Sustaining the trustworthiness of science

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If scientific research is to provide public benefits, scientific communities must be perceived as trustworthy in the eyes of decision-makers and laypeople. Fortunately, trust surveys – despite their limitations – suggest there is no fundamental crisis in trusting science[1]. They show that across countries, trust in science and in scientists remains very high.

However, this does not mean there are not matters needing attention. Firstly, the minority of people who do not trust science can have, and are having, disproportionate effects on policy and public opinion. Secondly, as science undergoes rapid changes in where and how it is done and is being fundamentally affected by AI, there are matters that must be considered if science is to sustain its trustworthiness.

Trust is based on a relationship between a person or group with another person, group or institution, The consequences of the trust depend on whether the person or institution in which trust is being placed is trustworthy. One can have trust in an institution or person that is not trustworthy (think of a cyber-scam) or fail to have trust in a trustworthy individual or institution. But individual psychology also matters. There is considerable individual variation in the propensity to be trusting, and this trait aligns with other features including individuals' value sets and worldviews.

Modern science is defined by its principles which allow it to be a universal knowledge system. Science is based on reliable evidence being developed through observation or experimentation and subject to open evaluation, contestation and critical review. Explanations can only be based on logic, theory and past observations and science excludes explanations based on belief, tradition or dogma. Such principles do not mean science can answer everything. Science has limits. Virtually everyone in their daily lives combines knowledge from science with other knowledge systems, be they professional or tacit knowledge, religion, local or indigenous knowledge. Many do not see science as part of their conscious lives, only considering science periodically in relationship to high

[1] Cologna V et al (2025); Trust in scientists and their role in society across 68 countries *Nature Human Behaviour* 9 , 713-730

profile issues such as vaccination or climate change; this 'tie' distance can affect their perceptions of trust in science.

It is naïve to claim that science and science-based technologies automatically and unequivocally advance wellbeing. Science, technology, economic power, security and geopolitical power have always been linked, but never more so than now. The boundary between science and technology is never sharp and science-based technologies have defined modern conflict and played a large part in driving climate change and other sustainability challenges. It is also naive to claim science is values free. Science ha values – perhaps the most important being the judgement on whether there is a sufficiency and quality of evidence on which to reach a conclusion. Science is never isolated from the context in which it is done.

When we turn to the question of 'trust in science', the issues are somewhat more nuanced than simply looking at institutional trust, on which much has been written. Science is a complex network involving multiple institutions and scientists operating as collectives and individuals. Trustworthy science is essentially dependent on social norms and practices associated with producing and communicating knowledge. Epistemic trust: that is the trust in another person's claims as possessing reliable knowledge is central to trust in individual scientists, to scientific collaboration and team-based science. The social practices of science and trust are both needed for effective collaboration, fair peer review and in the reliance between team members for the integrity of their contributions.

Looking at perceptions from the outside

While overall levels of trust in science remain high, there are significant risks. Perhaps the most obvious risk is political. Populists view science as an elite institution, and that is sufficient in their view to distrust it. The more extreme populists see science as having no more validity than their own opinion and should not have a privileged role in decision making. While this disturbing attitude may be held by a small proportion of people, they can have disproportionate influence.

But others do not reject science as automatically untrustworthy but react with trust or distrust to the domain or issue in play[2]. Political, ideological or financial interests can create biases that influence what science is accepted or not. Faced with such challenges, some resolve their cognitive dissonance by claiming they do not trust that sector of science. They may reject vaccination and climate change science but accept many other domains of science which are not in conflict with their worldviews or interests.

[2] Rekker R (2025) A four level model of political polarization over science: evidence from 10 European countries. *Public understanding of science* 34 424-445

Similarly, politicians and advocates of mainstream political parties may project distrust of an area of science because it does not fit their political interests, biases and is inconvenient electorally. Some political parties will reject genetic science while promoting climate science and the converse may be true of other political parties. Democratic politicians are entitled to override science to meet their short-term interests but that is distinct from hiding their interests by undermining science by claiming that those elements that do not suit them are untrustworthy. Similarly, there is a long history of vested interests in the private sector undermining trust in specific aspects of science - for example the fossil fuel industry and climate change, or in the tobacco industry.

An equally problematic framing can be seen when politicians claim to be just 'following the science' when they are following a political agenda. This behaviour was particularly obvious during the Covid pandemic, which had effects leading to greater cynicism and a broader loss of institutional trust, more polarisation, increased disinformation and a greater willingness to accept conspiracy beliefs.

For many, their perception of science is influenced by how they were exposed to science during their education. Science education remains patchy and there are arguments that in a rapidly changing technological world, science education needs to be less focused on the traditional academic and more on explaining how science can address challenges and complexity.

How science is positioned with the public matters. The sociologist of science Robert Merton once critiqued the way scientists presented a patronizing attitude to their communication with the public: too many still do. Not every scientist can be a good science communicator, and they should not be expected to: increasingly science communication is a distinct profession. Universities employ press offices which too often use hyperbole to overclaim the implications of the research. Similarly, some scientists exploit exposure to the media to extrapolate well beyond what the science shows. Hyperbole can breed scepticism, humility breeds trust. With the range of new communication modalities now available, it will become important that greater consideration is given to the ethics of science communication.

We must also be honest about the underlying nature of science – it is almost never definitive but is provisional in the conclusions it reaches. Often this is expressed in probability terms. Yet too often scientists claim a certainty which is not justified as we saw in the controversies over mask wearing in Covid. In general, a greater appreciation of the scientific method, its provisional nature and uncertainties is likely key to more effective science communication and thus to trust.

Some years ago the Science Council of Japan led the way in thinking through the inherent tension between scientists as citizens and scientists as experts in the public arena[3]. It is

[3] https://www.scj.go.jp/en/report/Code_of_Conduct_for_Scientists.pdf

a sensitive topic, but scientists can undermine trust when they use their status as scientists to speak on issues outside their expertise or do not acknowledge when they are breaking with the established consensus and why.

Disinformation can manipulate individuals across all these layers although it remains uncertain how effective disinformation is. Increasingly it can be targeted at susceptible individuals, but evidence of its effect to is hard to measure. Much of its effect is likely to reinforce anchoring biases that pre-existed. In general disinformation is more likely to sow broader distrust, and increase polarisation. The psychology of group formation means that distrust of elites including science can become a badge of political identity.

Looking at ourselves: the essential value of self-regulation

So now let me turn to the issue of how the science community must act to ensure that science remains trustworthy. My concern is that the well-established social norms and practices of science may not be well matched to the realities of the digital age and the impact of AI.

Public science has multiple objectives ranging from discovery science to produce new knowledge, to research to support stewardship of a nation's assets including environmental, human, social, cultural and economic to research where the primary objective is for exploitation either through public policy or through transfer to the private sector for economic return. Much science has implications for sustainability, economic, and political decision making and thus is increasingly entangled with interests and contested values. In such a context science and science advice must protect their integrity to remain trustworthy.

An increasing amount of discovery science occurs in private institutions where the compliance with the norms that are expected in public science are less certain. Scientifically based technologies, especially in AI, emerge rapidly from the private sector with little chance of governments developing pre-emptive and appropriate oversight. Rapid change is unsettling for many and can fuel societal unrest.

A key factor influencing whether an institution is perceived to be trustworthy is whether there are processes external to the institutions to ensure compliance with accepted and enforceable norms. For example, independent judiciaries, a formal opposition, and independent inspector generals are devices used within democracies to help sustain institutional trust. Similarly consider an airplane flight. It depends on trust in the manufacturer, the pilot and air traffic controller each of which is audited by independent regulators. Sanctions and legal remedies apply if rules and norms are broken. When things go wrong formal investigations follow. The least trusted components, baggage

handling and on time arrivals, are effectively audited by the travelling public through their direct experiences.

In contrast public science is almost entirely and largely informally self-regulated, reliant on social practices and epistemic trust within the science community and is remote from the public. Passionate defense of that self-regulation is core to our community.

Let me expand. The pathway to a science career is not defined or regulated– it may be entirely narrowly disciplinary based with no formal training in ethics or experimental design let alone broader dimensions such as the relationship between science and society, the history of science, the principles that define science nor the range of intellectual approaches that encompass the scientific enterprise. This is a major deficit in our community that I think merits reflection and action.

Funding decisions for individual research programs or projects are made by scientists working in allocative or assessment committees. How such committees work relies on the integrity of their members. They also face the reality that there are always more applications than funds available. This problem has exploded as academics have started to use AI to generate grant applications. It is becoming clear that the system cannot cope.

Peer review is problematic and with AI generated applications and papers, it is now in overload[4]. As the number of grant applicants has increased and success rates have fallen, tensions are emerging in how to fund – by project, by individual or larger aggregations or missions. There is likely to be significant change.

The role of AI in peer review remains uncertain but seems inevitable. At best it may identify what research is novel but may also be able to identify strengths and weaknesses in the methodology.

The conduct of the research itself is entirely in the hands of scientists with no external oversight, its public reporting in the scientific literature may or may not follow peer review by other scientists, and broader communication is not immune from self-interest from either the researcher or institution. When the social norms and practices are broken, trustworthiness is put at risk.

Medical research has had a long tradition of ethical oversight. But in the social, environmental and ecological sciences the use of such processes is much more variable. Norms of practice which generally must involve community engagement are yet to fully develop. As the use of AI across all disciplines rises, issues of associated with consent, data access and use will grow. New norms for conducting such research will be needed to sustain its trustworthiness

[4] Rees G and Wilsdon J (2026) Could agentic AI topple grant-funding systems *Nature* **652**, 1119-1121

The bibliometric culture is problematic, but it continues largely unabated despite attempts to reduce its impact. It produces premature publication, papers of doubtful quality, contributes to the incidence of scientific fraud, and to a plethora of papers that do not meet acceptable standards as part of the scientific record. While there are no people-proof institutions, bibliometric incentives underly much of this unacceptable behaviour. Addressing this is fundamental to a trustworthy science system. To do so is very complex: a collective approach is well overdue.

A further issue is that of replicability and reproducibility. The issues extend well beyond those of inherent variability in the subject being studied or fraud. But the culture of being first to publish and an unwillingness to fund or publish confirmatory research contribute to ongoing concerns that have the potential to negatively impact on perceptions of science.

Trustworthiness is enhanced by transparency. In domains such as life sciences declarations of financial interests are generally adhered to. But this is not universal across science; other interests that might be relevant are often not declared. Only a few journals seek broader declarations of interest, for example membership in a relevant advocacy group.

A loss in trust in the scientific record would lead to a loss of trust in science itself. Scientific publication is core to the constructive iterative processes that are fundamental to science. Poor peer review can be a source of much frustration within the science community and yet it is fundamental to the social norms of good science. AI is increasingly used in peer review although its value is yet to be demonstrated.

The incentive culture in science and the massive expansion of science has led to a flood of predatory journals that do not undertake genuine peer review, of papermills that are willing to write generally by AI and publish a paper for a fee, and in other behaviours such as plagiarism, image manipulation, and false referencing. The record of science is being contaminated: the number of AI generated papers submitted is growing at an exponential rate.

Publishers and the International Science Council have recognized this intolerable situation. They are working jointly to agree on criteria that would determine whether a journal has trustworthy practices and award trust markers. This is likely to impact on a large range of marginal and suspect journals, some of which have no interest in the quality or integrity of what is published.

We should not ignore the need to continue to improve the interactions between scientists from the global north and south. Issues of patronizing attitudes, exploitation and data sovereignty cannot be avoided – if they are ignored then trust in science will be undermined. In many cases both scientists and citizens of post-colonial societies are sensitized because science was central to the grand colonial projects of past centuries.

It has led to the perception that modern science, which is a global endeavour, is a colonial enterprise and to disappointing claims that 'modern science' is 'western science'. This is problematic because modern science is built on a broad range of diverse heritages extending well beyond Europe and in particular from Asia and Arab lands and extending over more than a millennium. Science is clearly a universal language. The ISC is leading a project funded by the European Commission to address these issues and promote international scientific cooperation.

Bridging from science to other knowledge systems, does not mean a conflating them, but rather acknowledging the reality that science and other knowledge systems coexist in societies and in individuals. The range of transdisciplinary approaches that science can use can do much to enhance and sustain trust obviating the power distance between science programs and individuals and this can do much to enhance trust.

Concluding comments

Trust is, by definition, fragile and complex. While other institutions have seen a decline in trust over recent decades, scientists and science are generally seen as trustworthy. But it would be unwise to assume that just because a minority of people do not trust science, that the impact is negligible. Indeed, we have political responses influenced by distrust affecting areas such as climate change, fluoridation, and vaccination.

Ensuring that science remains trustworthy in the context of AI is a speculative challenge that science is yet to fully grapple with. I have alluded to some of the issues. But there is little in the way of a framework to ensure that science remains trustworthy in this evolving context. New social norms and practices may be needed within science to protect the trustworthiness of science in an AI-dominant age.

Science does not hold all the answers. Yet science, of all human endeavours, can advance the interests of the people and the planet, but in doing so it must understand its limits and recognise that science and technologies, inappropriately used, can also do harm.

The impact of science on society will continue to grow. For that growth to be positive, the various actors in the institution of science must be active in ensuring the trustworthy production and communication of scientific knowledge. That will be essential if we are to sustain the high level of public trust in science in the face of political and other challenges.