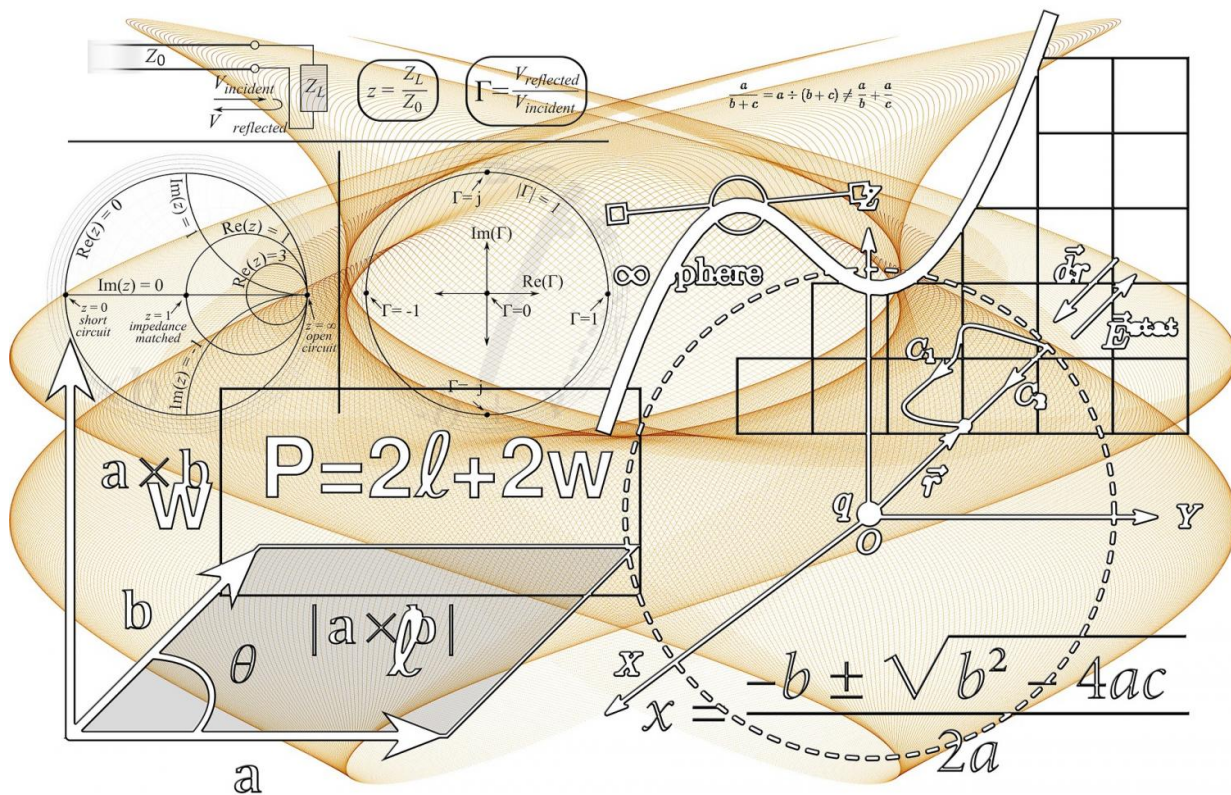


International science collaboration growing at astonishing rate

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Even those who follow science may be surprised by how quickly international collaboration in scientific studies is growing, according to

new research.

The number of multiple-author scientific papers with collaborators from more than one country more than doubled from 1990 to 2015, from 10 to 25 percent, one study found. And 58 more [countries](#) participated in international research in 2015 than did so in 1990.

"Those are astonishing numbers," said Caroline Wagner, associate professor in the John Glenn College of Public Affairs at The Ohio State University, who helped conduct these studies.

"In the 20th century, we had national systems for conducting research. In this century, we increasingly have a global system."

Wagner presented her research Feb. 17 in Boston at the annual meeting of the American Association for the Advancement of Science.

Even though Wagner has studied [international collaboration](#) in [science](#) for years, the way it has grown so quickly and widely has surprised even her.

One unexpected finding was that international collaboration has grown in all fields she has studied. One would expect more cooperation in fields like physics, where expensive equipment (think supercolliders) encourages support from many countries. But in mathematics?

"You would think that researchers in math wouldn't have a need to collaborate internationally - but I found they do work together, and at an increasing rate," Wagner said.

"The methods of doing research don't determine patterns of collaboration. No matter how scientists do their work, they are collaborating more across borders."

In a study published online last month in the journal *Scientometrics*, Wagner and two co-authors (who are both from The Netherlands) examined the growth in international collaboration in six fields: astrophysics, mathematical logic, polymer science, seismology, [soil science](#) and virology.

Their findings showed that all six specialties added between 18 and 60 new nations to the list of collaborating partners between 1990 and 2013. In two of those fields, the number of participating nations doubled or more.

The researchers expected astrophysics would grow the most in collaboration, given the need to use expensive equipment. But it was soil science that grew the most, with a 550 percent increase in the links between research groups in different countries in that time period.

"We certainly didn't expect to see soil science have the fastest growth," she said.

"But we saw strong increases in all areas. It appears that all the fields of science that we studied are converging toward similar levels of international activity."

The study found that virology had the highest rate of collaboration, with the most countries involved. "They aren't working together because they need to share expensive equipment. They're collaborating because issues like HIV/AIDS, Ebola and Zika are all international problems and they need to share information across borders to make progress."

Wagner has started a new line of research that attempts to determine how much nations benefit from their scientific work with other countries. For this work, she is looking at all the scientific articles that a nation's scientists published with international collaborators in 2013. She

is looking at each article's "impact factor" - a score that measures how much other scientists mentioned that study in their own work.

"How much recognition a study gets from other scientists is a way to measure its importance," Wagner said.

She compared each nation's combined impact factor for its international collaborations to how much money the same country spent on scientific research. This is a way to determine how much benefit in terms of impact each nation gets for the money it spends.

The United States has the highest overall spending and shows proportional returns. However, smaller, scientifically advanced nations are far outperforming the United States in the relationship between spending and impact. Switzerland, the Netherlands and Finland outperform other countries in high-quality science compared to their investment. China is significantly underperforming its investment.

Wagner said this isn't the only way to measure how a country is benefiting from international science collaboration. But it can be one way to determine how efficiently a country is using its science dollars.

In any case, Wagner said her findings show that international science collaboration is becoming the way [research](#) gets done in nearly all scientific fields.

"Science is a global enterprise now," Wagner said.

Provided by The Ohio State University

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