

Global evidence suggests new directions for studying trust in science

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Abstract

Public trust in science is vital for tackling global challenges, and recently, global surveys and manylabs collaborations have begun to broaden the scope of research. However, these studies have also highlighted theoretical and methodological challenges. This review examines current approaches to studying trust in science at two levels: theoretical and methodological. We argue that beyond expanding geographical coverage, greater conceptual clarity and harmonized measures are essential to improve comparability across studies. We conclude by reflecting on the normative assumptions that currently—implicitly or explicitly—guide research on trust in science.

Keywords: trust, science

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To recognize and effectively address some of the pressing challenges we face as humanity, we need to trust scientists: challenges 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 likely to accept human made climate change [1], to engage in pro-environmental behavior [2–4], and to be willing to get vaccinated [5], for Covid-19 in particular, see 6,7].

Much research on 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. “Manylabs” 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) Manylabs study with over 71,000 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 scientific 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 Manylabs [8] study found the opposite. Numerous differences in research design—from measuring trust to country selection—make it difficult to draw meaningful conclusions from these divergent findings.

As this example illustrates, simply 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 to advance knowledge. In this review, we outline current challenges and discuss normative considerations that we hope will inform future trust in science research.

Theoretical level

When investigating public trust in science, researchers first need to ask: What exactly do we want to explain? Clearly defining referents of trust will likely improve comparability across studies and produce more robust results.

Trust in what?

The term science can evoke different representations among different individuals or groups [11]. Science may be understood as a body of literature, an institution, a method, individual scientists, or disciplines. 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 [14–16], but also in France [17], 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—even a minority of people who say they do not trust science in general—tends to overwhelmingly trust basic scientific knowledge [e.g. electrons are smaller than atoms, 18]. Yet, on contentious topics, substantial minorities reject the scientific consensus [19, on climate change, see, e.g., 20, on GMOs, see, e.g., 21].

Despite this complexity, many large survey projects assess trust in science with very general questions, often relying on single items¹. Because people can hold different representations of science, and because trust is domain-specific, it remains unclear what exactly these questions capture [23,24]. As a consequence, general single-item measures of trust in

¹For 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” [22].

science risk producing inconsistent findings across populations and hindering the comparability of findings across studies.

Perceptions of trustworthiness vs. acts of trusting

Asking people broad questions about their trust in science not only neglects different representations of science; it also blurs the line between perceptions of trustworthiness and acts of trusting. Most research on public trust in science investigates the former—perceptions of scientists’ trustworthiness—while much less attention has been paid to the latter—behavioral trust [24].

Perceptions of trustworthiness are often measured by asking people to evaluate scientists’ character traits, such as competence, integrity, or benevolence [25]. Behavioral trust, by contrast, reflects people’s willingness to make themselves vulnerable to the behaviors or decisions of scientists [24]. For instance, [23] developed a scale to capture how much influence people think scientists should have over public policy and their personal life. This willingness to be vulnerable correlates with trust in scientists [8].

However, conceptualizations of behavioral trust differ across studies, and it is not always clear how they can be distinguished from beliefs or perceptions. For example, does believing in human-made climate change already constitute an act of trust in climate scientists? If so, how can we distinguish between different forms of trusting behavior, e.g., wanting more political power for climate scientists?

For social trust in general, it has been shown that trust measured via survey items is associated with behavioral trust [26]. In the case of science, that also seems to be the case: For example, it has been shown that during the Covid-19 pandemic, declared trust in science was one of the most important correlates of protection intentions [e.g., social distancing, or maskwearing, see 27,28] and supporting protective policies [e.g., implementing curfews, or closing schools, 6]. However, researchers have could not demonstrate that trust in science caused protection

intentions against Covid-19 [29]. Conceptually distinguishing different forms of trust might help understanding of causal relationships.

Methodological level

Ambiguity and disagreement on the theoretical level is reflected in current methodological approaches related to sample selection and measurement, which hinder robust knowledge generation on trust levels, determinants, and outcomes.

Sample selection

In the Global North, research on public perceptions of science is often institutionally anchored in public surveys, such as the National Science Foundation's (NSF) "Science and Engineering Indicators" in the US, or the "Eurobarometer" in the EU. However, only studying these world regions risks biasing our theories about trust in science and its determinants, as we will illustrate with two examples: political orientation and religiosity.

In the US, there is a strong partisan divide regarding trust in science: democrats tend to express more trust in science, and republicans less [30–32]. Based on this evidence, it would be reasonable to assume that political orientations are an important determinant of 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, political conservatism is associated with greater climate change skepticism in North America and Europe, but not in other countries [33,34].

A similar pattern emerges for religiosity. Studies have found that in the US [32] or in the Netherlands [35], more religious individuals express lower trust in scientists. By contrast, evidence from the TISP manylabs study shows that religiosity is, on average, slightly positively associated with trust in scientists, driven mostly by a positive association in several Muslim-majority countries [8]. This aligns with other findings on other global findings on religion and

attitudes towards science more generally [36], as well as with qualitative research suggesting that Muslims tend to view teachings of their religion and science as overlapping [37].

These examples illustrate how alleged determinants of trust in science can be highly context-dependent. Relying primarily on Global North samples risks overgeneralization, whereas incorporating more diverse samples allows for more refined explanations of (dis)trust in science.

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.

Recent global studies on public perceptions of science have often relied on index measures of trust. For example, the Wellcome Global Monitor surveys use a five-item index to assess trust in scientists [9,10]². Index measures help address some concerns about general, 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.

To increase comparability, researchers should be more specific about the construct they seek to capture and, ideally, converge on shared, validated scales. For example, the TISP manylabs study [8, items originally proposed by 23] assessed the perceived trustworthiness of scientists with a multi-item index covering competence, benevolence, integrity, and openness—an index based on a large systematic review of trust dimensions. 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 moral

²These 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?”

credibility and relatability. Qualitative interviews and thematic analyses of open-ended questions can provide important insights into the public's opinion of what makes a scientist trustworthy. For example, an analysis of open-ended answers to the question "What makes a scientist trustworthy?" in Ireland showed that elicited responses closely reflected the widely assessed trustworthiness dimensions of competence, integrity, benevolence, and openness. [38].

Measurement heterogeneity not only applies to trust measures, but also to covariates commonly studied in relation to trust. Sometimes, new operationalizations can strengthen confidence in established findings. For instance, classic research in the field of public understanding of science found that the link between scientific knowledge and attitudes toward science is weak, and largely absent for issue-specific attitudes [39]. Using different measures, the TISP manylabs study [8] confirmed this result: instead of assessing general attitudes toward and measuring science knowledge with narrow factual quizzes, they focused on trust in scientists specifically, and used average national scores from the Program for International Student Assessment (PISA). They found no statistically significant association between countries' average trust in scientists and their average PISA scores.

At the same time, measuring covariates differently can also challenge previously established findings. For example, many global studies have identified education [40], and particularly science education [9], as one of the strongest correlates of trust in science. By contrast, the TISP manylabs 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, again, religion: As mentioned above, the TISP manylabs study [8] found a positive correlation between religiosity and trust in science in several muslim-majority countries. However, [40] 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

groups³. Other differences between the two studies, such as model specification and country selection, further impede comparability⁴.

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 agreement on shared measures is needed for findings to be comparable across contexts and theory to advance. Collaborative efforts, such as manylabs studies, provide promising pathways to achieve this.

Normative considerations

Approaches to studying trust in science are not neutral: 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 various public “deficits”—from a lack of knowledge to a lack of trust [41,42]. We argue that this deficit thinking has two major consequences: First, it takes trust in science for granted and treats it as a rational default. Theoretical approaches in psychology [43–45], communication [46,47], political science [48], and sociology [11,49] have focused on why certain groups deviate from that default. More research is needed on why people across the globe tend to trust science [8], in spite of knowing little about it [50]. Addressing this gap is essential if we want to understand how trust can be fostered and sustained [Reference dissertation]. 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

³The other religious groups were Catholic, Protestant, Orthodox, Jewish, Buddhist and Hindu

⁴[40] use several additional covariates in their model, and do not include countries in which the TISP manylabs study [8] found a positive effect of religiosity and which are majority Muslim, such as Malaysia, Egypt, Morocco, Bangladesh.

indeed be expected to lead to better societal outcomes. But 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., 51]. A research agenda on trust should therefore not only ask how to increase trust, but also when healthy skepticism is warranted.

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 narratives of a loss of public trust are instrumentalized to justify budget cuts for US universities [52]. In the face of these challenges, advancing research on public trust in science is perhaps more important than ever.

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