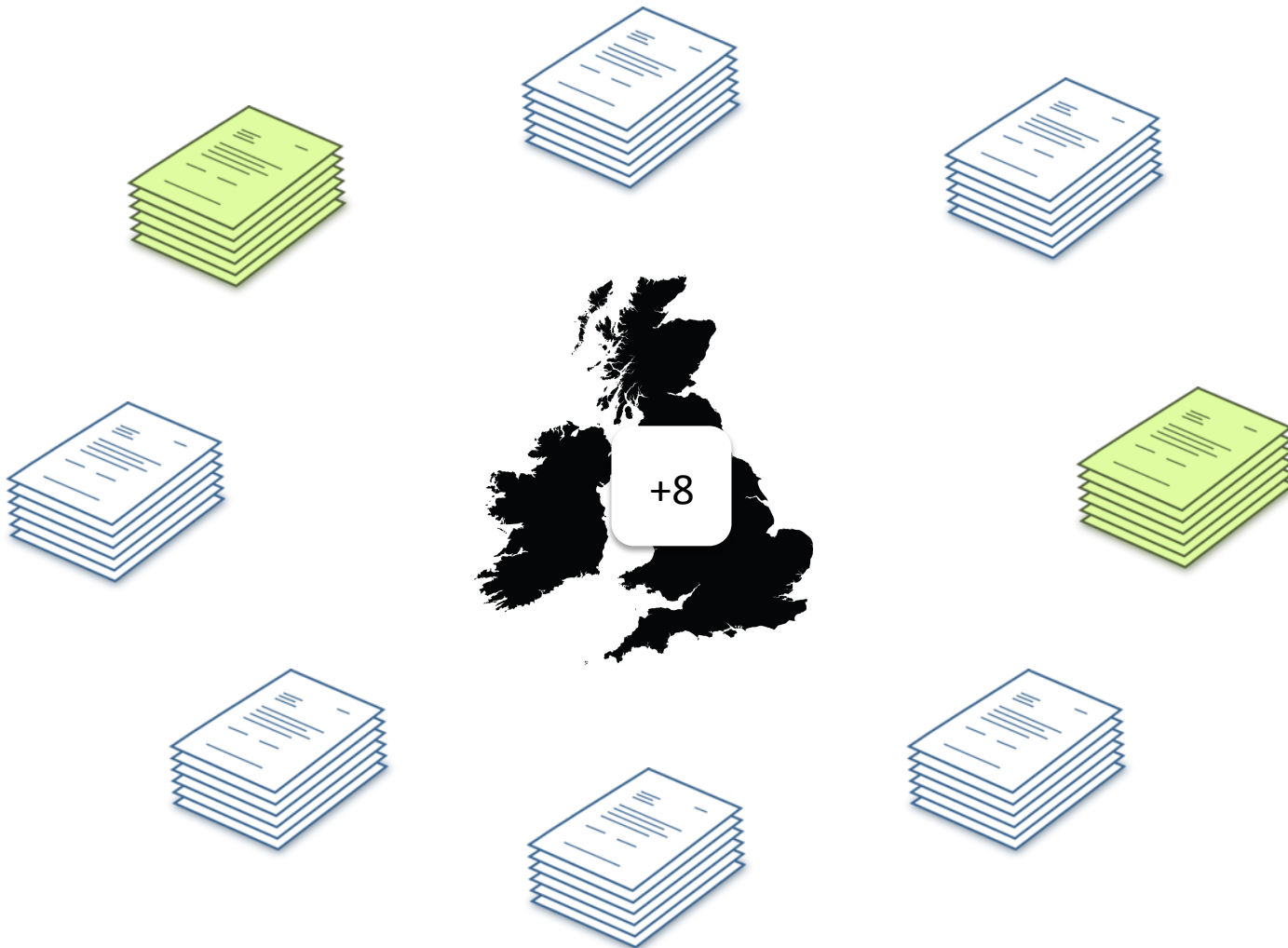
213 Countries



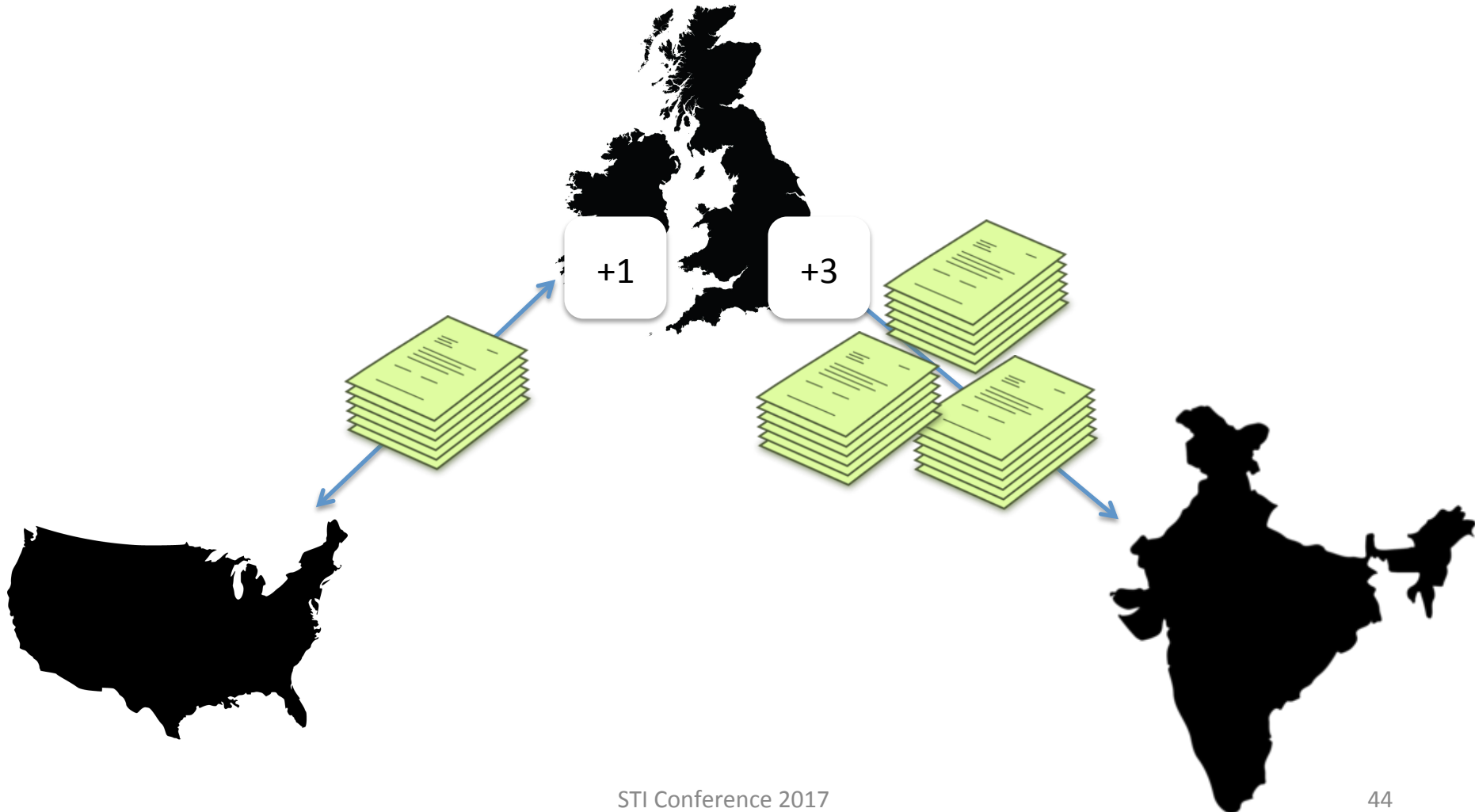
Lili Miao

METHODS AND RESULTS

Total number of publications



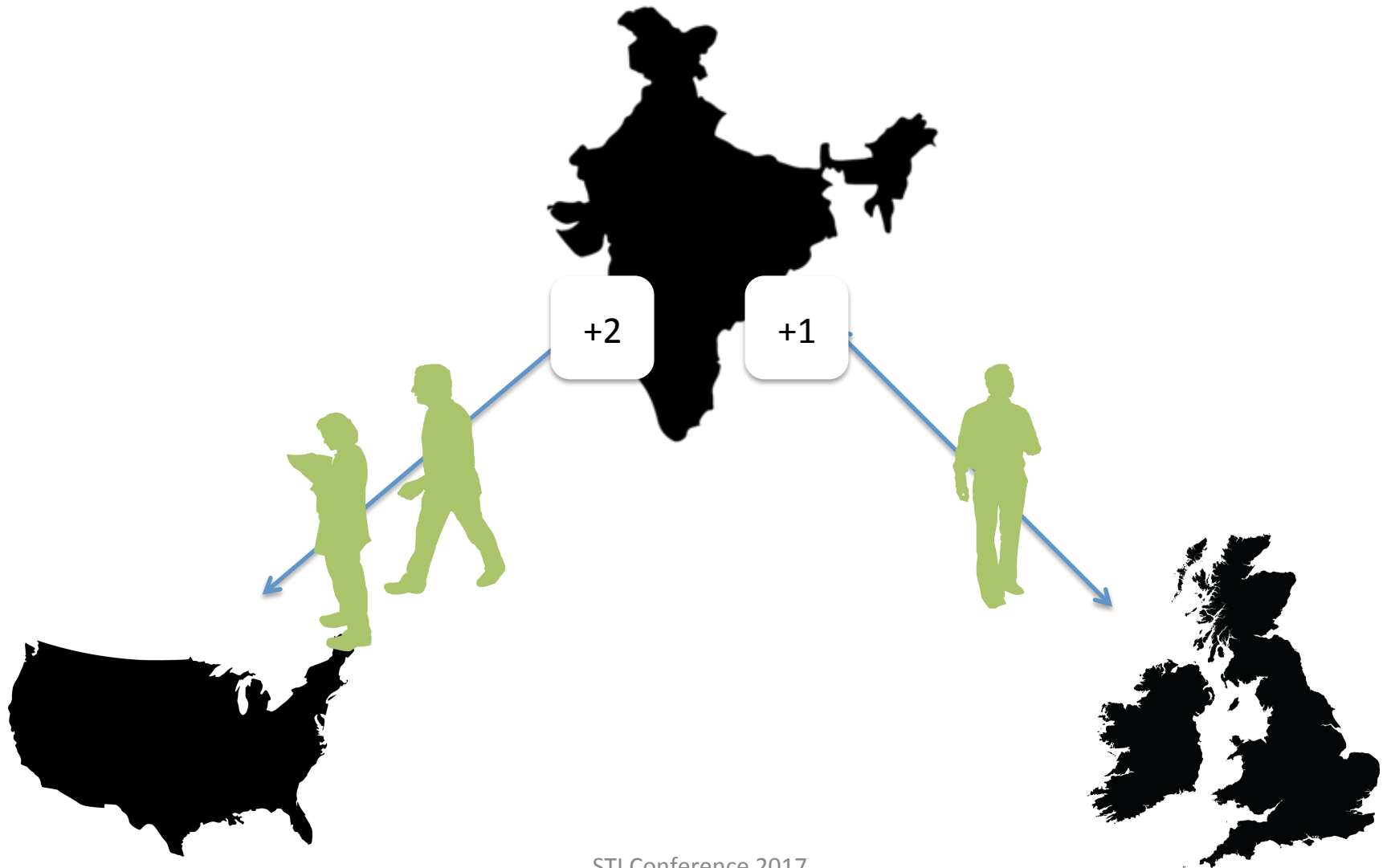
Number of international publications



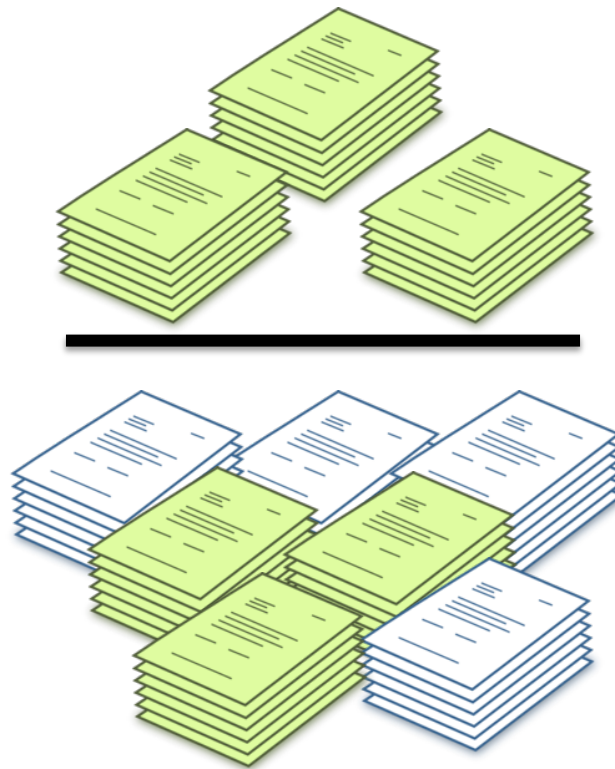
Total number of active researchers



Number of mobile researchers



Percentage of international collaboration



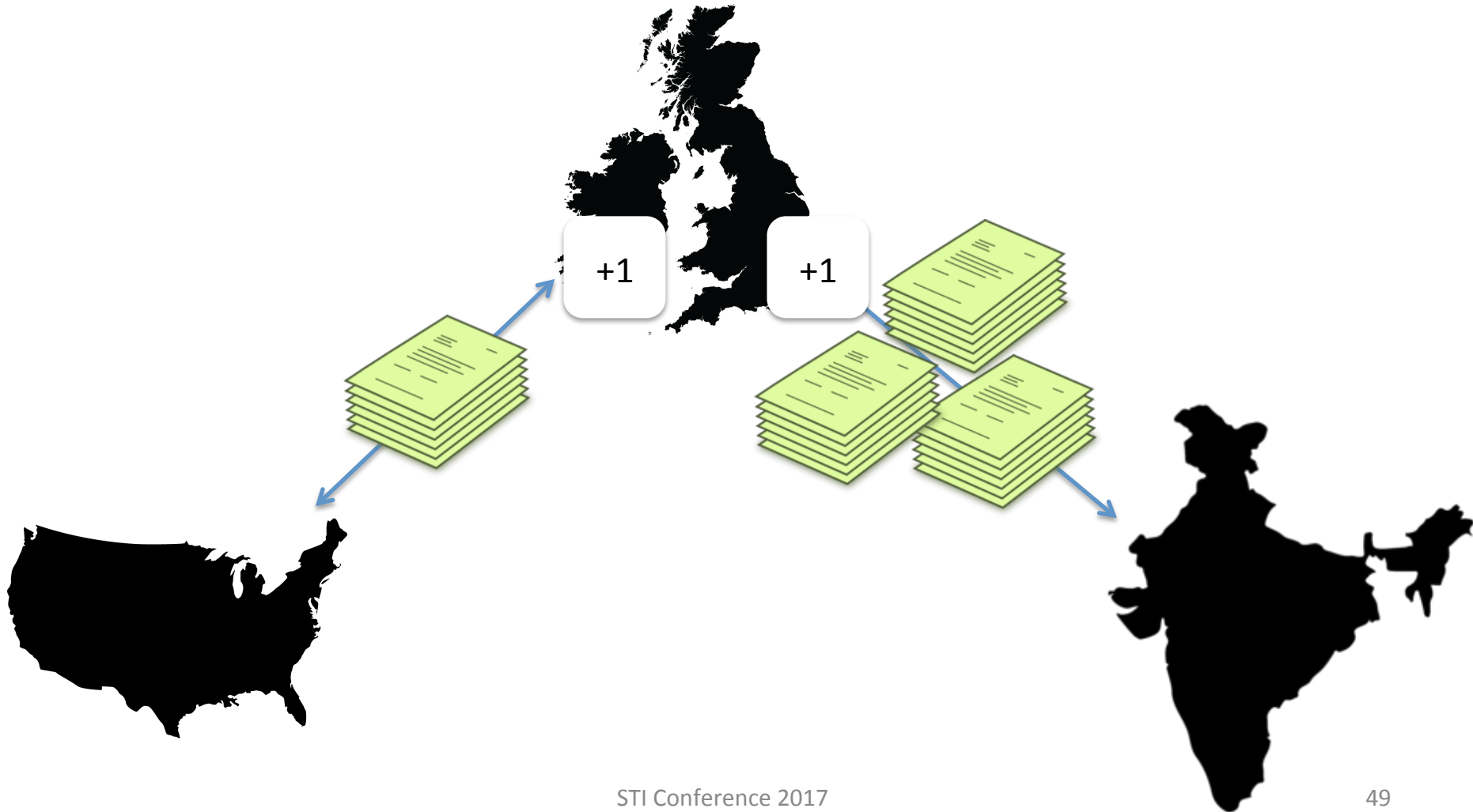
#international pubs

#all pubs

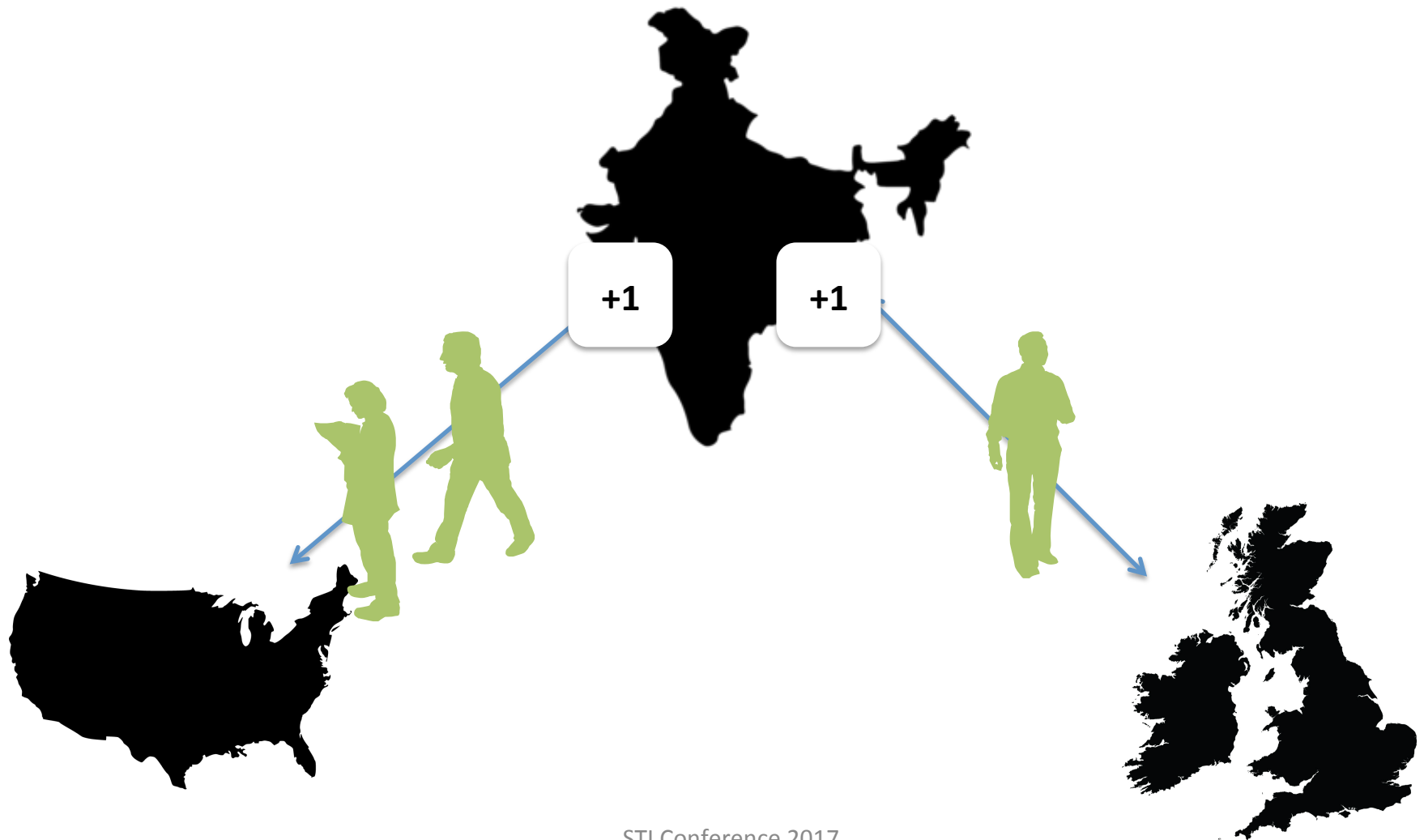
Percentage of mobile researchers linked to other counties



Number of countries linked in collaboration



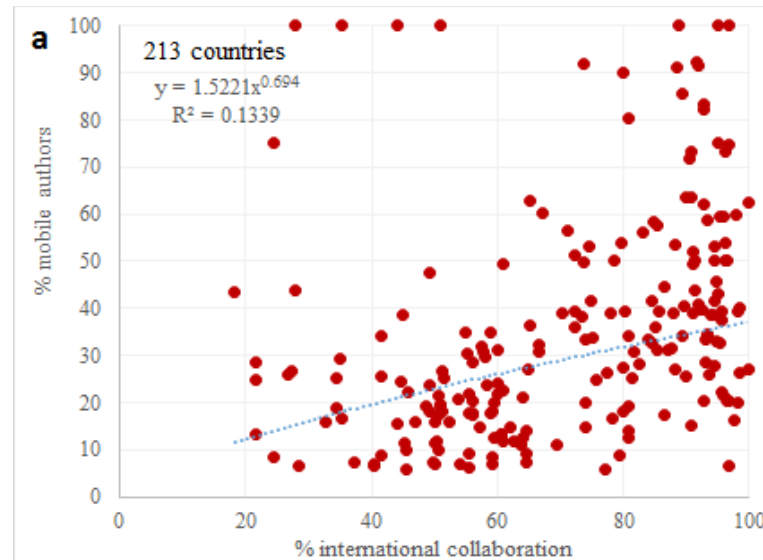
Number of countries linked in mobility



Results (I)

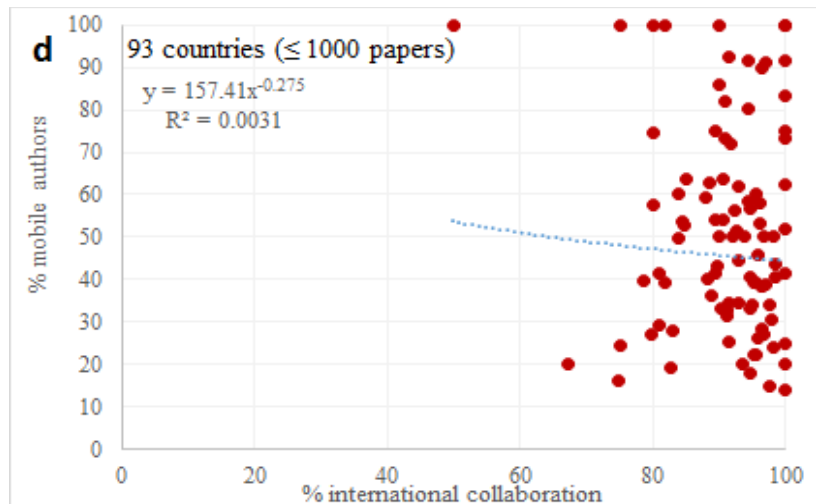
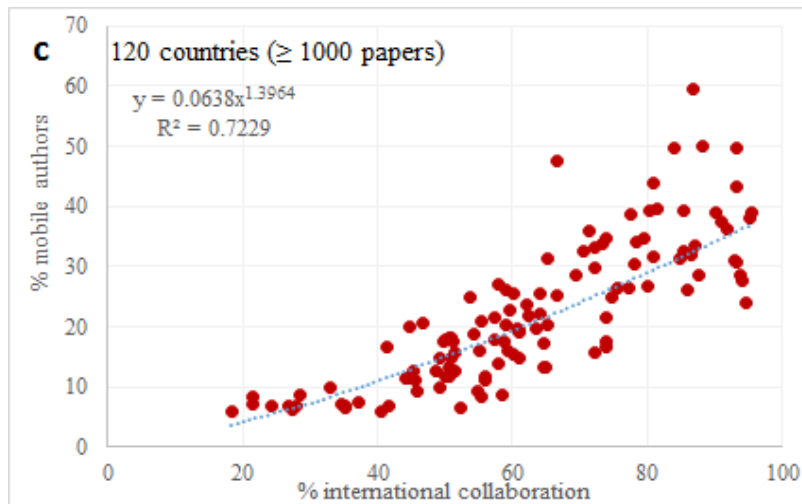
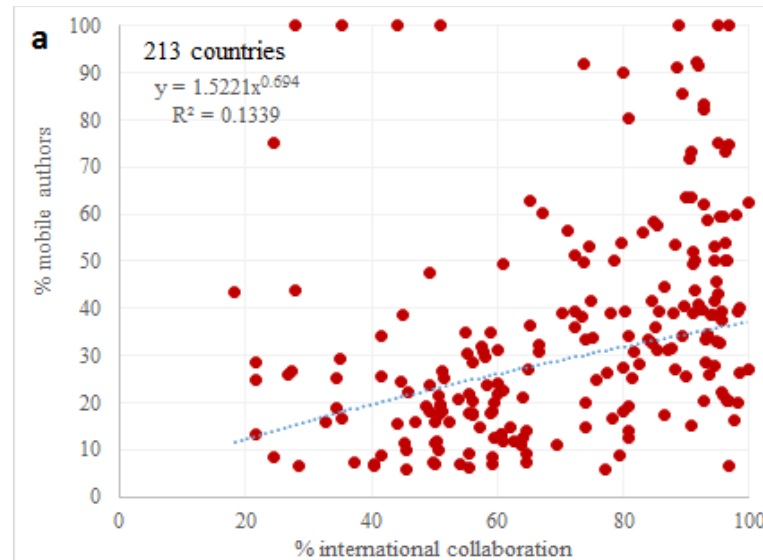
An overview of collaboration and mobility patterns

Size matters. Strong size-dependence relationship



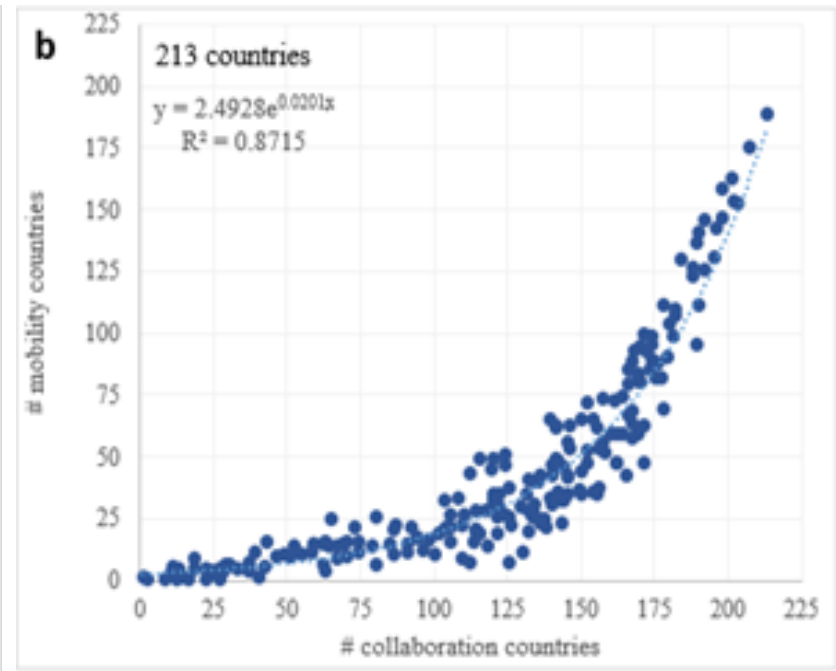
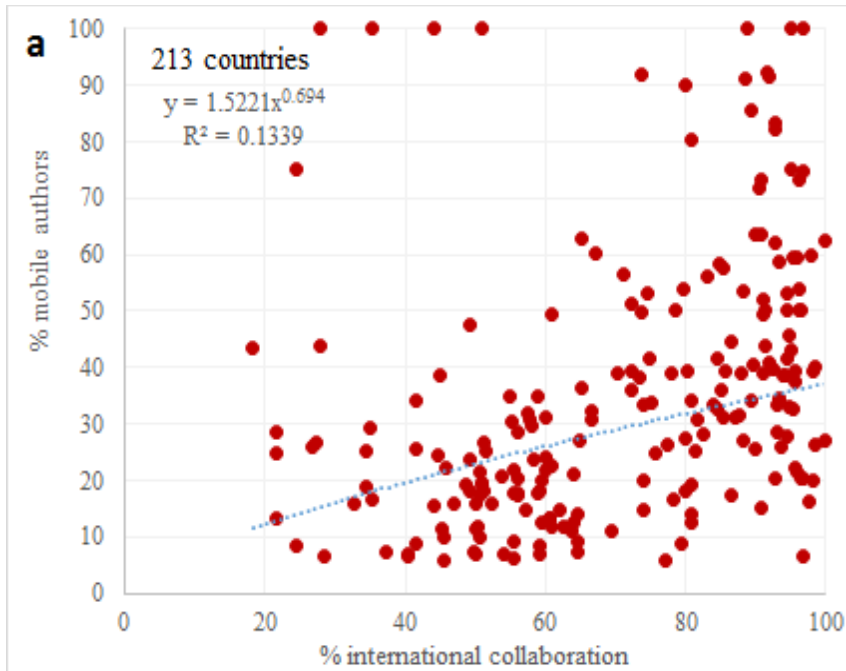
Correlation between percent of mobile authors and percent of internationally co-authored publications for (a) all countries, (c) more prolific countries and (d) less prolific countries

Size matters. Strong size-dependence relationship



Correlation between percent of mobile authors and percent of internationally co-authored publications for (a) all countries, (c) more prolific countries and (d) less prolific countries

Higher collaboration shares reach the fewer number of countries



Correlation between percent of mobile authors and percent of internationally co-authored publications for (a) all countries, and (b) number of countries with which a country has established mobility links by the number of countries with which that country has collaboration co-authored publications

Scientific relationships are highly resource-dependent

The smaller the country, the more dependence on connectivity

S&T capacity index groups	%international collaboration	% authors in mobility
Advanced	51.40	16.65
Proficient	49.94	13.68
Developing	61.89	19.81
Lagging	81.85	34.55
World average	69.18	26.31

Mean average of mobile authors and international publications by group.

Scientific relationships are highly resource-dependent

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Mean average of mobile authors and international publications by group.

The number of countries with mobility is fewer than collaborative partners

Mobile researchers in advanced countries reach 68 % of collaborative partners, whereas in lagging countries, they hardly reach 29%

S&T capacity index groups	# collaborators countries	# mobility countries	% reaching countries
Advanced	186.64	126.41	67.73
Proficient	161.75	79.71	49.28
Developing	139.86	50.05	35.78
Lagging	125.40	36.38	29.01
World average	142.55	58.82	41.26

Mean average of countries with mobile authors and international publications by group.

Partnerships, preferences, or possibilities?

	MOBILITY					
	Advanced	Proficient	Developing	Lagging	Others	Total
Advanced	65.32	75.19	64.33	63.04	59.86	67.00
Proficient	22.01	14.58	17.74	12.86	13.21	19.61
Developing	5.54	5.22	6.36	9.13	6.13	5.77
Lagging	6.29	4.38	10.57	13.32	11.75	6.68
Others	0.84	0.63	0.99	1.66	9.40	0.94

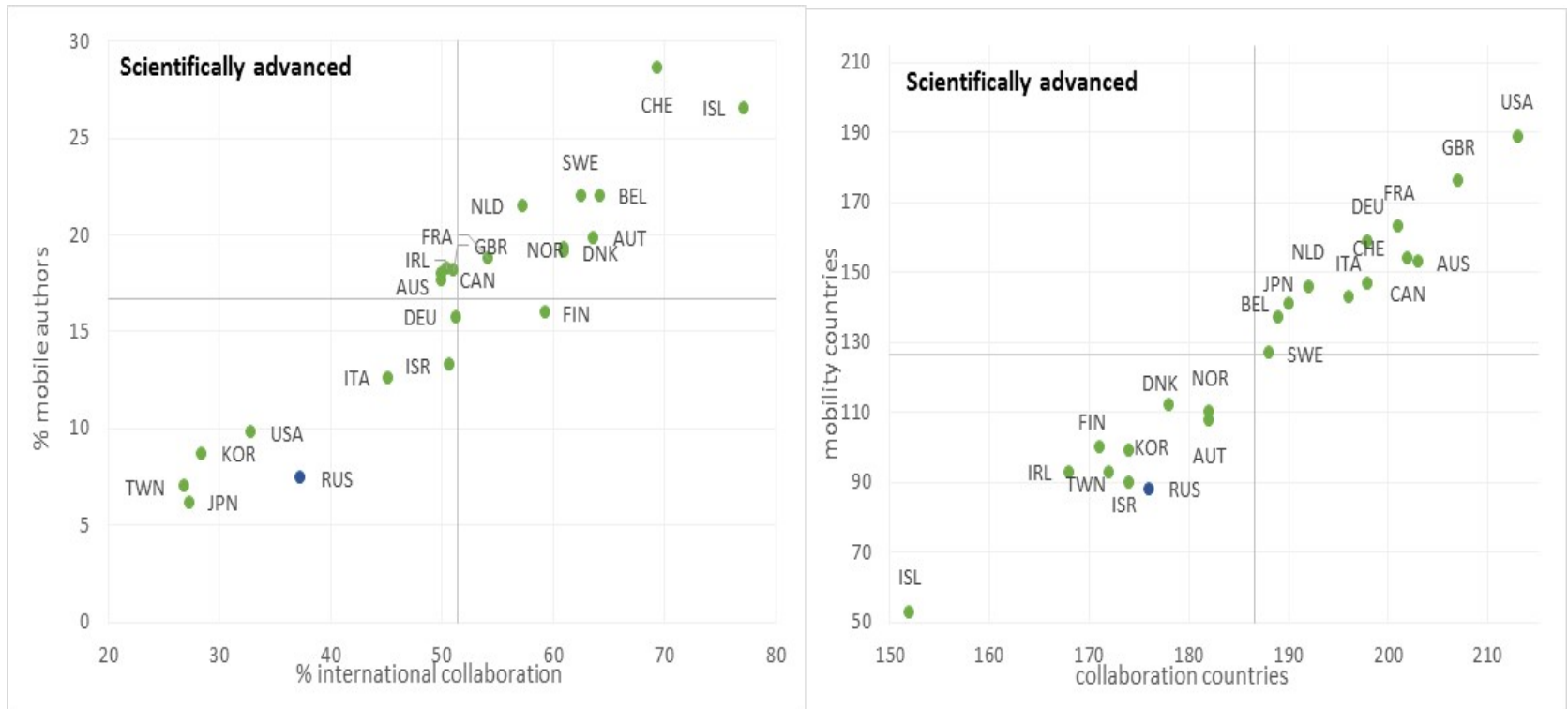
	COLLABORATION					
	Advanced	Proficient	Developing	Lagging	Others	Total
Advanced	67.05	62.51	49.96	50.06	45.96	63.70
Proficient	22.67	23.37	27.76	20.06	29.88	23.10
Developing	4.93	7.55	10.26	10.93	10.91	6.29
Lagging	4.39	4.85	9.71	16.73	9.33	5.59
Others	0.96	1.72	2.31	2.22	3.94	1.33

Distributions of mobility and international collaboration by group.

Results (II)

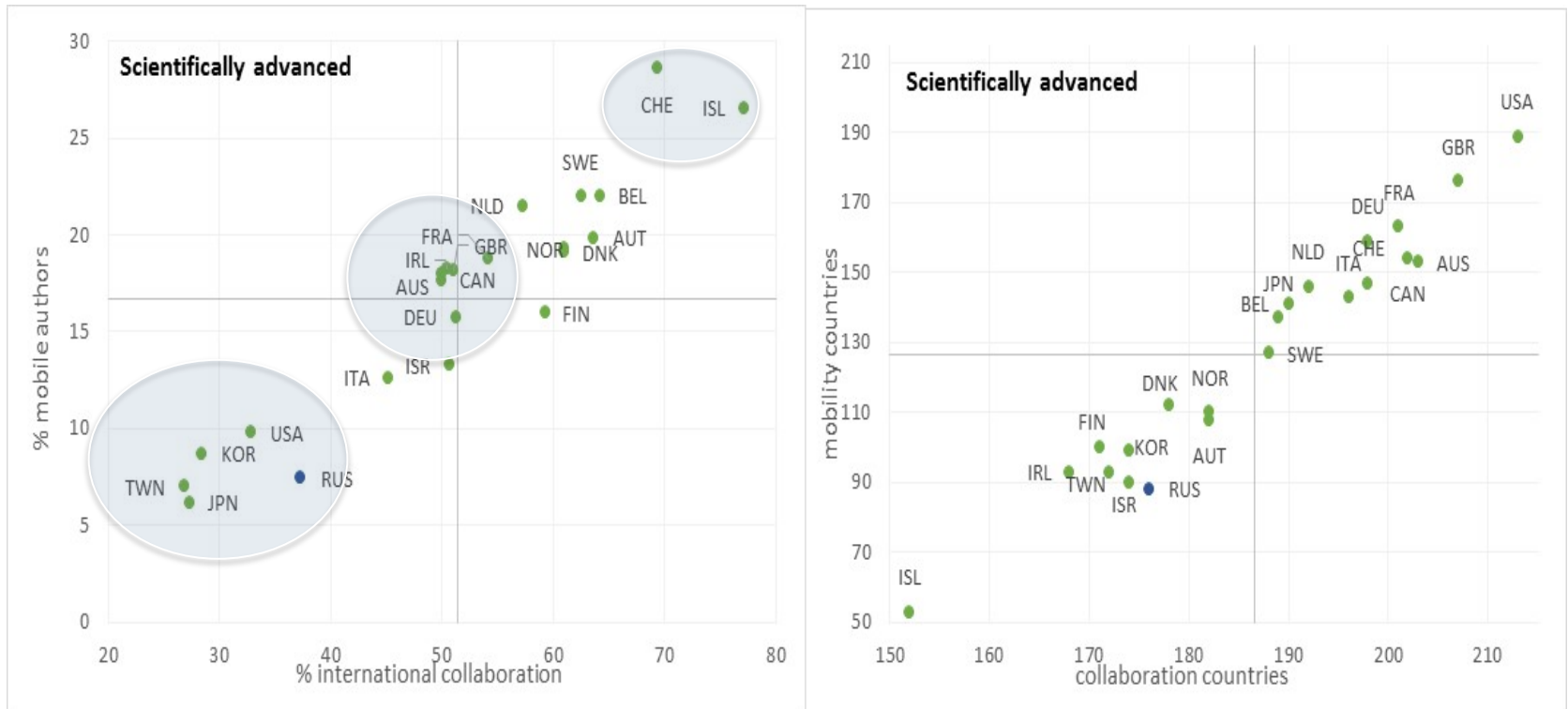
Group-specific analysis according to their scientific and technological capacities

Percentages (left) and number of countries (right) in international mobility and in collaboration among the scientifically advanced countries



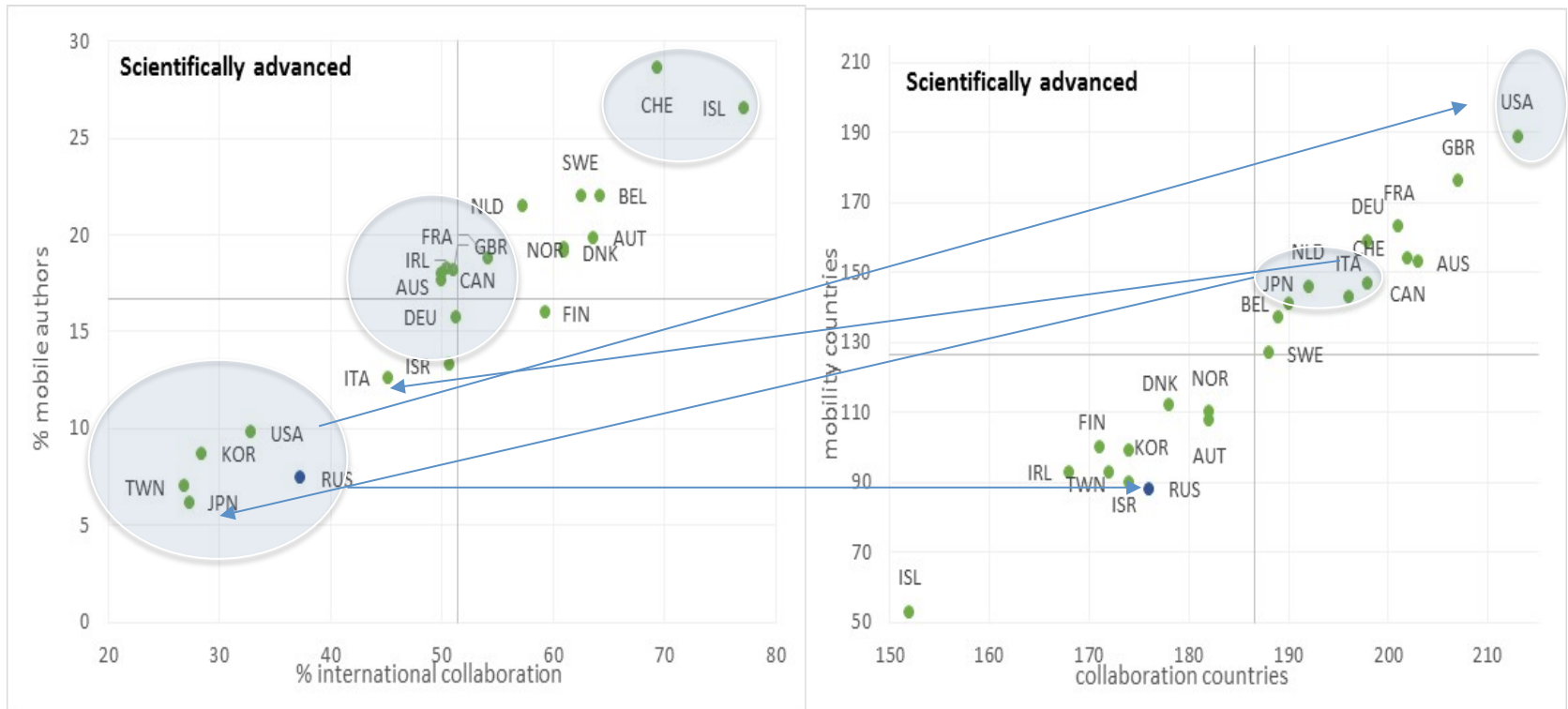
Legend: The central axes show the mean average of percentages and number of countries in each group. The colours refer to the income level: (green: high, blue: upper-middle, orange: low-middle and red: low)

Percentages (left) and number of countries (right) in international mobility and in collaboration among the scientifically advanced countries



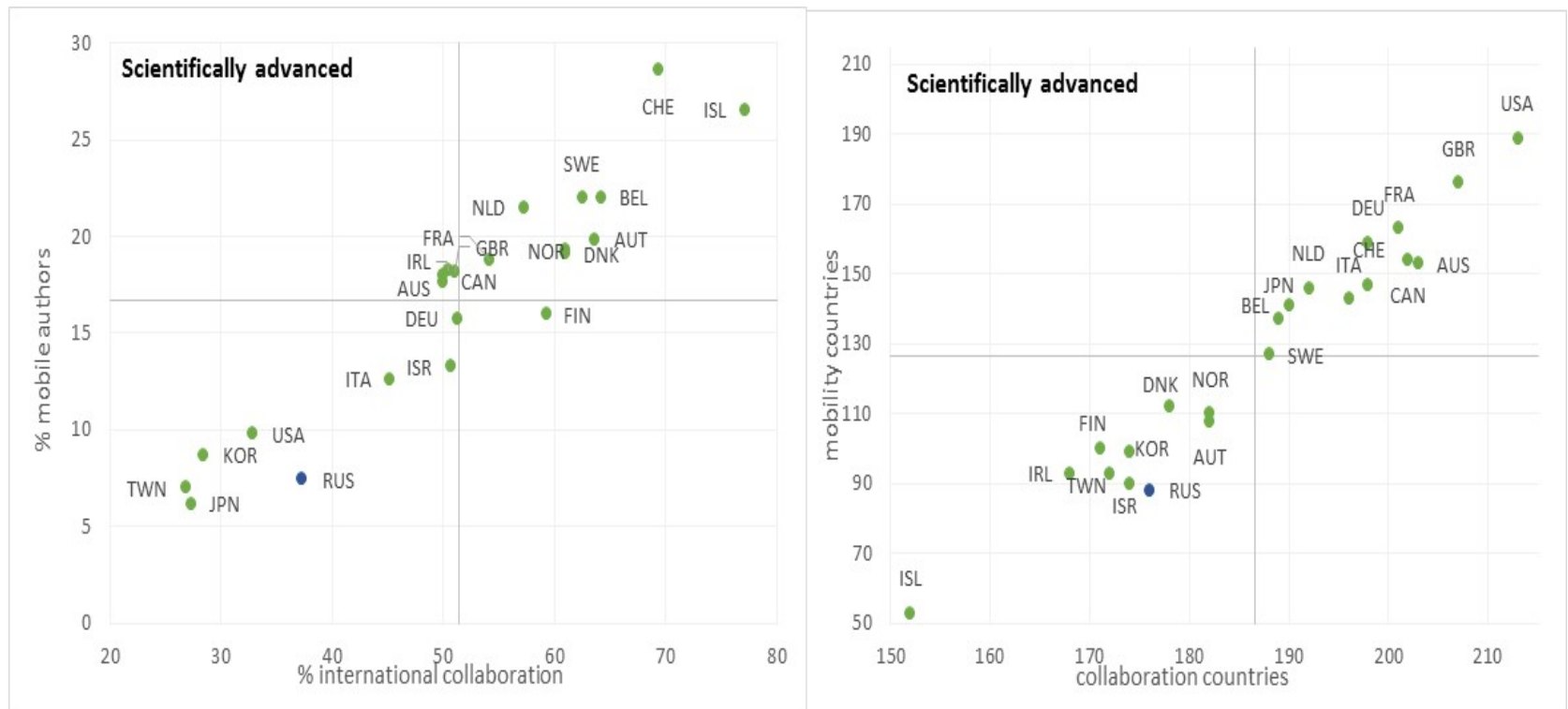
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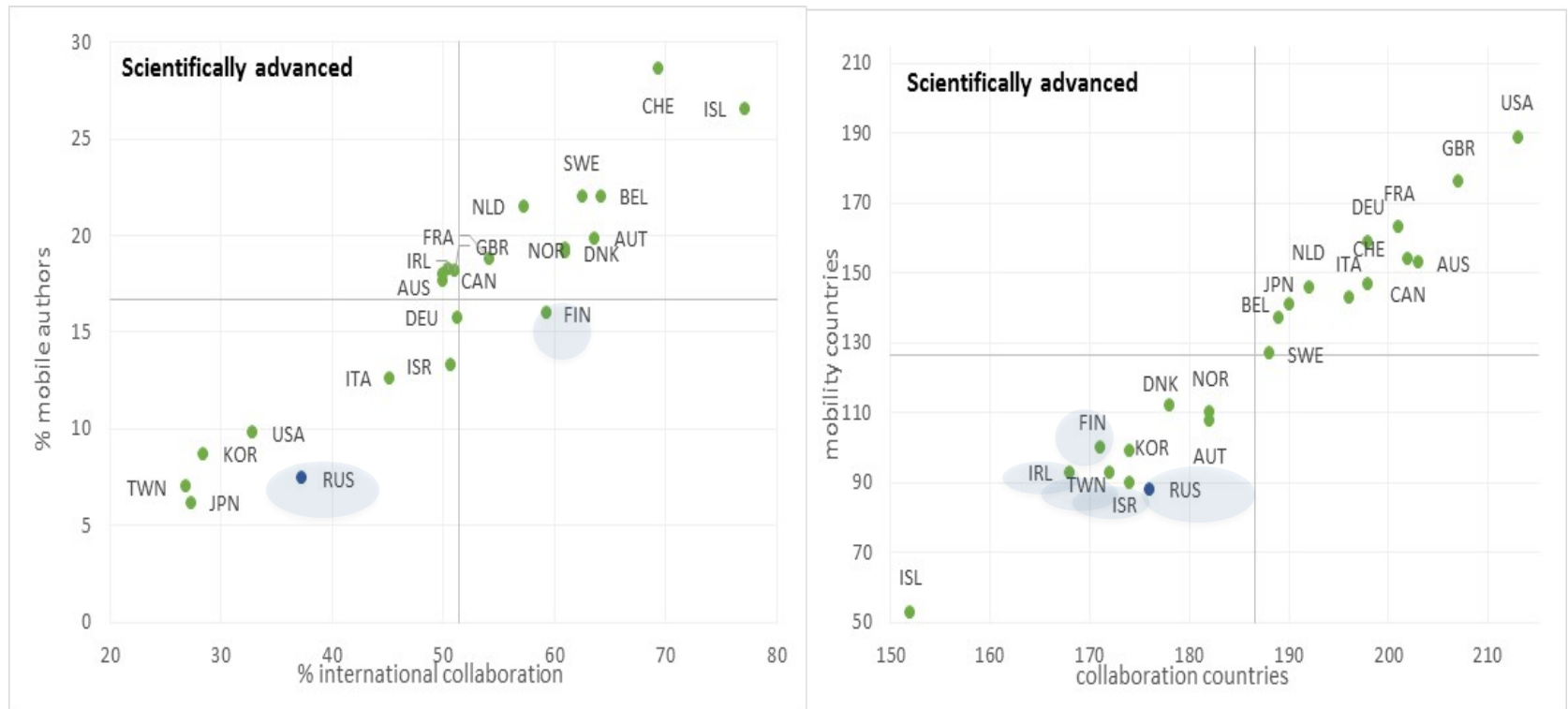
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Percentages (left) and number of countries (right) in international mobility and in collaboration among the scientifically advanced countries



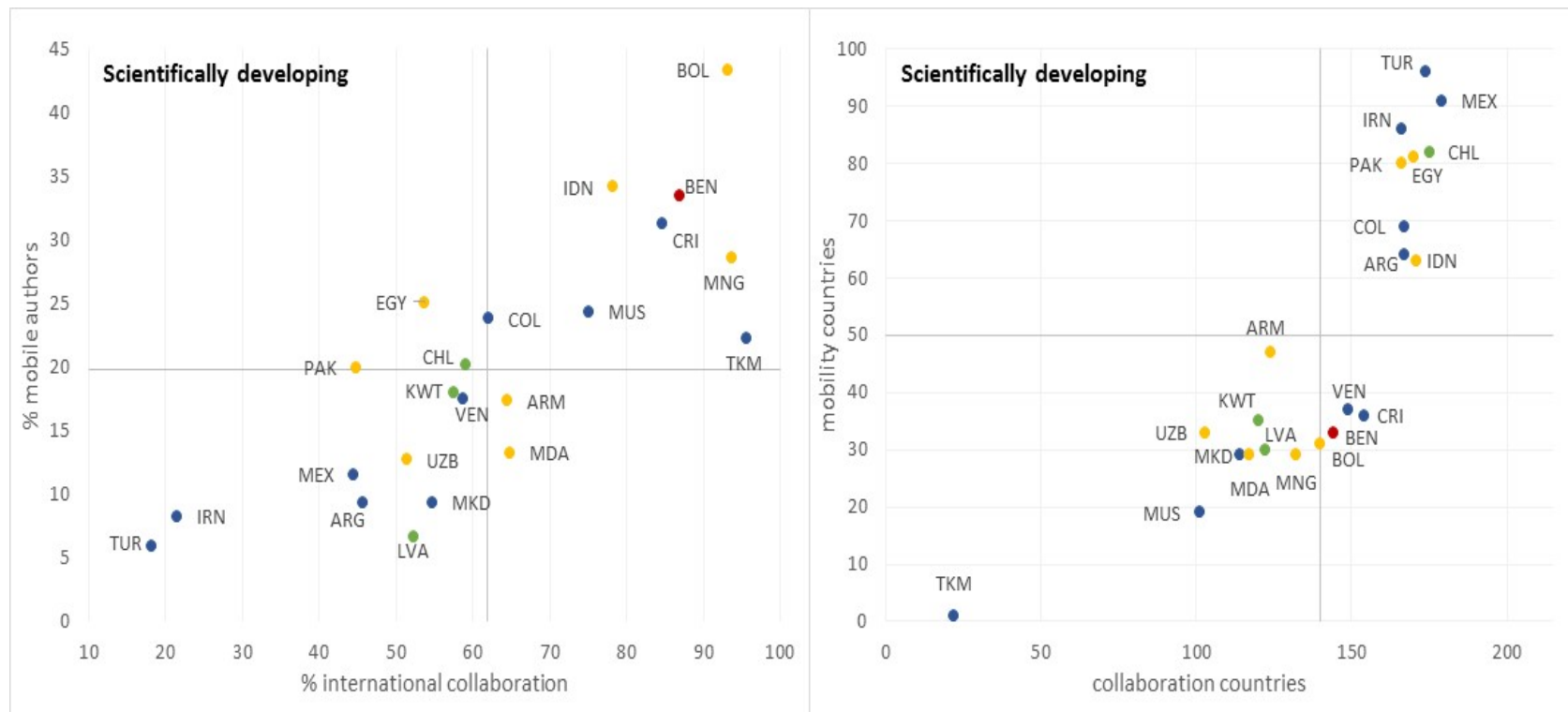
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Percentages (left) and number of countries (right) in international mobility and in collaboration among the scientifically advanced countries



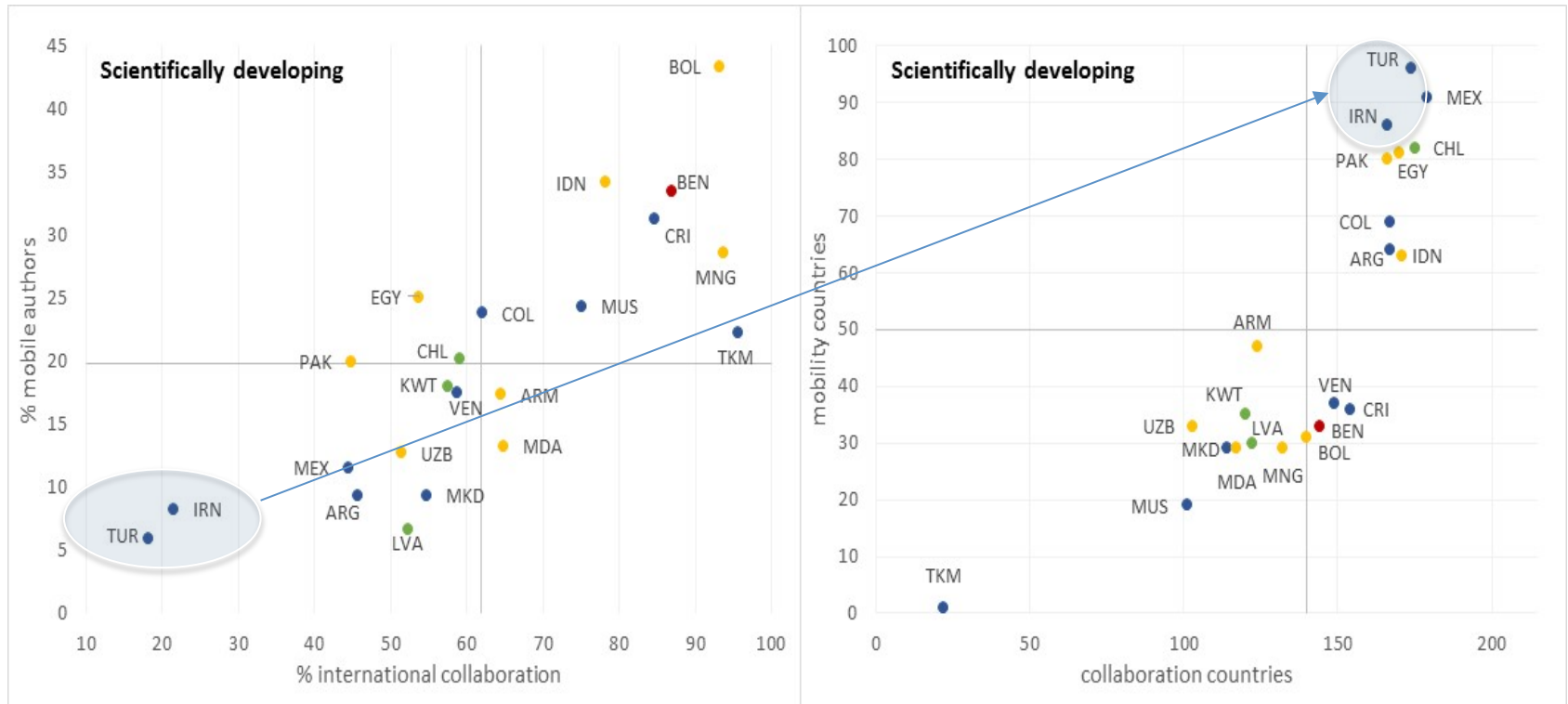
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Percentages (left) and number of countries (right) in international mobility and in collaboration among the scientifically developing countries



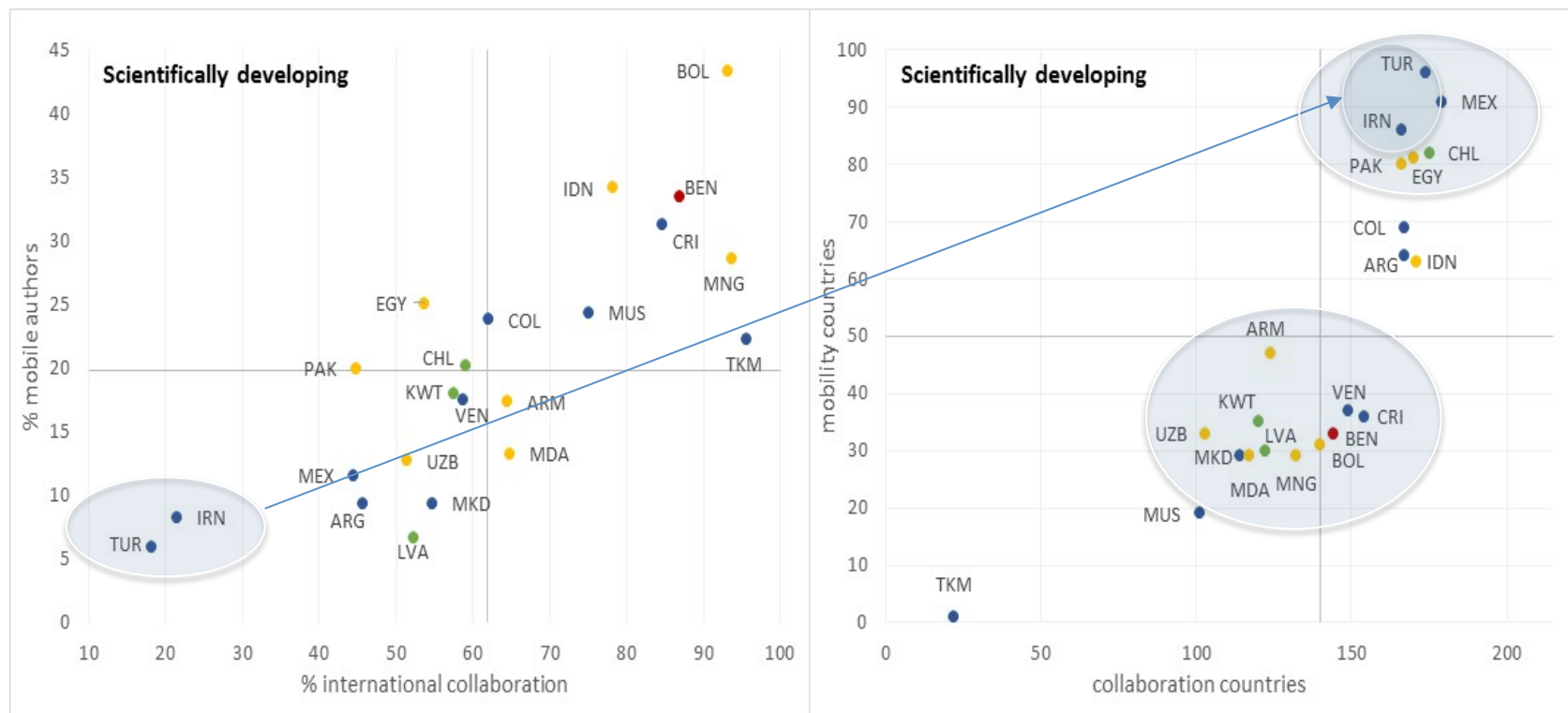
Legend: The central axes show the mean average of percentages and number of countries in each group. The colours refer to the income level: (green: high, blue: upper-middle, orange: low-middle and red: low)

Percentages (left) and number of countries (right) in international mobility and in collaboration among the scientifically developing countries



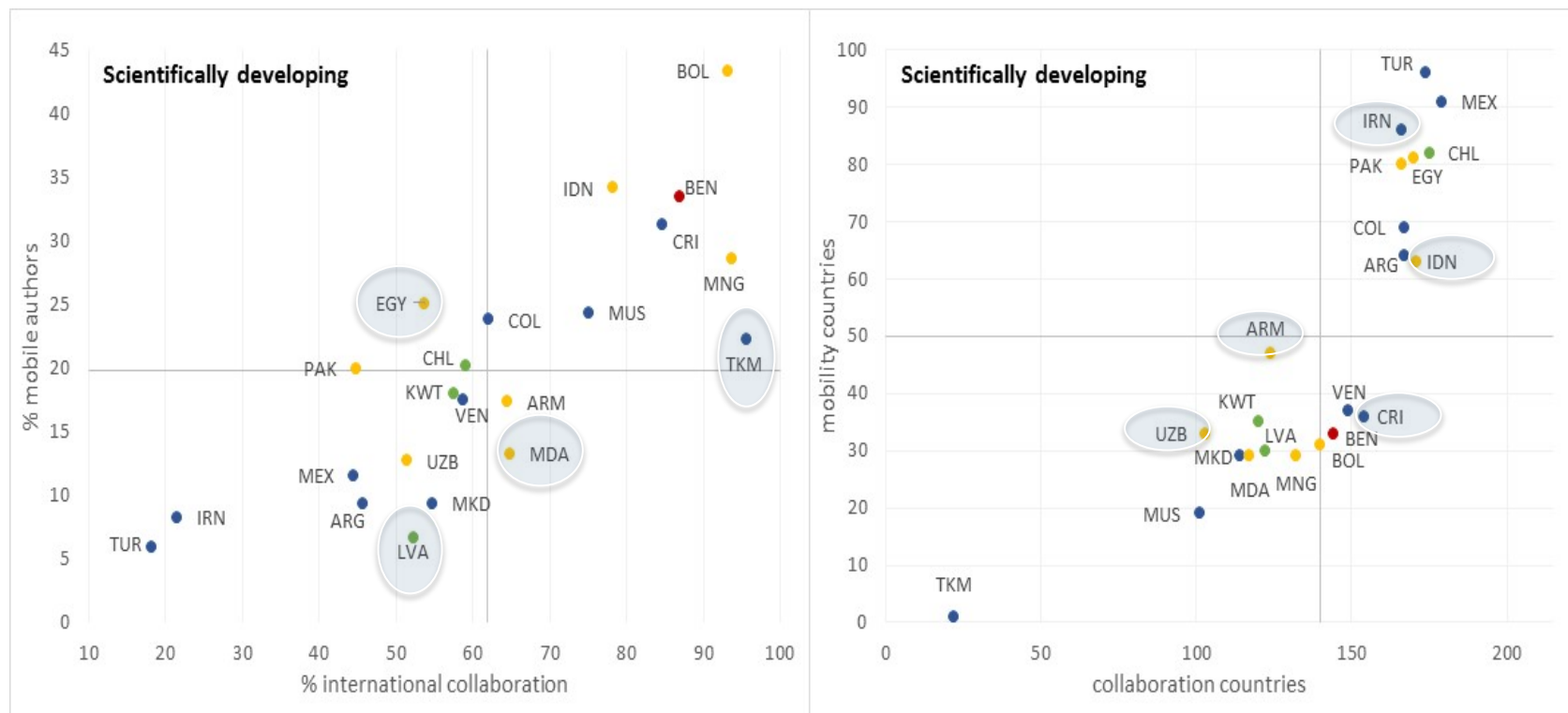
Legend: The central axes show the mean average of percentages and number of countries in each group. The colours refer to the income level: (green: high, blue: upper-middle, orange: low-middle and red: low)

Percentages (left) and number of countries (right) in international mobility and in collaboration among the scientifically developing countries



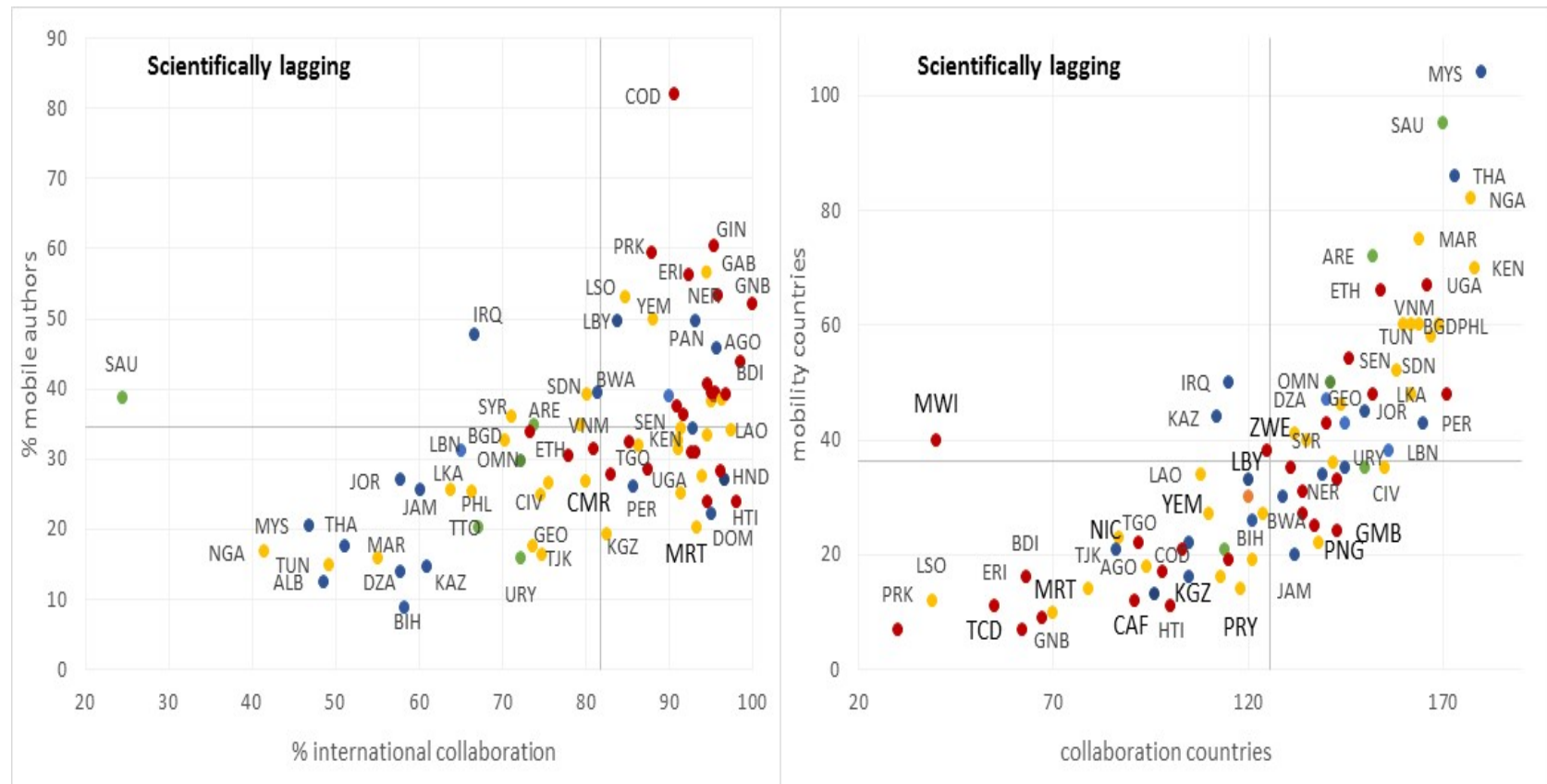
Legend: The central axes show the mean average of percentages and number of countries in each group. The colours refer to the income level: (green: high, blue: upper-middle, orange: low-middle and red: low)

Percentages (left) and number of countries (right) in international mobility and in collaboration among the scientifically developing countries



Legend: The central axes show the mean average of percentages and number of countries in each group. The colours refer to the income level: (green: high, blue: upper-middle, orange: low-middle and red: low)

Percentages (left) and number of countries (right) in international mobility and in collaboration among the scientifically lagging countries



Legend: The central axes show the mean average of percentages and number of countries in each group. The colours refer to the income level: (green: high, blue: upper-middle, orange: low-middle and red: low)

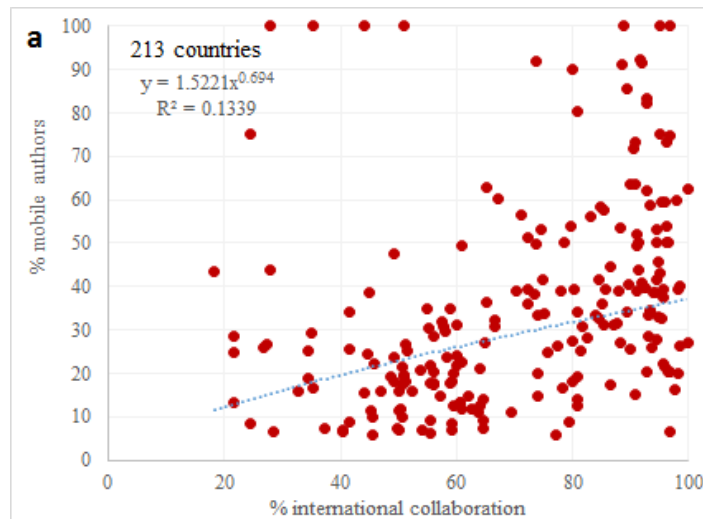
Dakota Murray

SUMMARY

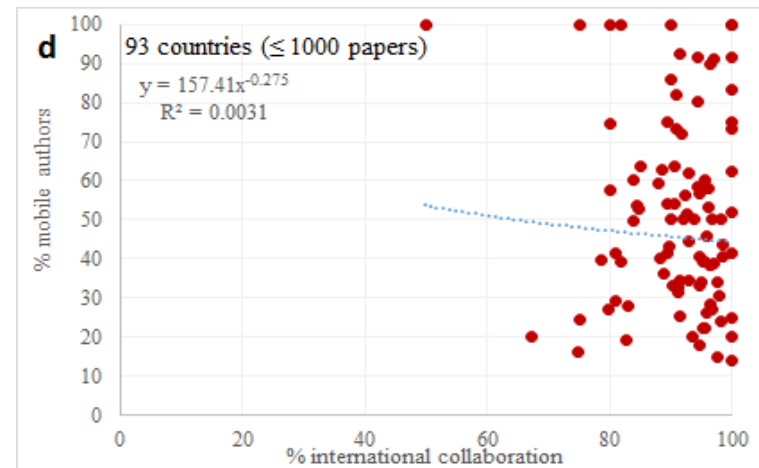
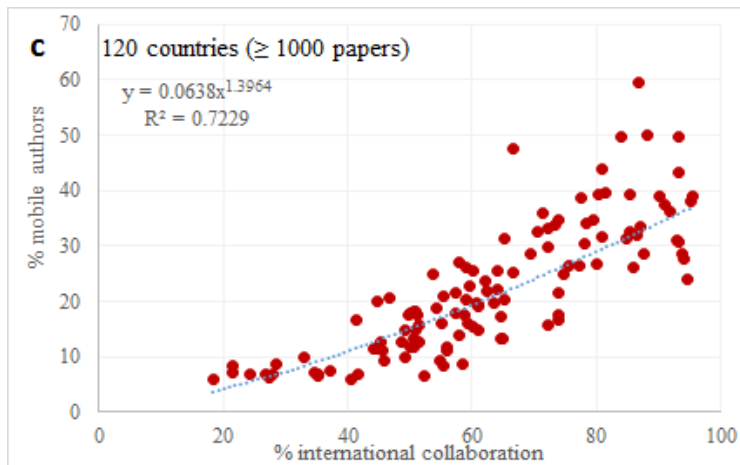
Introduced indicators



Collaboration related to mobility



But not the same

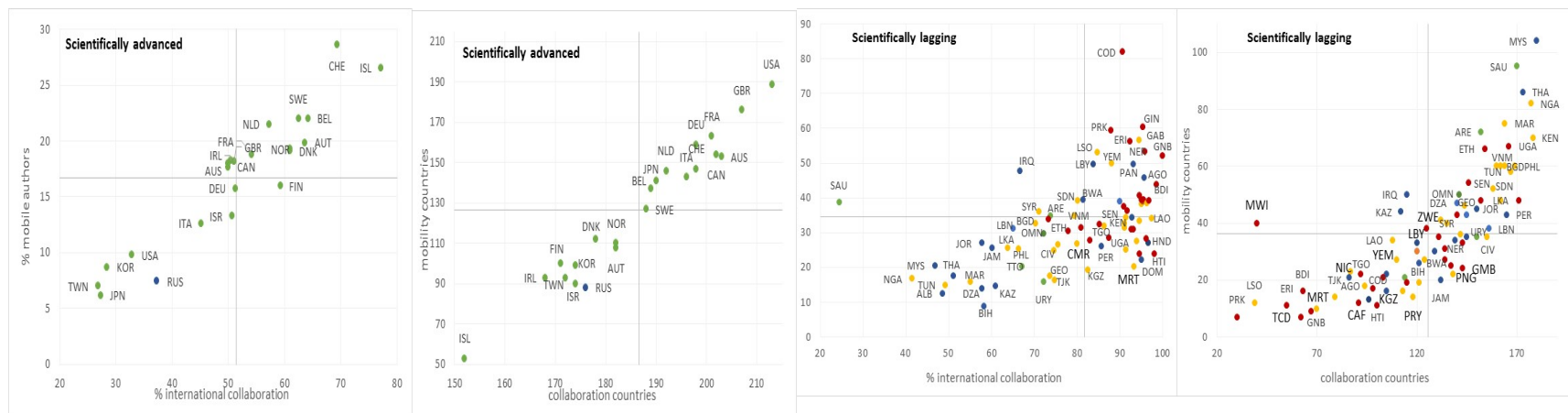


Partnership preferences

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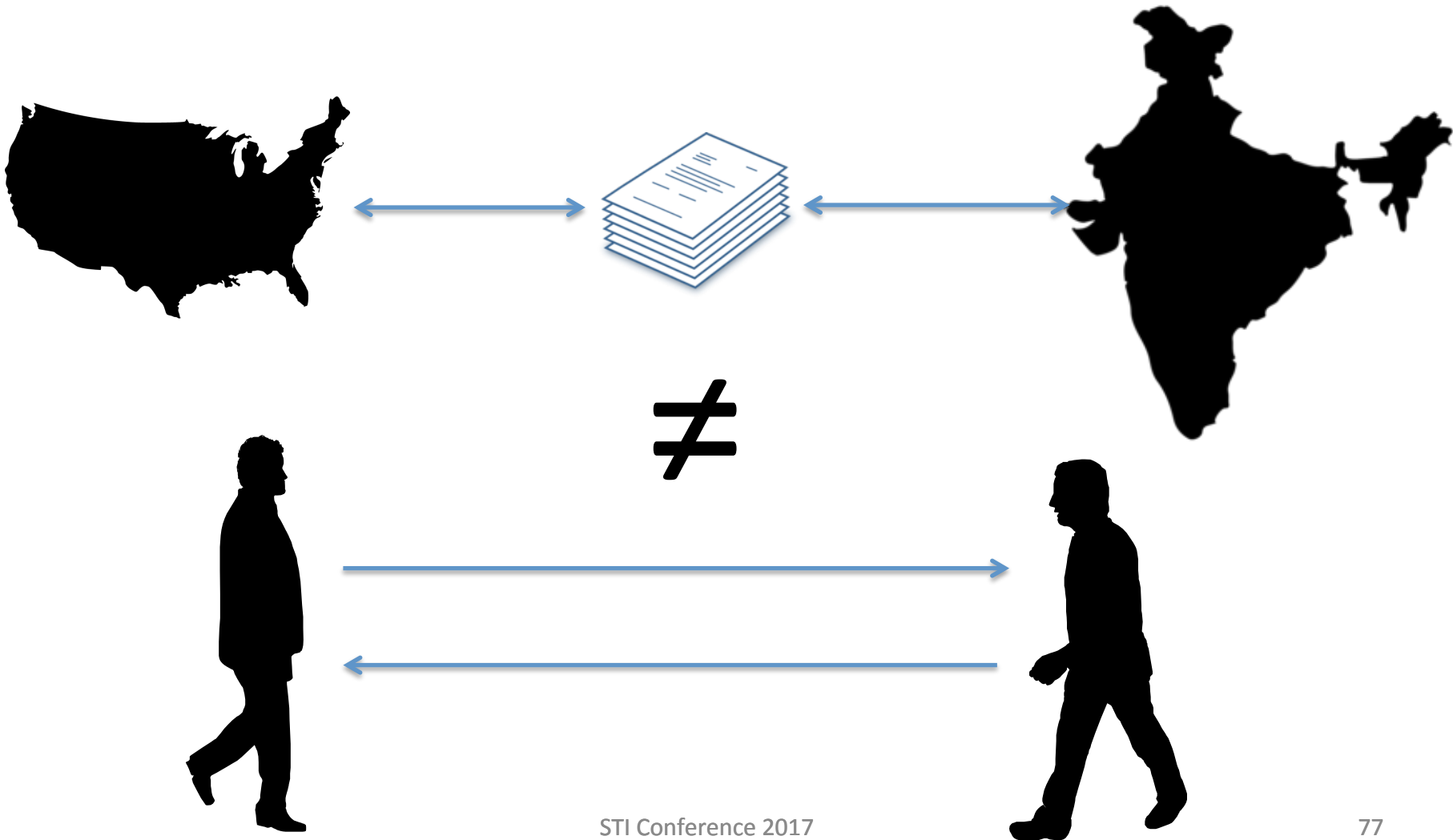
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Heterogeneity of the “global brain”

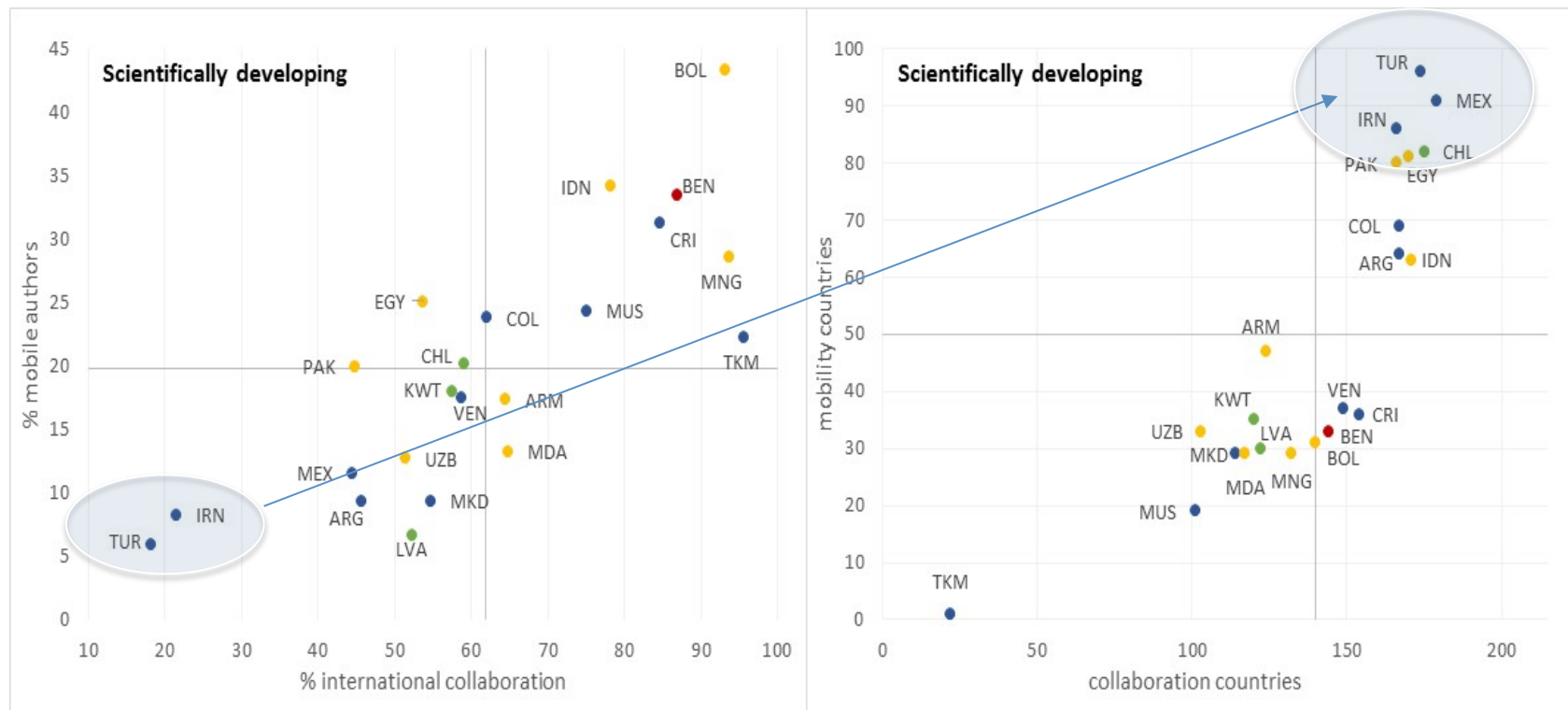


IMPLICATIONS

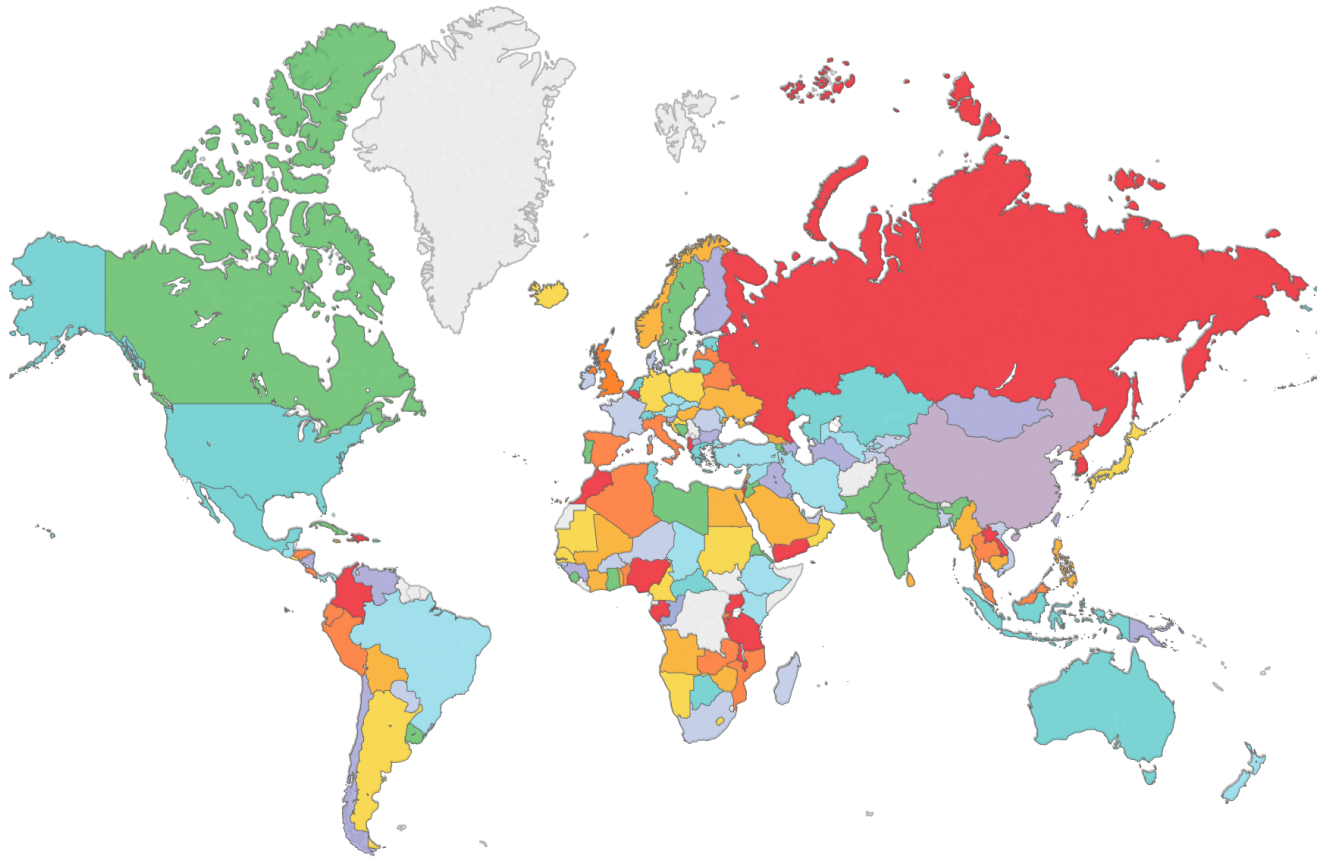
Not all partnerships are equal



Deviance from assumptions



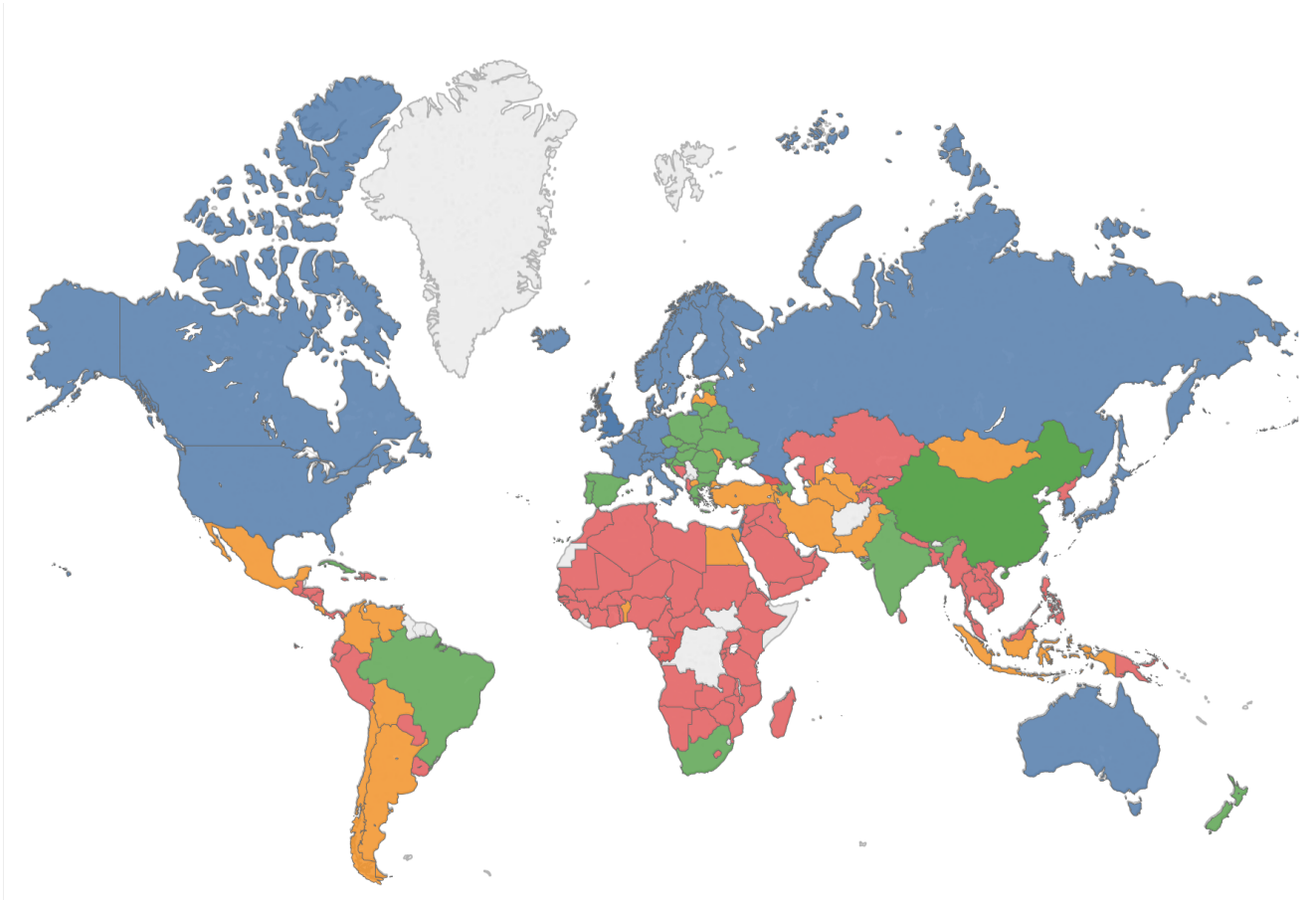
Heterogeneity



Many perspectives needed



Revisiting classifications



LIMITATIONS AND FUTURE WORK

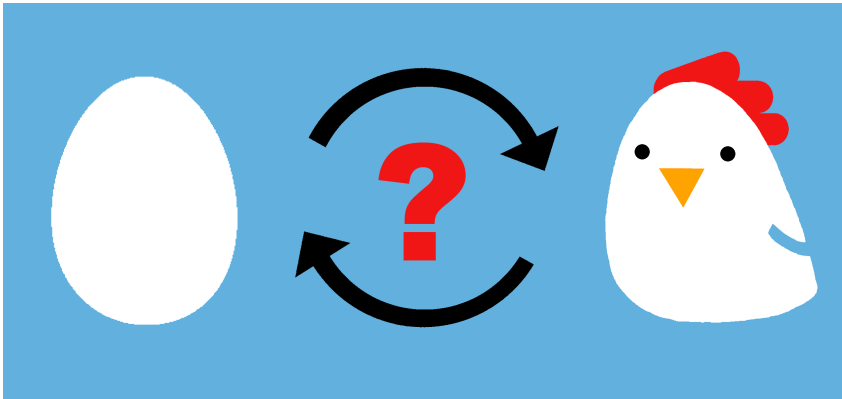
Heterogeneity

- Preliminary, large-scale analysis
- No consideration of disciplinary context
- Size-dependent indicators



Causality

- **Mobility $\neq$ Collaboration, but they *are* related**

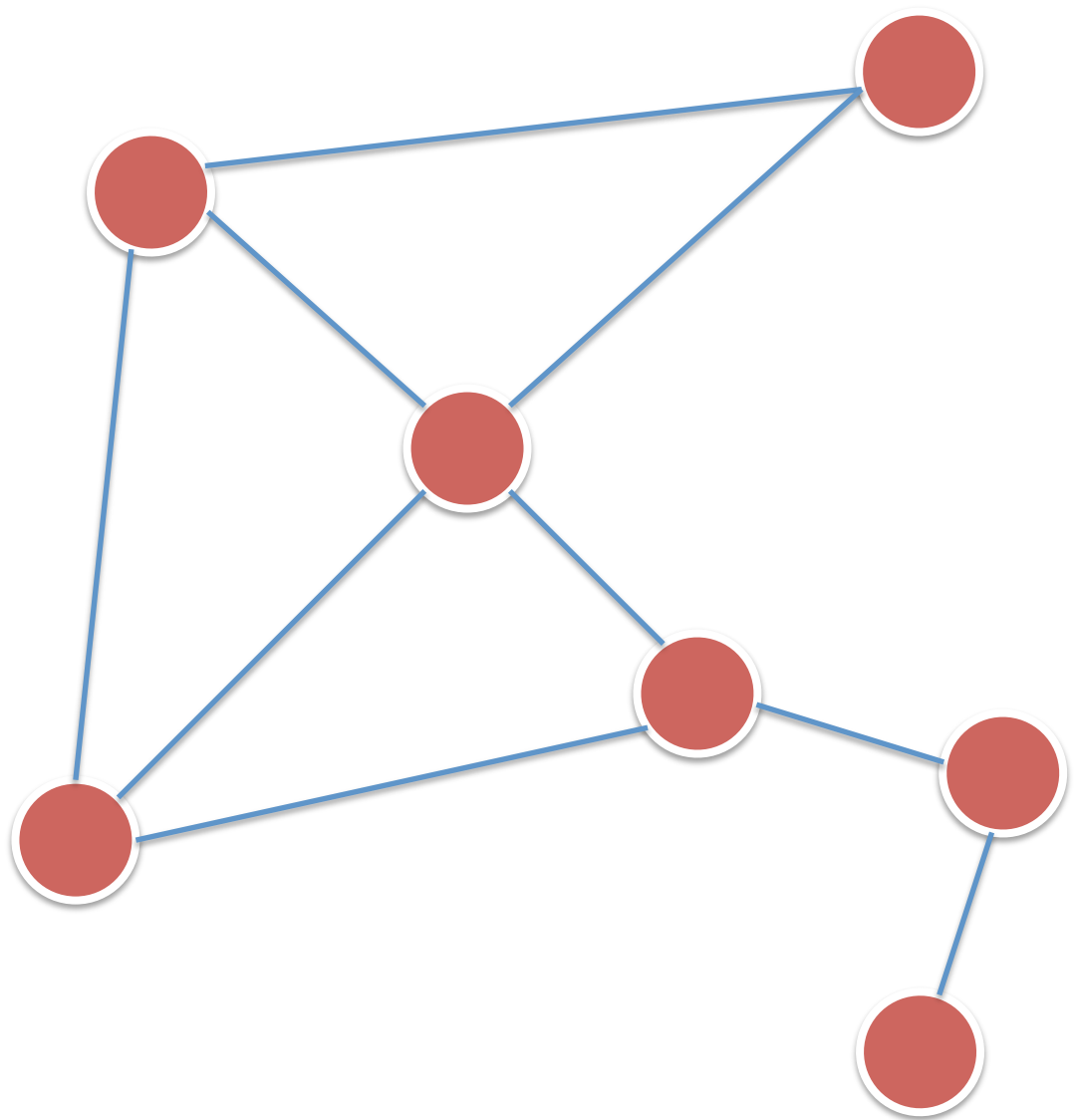


- **does mobility cause collaboration, or vice versa?**
- **Are the people who are mobile the same people who are collaborating?**

Future Approaches

Future Approaches

Network analysis



Future Approaches

Network analysis

Time dimension



Future Approaches

Network analysis

Time dimension

Diverse Indicators



Future Approaches

Network analysis

Time dimension

Diverse Indicators

Mobility Flows



Future Approaches

Network analysis

Time dimension

Diverse Indicators

Mobility Flows

Size-independent
indicators

- Affinity Indices



Acknowledgements

- **Zaida Chinchilla-Rodríguez, Nicolás Robinson-García, Rodrigo Costas and Cassidy R. Sugimoto**
- **CWTS for insights and data**
- **STI 2017 Paris**

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*Thanks for your attention!
Questions?*

STI 2017, 6-8 September, Paris, France

