



Changing Science

SUMMARY: The global scientific enterprise is changing. New regions are developing research centers and funding science on the scale of traditional science hubs in the West, while in the West, citizen science and DIY research are supplementing and challenging traditional scientific institutions. At the same time, falling trust and rising sociopolitical polarization are impacting science, while automation brings new changes and challenges.



Forecasts

- Within a few years, the majority of global research and development spending and the scientific workforce will be in East and South Asia. Asia will continually upgrade scientific capabilities and resources.
- New centers of scientific research will reflect the cultures, values, and priorities of the regions or countries in which they are based or those of funders or corporate interests. In some cases, differing standards and ethics will conflict with Western scientific ideals and could become a source of trade and political friction.
- Citizen science—research conducted by nonprofessionals and via crowdsourcing—will expand, with new capabilities and in response to unmet needs for less-expensive, rapid research not focused on blockbuster returns.
- Increasingly, automated systems will augment human research as robotics and software advance. This will range from basic testing to higher-level evaluations. Expanding automation will allow many fields of science to do more work at lower cost.

Key Uncertainties

The changing flow of scientific talent between world regions

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Automation's impact on scientific research

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Conflict over research ethics

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Global cultural and political clashes over technologies and research areas

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National and global political support for science education and research

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Increasing efficacy and mainstreaming of DIY science

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Effects of science denialism and political polarization

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Supporting Trends

- **Automation in scientific research.** As robotics, automation, and software advance, more research, from basic assays to higher-level evaluations, will be automated.
- **Cognitive computing and research.** Emerging data analytics systems are able to formulate research hypotheses by analyzing thousands of scientific papers.
- **Ethics shopping.** Attention is growing to the practice of carrying out scientific research in jurisdictions with looser ethical restrictions. Cases are surfacing in which American and European researchers seem to have taken part in biomedical research in Asia and Africa that would not be allowed in their home countries.
- **Citizen science.** Citizen science and structures to support it are growing. DIYBio, which was founded in 2008 to help facilitate the growing interest in “amateur” biology research, runs DIYBioSphere, a site that logs DIY bio projects around the world.
- **Billionaire-funded science.** Wealthy tech moguls are beginning to put their billions to work funding pet science projects. Amazon CEO Jeff Bezos, who is already backing space exploration, has made climate change mitigation the first focus of funding from the foundation he created in 2020.

Related Drivers of Change

- China's World
- Automating Work
- Standards Under Pressure
- Rejection of Expertise

Notable Data Points

STEM IN CHINA

China produced
4.7 million STEM grads
 in 2016, the highest total globally.

Source: World Economic Forum.

RISE OF GLOBAL STEM DEGREES

In 2018,
more than 30%
of higher ed grads
 in Oman, Tunisia, Germany, Singapore,
 Malaysia, Algeria, Iran, Myanmar, and
 Belarus took a STEM degree, compared
 to 17% in the United States.

Source: UNESCO.

TRUST IN SCIENCE

More college graduates
(43%) trust science “a lot”
 to do what is right,
 versus 30% of nongraduates.

Source: Pew Research Center.

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Strategic Insights

- For many science-related member organizations, shifting science will create new ethical challenges arising from ethics shopping,” the growth of nonprofessional citizen science, and science developed within different legal and ethical frameworks. Associations will need policies in place to manage points of friction and resolve ethical conflicts.
- The spread of open-source research, along with the dramatically falling cost of tools, is making citizen—or DIY—science more robust and effective. Scientific associations may find advantages in working with these researchers, whether by creating parallel memberships or developing programs to support such research.
- The shifting center of scientific activity, along with rising nationalism, means that scientific associations in the developed world may find their power and influence challenged by associations from rising scientific powers. Scientific organizations may find themselves having to learn how to cooperate across borders in a Cold War-like environment.
- The shifting center of activity will also create greater opportunity and competition for the scientific workforce. Talent will be drawn to new centers. STEM education from early childhood will be critical to developing the talent pool needed for the future of science and healthcare.
- As demonstrated by the politicized response to the coronavirus pandemic, political polarization and falling levels of trust are affecting science, and scientific misinformation is entangled with these issues. Scientific associations will need to be alert to political shifts and combat politicization of their fields while creating long-term programs to counter these problems.

Timing

- **Stage:** Growth, with significant changes underway in multiple dimensions.
- **Speed:** Medium, but subject to acceleration.

Potential Alternative Futures

- **Scientific cold war.** Two spheres of scientific research emerge: the West and China. Both sides limit scientific cooperation and compete for talent.
- **U.S. science falters.** Polarization and politicization of science, lack of public investment in basic research, and a drop-off in arriving immigrant talent result in the U.S. losing leadership in various fields of science.
- **Science as a pursuit for the wealthy.** Falling governmental funding and political gridlock over what scientific projects should be funded create gaps that are filled by wealth-backed private interests.

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Take Action

- **Raise the public profile of science and scientists.** Given that associations often hold a position of trust within their community, every organization can play a role in broadening the perception of science as accessible and elevating the value of evidence-based information. Break down traditional constructs to de-politicize science and help the public see how science impacts their daily lives.
- **Educate all stakeholders.** Whether you are a science-based association or not, approach education broadly. Provide consumers of scientific reports and data, including policy makers, with the tools to read, evaluate, and digest the information. Help researchers develop their communications skills so they can translate their findings and deliver them in more accessible ways. Champion scientific literacy, critical thinking, and clear communications.
- **Form new partnerships.** Serve a convening role to connect a broad array of funders, producers, and consumers of science and data. This may include other associations with which you have never partnered. Look for opportunities to include diverse voices. Create a framework for sustaining these new connections.
- **Activate interest in and trust of science by making it more accessible.** Incorporate storytelling into your dissemination tactics. Center ethics in the story of what you do. Answer the “so-what” of science to make it more relevant. Adopt an “experience” mindset where you consider multiple pathways for consuming information and make making it memorable.
- **Focus on the professional pipeline.** Include in your portfolio programs to reach future scientists early, particularly in underrepresented communities. Include a full range of career options and work settings such as cosmetics and cooking. Train elementary school teachers on how to encourage interest in science. Be aware of emerging jobs and the skills, such as (e.g. collaboration with robots,) needed to perform these jobs.

Keyword Search

To continue researching this change driver, use these search terms alone or in combination: *science, DIY science, R&D spending, STEM, STEM graduates, Chinese science, Indian science, citizen science, politicization of science, automation and science, automating science.*

Who Will Be Affected

Science-oriented associations will be most directly affected by these trends, as will technology producing industries.

About ASAE ForesightWorks

ASAE ForesightWorks is a deliberate, evidence-based research program and line of products to provide association professionals with a continual stream of intelligence about the changes facing the association industry, including

- Regularly updated action briefs;
- Tools for applying insights from the research in your association;
- Guidance in performing environmental scans;
- Opportunities to engage with peers around the research.

Ultimately, the program's mission is to empower association leaders to create a culture of foresight in their associations and to lead their organizations confidently into the future.

Check the asaecenter.org/foresightworks webpage and follow ASAE Research Foundation on [LinkedIn](#) for updates on new findings and events.