

# Studying trust in science: Global evidence suggests new theoretical and methodological directions

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## Abstract

Public trust in science is vital for tackling global challenges. Recently, global surveys and Many Labs collaborations have begun to broaden the scope of research. However, these studies have also highlighted theoretical and methodological challenges. Here, we review these challenges and argue that beyond expanding geographical coverage, greater conceptual clarity and harmonized measures are essential to improve comparability across studies on trust in science. We conclude by encouraging reflection on the normative assumptions that currently guide research on trust in science.

*Keywords:* trust, science


We need public trust in scientists to effectively address pressing challenges of humanity: Crises such as climate change are so complex in nature that evaluating their risks and mitigation options requires extensive expertise. People with higher trust in scientists are more supportive of such expertise. For example, they are more likely to accept human made climate change [1], engage in pro-environmental behavior [2–4], and get vaccinated [5, for Covid-19 in particular, see 6,7].

Much research on public trust in science has focused on the United States (US) and Europe. However, tackling global issues such as climate change or pandemics requires trust in science at a global scale. “Many Labs” studies present a promising approach to address this gap by pooling resources and expertise from research teams worldwide, allowing for more feasible and harmonized data collection. The recent Trust in Science and Science-related Populism (TISP) Many Labs study with almost 72,000 participants from 68 countries illustrates the benefits of this approach by revealing important regional differences in trust in science [8].

Recent global approaches [8–10] have significantly advanced our understanding of trust in science and its cross-country determinants, but also raised new questions due to contrasting findings. For example, the Wellcome Global Monitor [9] reported that greater income inequality was negatively associated with trust in scientists, while the TISP study [8] found the opposite. Numerous differences in research design—from

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**Table 1***Summary table.*

<b>Dimension</b>	<b>Challenges</b>	<b>Future Directions</b>
Theoretical	Ambiguity in referents of “science” (methods, institutions, individuals); domain-specific trust; trustworthiness vs. behavioral trust	Use more specific concepts and domain-specific measures
Methodological	Country-dependent findings; heterogeneous measures of trust and covariates	Expand regional coverage; converge on validated measures
Normative	Deficit thinking: trust is taken for granted, more trust is assumed to always be better, legitimate reasons for distrust are neglected	Explain why people tend to trust science in the first place; reflect on what levels of trust are desirable; balance fostering trust with healthy skepticism

measuring trust to country selection—make it difficult to draw meaningful conclusions from these divergent findings.

This example illustrates that broadening the geographical scale is not enough to robustly advance knowledge on trust in science. As the study of trust in science is growing, there is a need to discuss current theoretical and methodological approaches and how they can be improved. In this review, we outline current challenges and discuss normative considerations that we hope will inform future research.

### **Theoretical challenges**

When investigating public trust in science, researchers first need to ask: How should we conceptualize trust? Clearly defining referents of trust will likely improve comparability across studies and produce more robust results.

#### **Trust in what?**

The term ‘science’ evokes different representations among different individuals or groups [11]. Science may be understood as a body of literature, an institution, a method, or individual scientists. These representations matter for trust. For example, in the US, people tend to trust scientific methods more than scientific institutions—particularly among less-educated segments of the population [12].

Trust in science is also domain-specific: people do not trust all scientific disciplines equally. For instance, people around the world perceive climate scientists as less trustworthy than scientists in general [13]. In the US [14–17], but also in France [18], disciplines such as biology or physics enjoy considerably more trust than economics or sociology. Scientific knowledge is another example of domain-specific trust. In the US, essentially everyone tends to overwhelmingly trust basic scientific knowledge [e.g. electrons are smaller than atoms, 19]. Yet, on certain contentious and politicized topics, small but concerning minorities reject the scientific consensus [23]. Domain-specific trust can also relate to different character traits of scientists such as competence, integrity, or benevolence [24]. Research from the US has shown that people tend to perceive scientists as competent, but less as warm [25].

Being precise about the construct under study and its domain-specific aspects can result in more meaningful insights. For example, the TISP study [8] assessed the perceived trustworthiness of scientists with a multi-item index based on a large systematic review of trust dimensions [26]. This more detailed

scale allowed for fine-grained insights: While the public perceived scientists' competence to be high, perceptions of integrity and openness were notably weaker. These findings point to a key challenge for science communication—not only demonstrating expertise but also integrity.

To identify and validate theoretical dimensions of trust, qualitative studies play a crucial role. For example, an analysis of open-ended answers to the question “What makes a scientist trustworthy?” in Ireland [27] validated the dimensions of trustworthiness used in the TISP study [8].

### **Perceptions of trustworthiness vs. acts of trusting**

Most research on public trust in science has investigated perceptions of trustworthiness, while much less attention has been paid to specific acts of trusting [28]. Perceptions of trustworthiness are often conceptualized as evaluations of scientists' character traits [e.g., 24]. Behavioral trust, by contrast, reflects people's willingness to make themselves vulnerable to the behaviors or decisions of scientists [28]. For instance, [26] developed a scale to capture how much influence people think scientists should have on public policy and their personal life.

However, conceptualizations of behavioral trust differ across studies, and it is not always clear how they can be distinguished from beliefs. For example, does believing in human-made climate change already constitute an act of trust in climate scientists?

Social trust has been shown to be associated with behavioral trust [29]. This also seems to be the case for trust in science: During the Covid-19 pandemic, declared trust in science was one of the most important correlates of protection intentions [e.g., social distancing 30,31] and supporting protective policies [e.g., implementing curfews 6]. However, experimentally manipulating perceptions of trustworthiness, researchers could not demonstrate that they *caused* protection intentions against Covid-19 [32]. As this example suggests, it is often not clear how perceptions of trustworthiness translate into specific acts of trusting.

### **Methodological challenges**

Ambiguities at the theoretical level are frequently mirrored in the varying approaches researchers use for sample selection and measurement. Such differences have led to inconsistent findings, hindering cumulative knowledge generation.

#### **Sample selection**

Selecting study participants involves several methodological choices—such as whether to conduct fieldwork online or by telephone, use probability-based or quota sampling, and rely on weighting or stratification procedures—all of which can influence findings on trust in science [33]. Recent evidence suggests that one aspect of sample selection is particularly important: country selection.

In the US, there is a strong partisan divide regarding trust in science: Democrats tend to express more trust in science than Republicans [34–36]. Based on this evidence, it would be reasonable to assume that liberal political orientation is an important predictor of higher trust. However, global analyses reveal a more nuanced picture: While in Europe and in the US more right (vs. left) leaning and more conservative (vs. liberal) individuals tend to trust scientists less, the opposite is true in several countries in Africa and Southeast Asia [8]. Moreover, the role of political orientation can shift across domains of science: For instance, conservatism is associated with greater climate change skepticism in North America and Europe, but not in other countries [37,38].

A similar pattern emerges for religiosity. Studies have found that in the US [36] or in the Netherlands [39], more religious individuals express lower trust in scientists. The TISP study [8] revealed important nuances: It showed that religiosity is, on average, slightly positively associated with trust in scientists, driven mostly by a positive association in several Muslim-majority countries. This aligns with global findings on

religion and attitudes towards science more generally [40], and with qualitative research suggesting that Muslims tend to view teachings of their religion and science as overlapping [41].

These examples illustrate how relying exclusively on samples from the Global North, where survey research on trust in science is institutionalized and well accessible, bears the risk of overgeneralization. Achieving more diverse samples remains a major challenge. Even in the TISP study [8], several regions such as Central Asia, the Middle East, and Oceania were underrepresented.

## Measurement

Using different measures to assess the same theoretical construct can lead to inconsistent results. This concerns both trust in science and the covariates assessed in relation to trust.

Some survey projects assess trust in science with very general questions, often relying on single items<sup>1</sup>. Because people can hold different representations of science, and because trust is domain-specific, it remains unclear what exactly these questions capture [26,28]. As a consequence, general single-item measures of trust in science may produce inconsistent findings across populations and hinder the comparability of findings across studies.

Recent global studies on public perceptions of science have often relied on aggregate measures of trust. For example, the Wellcome Global Monitor surveys use a five-item index to assess trust in scientists [9,10]<sup>2</sup>. Aggregate measures help address concerns about single-item questions discussed above. What they cannot address, however, is the issue of comparability: if studies use different trust indices and arrive at different conclusions, it is difficult to reconcile the discrepancies [43].

The issue of measurement heterogeneity also extends to common covariates of trust. On the one hand, new operationalizations can strengthen confidence in established findings. For instance, research has found that the link between scientific knowledge and attitudes toward science is weak, and largely absent for issue-specific attitudes [44]. Using different measures, the TISP study [8] confirmed this result: Instead of measuring science knowledge with narrow factual quizzes, they used average national scores from the Program for International Student Assessment (PISA) and found no statistically significant association between countries' average trust in scientists and their average PISA scores.

On the other hand, measuring covariates differently can also challenge previously established findings. For example, many global studies have identified education [45] and science education [9] as two of the strongest correlates of trust in science. By contrast, the TISP study [8] tested this relationship using only a coarse distinction between tertiary versus all other forms of education (including none), finding only a weak positive association.

Another example is religion: The TISP study [8] found a positive correlation between religiosity and trust in science in several muslim-majority countries. By contrast, another global study [45] used data on religious affiliation not at the country, but at the individual level, and found that Muslims held the least favorable views of science among several religious groups<sup>3</sup>. Differences in model specification and country selection, further impede comparability<sup>4</sup>.

<sup>1</sup>For example, the US General Social Survey has tracked trust in science for 50 years, but relies on a single item: "Would you say you have a great deal of confidence, only some confidence, or hardly any confidence at all in the scientific community?". Similarly, the Pew research center relies on a single-item question, asking people about how much confidence they have that "scientists act in the best interests of the public" [42].

<sup>2</sup>These items are: "How much do you trust scientists in this country? A lot, some, not much or none at all?"; "In general, how much do you trust scientists to find out accurate information about the world? A lot, some, not much or none at all?"; "How much do you trust scientists working in colleges/universities in this country to do their work with the intention of benefiting the public? A lot, some, not much or none at all?"; "How much do you trust scientists working in colleges/universities in this country to be open and honest about who is paying for their work? A lot, some, not much or none at all?"; "How much do you trust scientists working for companies in this country to do their work with the intention of benefiting the public? A lot, some, not much or none at all?"

<sup>3</sup>The other religious groups were Catholic, Protestant, Orthodox, Jewish, Buddhist and Hindu

<sup>4</sup>[45] use several additional covariates in their model, and do not include countries in which the TISP study [8] found a positive

As research on trust in science increasingly relies on more culturally diverse samples, our understanding of regional patterns of trust has improved. However, greater conceptual clarity and convergence on validated, theoretically grounded measures is needed for findings to be comparable across contexts and theory to advance. Collaborative efforts, such as Many Labs studies, provide promising pathways to achieve this.

### Normative considerations

Approaches to studying trust in science are not value-agnostic: they are guided, implicitly or explicitly, by normative assumptions about what trust in science should look like. Moving forward, we believe the field needs to reflect more explicitly on its underlying normative assumptions.

One important example is the long-standing influence of deficit thinking. For decades, research on public perceptions of science has emphasized public “deficits”, ranging from a lack of knowledge to a lack of trust [46,47]. This deficit thinking has three major consequences: First, it takes trust in science for granted and treats it as a rational default. Theoretical approaches in psychology [48–50], communication [51,52], political science [53], and sociology [11,54] have focused on why certain groups deviate from that default. But more research is needed on why people across the globe tend to trust science in the first place [8], in spite of knowing little about it [55]. Addressing this gap is essential if we want to understand how trust can be fostered and sustained [56]. Second, deficit thinking suggests that the more people trust science, the better. For topics with a well-established scientific consensus—e.g., the existence of human made climate change, or the safety of vaccines—more trust in science can indeed be expected to lead to better societal outcomes. But public trust in science should not be blind, either: for disruptive knowledge and emerging technologies to be in the best public interest, the public needs to critically evaluate them [see e.g., 57]. A research agenda on trust should therefore not only ask how to increase trust, but also when healthy skepticism is warranted. Third, deficit thinking tends to stigmatize the public as ignorant. This pathologization of trust deficits does not acknowledge that low trust in science may have legitimate reasons, such as past failures and scientific misconduct [58].

To meaningfully advance research on trust in science, three key aspects deserve greater consideration: theoretical clarity about what trust is, methodological rigor to measure it consistently across contexts, and normative deliberation of what levels and forms of trust are desirable. Elevated levels of public trust in science should not encourage complacency. As demonstrated by recent political developments, science is under attack even in countries such as the US, where most people trust science at least to some extent, but where trust is increasingly polarized along political ideologies and where narratives of a loss of public trust are instrumentalized to justify budget cuts for US universities [59]. In the face of these challenges, advancing research on public trust in science is perhaps more important than ever.

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effect of religiosity and which are majority Muslim, such as Malaysia, Egypt, Morocco, Bangladesh.

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### Further information on references of particular interest

- \*\*[4] Among 19 candidate variables, trust in climate science was the most important predictor of climate change belief and policy support.
- \*\*[8] The TISP Many Labs assessed perceived trustworthiness of climate scientists with a 12-item scale, covering the dimensions of competence, benevolence, integrity and openness. They found moderately high levels of trust in scientists across the globe.
- \*\*[14] People across the political spectrum hold stereotypes about scientists’ political orientation (e.g., “scientists are liberal”). These stereotypes matter for trust in science: Both in the US and in Germany, conservatives tend to distrust scientists more when they believe that scientists are liberal.
- \*[15] Trust in most scientists is relatively high but varied substantially with the discipline. For example, among the most trusted were meteorologists and physiologists, among the least trusted pharmacologists and political scientists.
- \*[19] In four studies, they asked U.S. Americans—including flat Earthers, climate change deniers and vaccine skeptics—whether they accepted basic scientific facts. Acceptance of the scientific consensus was very high in the sample as a whole (95.1%), but also in every sub-sample (e.g. no trust in science: 87.3%; complete endorsement of flat Earth theory: 87.2%)
- \*[32] Four studies amid the COVID-19 pandemic (March 2021 – February 2022). They experimentally manipulated trust in science by presenting participants with real-world statements from the same scientists during the COVID-19 pandemic, some of which later turned out to be primarily correct (high trust condition), some of which incorrect (low trust condition). They did not find that this manipulation increased protection intentions (e.g. physical distancing, mask wearing).
- \*\*[35] Trust in science in the U.S. is remarkably stable, and so are its demographic correlates: women, Black, rural, religious, non-college educated, and lower/working class individuals exhibit less trust. They argue that the current partisan gap (Democrats trusting more, Republicans less) can be explained by low-trust demographic strata shifting partisan allegiances. This suggests that political ideology might be a less important factor of polarization than demographic inequities.
- \*\*[54] Argues that politicization of science in the US needs to be seen in its broader cultural context. Science has played a crucial role in legitimizing the modern regulatory state. Consequently, conservative distrust of science reflects deeper structural tensions with the rational–legal authority of modern governance.