

From Scientific Knowledge to Social Justice: The Science–Society Intersection Through Public Policy in India

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Abstract:

In contemporary governance, scientific knowledge increasingly informs public decision-making in areas such as agriculture, public health, and environmental management. While the integration of science into policymaking can promote development and address major social challenges, translating evidence into policy raises critical normative questions about justice, fairness, and equitable access. While empirical data identify effective interventions, the design and implementation of policies are shaped by political institutions, ethical norms, and social structures. This chapter examines the intersection between science and society through public policy in India and evaluates whether this relationship contributes to socially just outcomes. The chapter first conceptualises the science–society intersection as the point where scientific knowledge and social needs converge in policy processes. It then analyses how this intersection operates in India by examining key policy areas, including the Green Revolution, public health responses during the COVID-19 pandemic, and environmental sustainability initiatives. Through these cases, the chapter demonstrates that science-based policies have produced significant developmental achievements but have also generated regional, economic, and social disparities. Drawing on the theoretical perspectives of Amartya Sen and John Rawls, the chapter argues that scientific advancement alone cannot guarantee justice unless policy frameworks actively address issues of equity and accessibility. It concludes that science-based policymaking must incorporate principles of inclusive participation, institutional support, and equitable distribution to ensure that scientific knowledge contributes not only to development but also to the broader goal of social justice.

Keywords: science–society intersection, public policy, evidence-based policymaking, India, development and inequality, social justice.

Introduction:

In contemporary societies, the relationship between science and society has become increasingly important in shaping public decision-making and development policies. Scientific knowledge today does not remain confined to laboratories or academic institutions; rather, it increasingly informs policies that address social problems such as public health crises, environmental degradation, and food security. Governments often rely on scientific research to

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understand these challenges and to design policies that respond to them. For this reason, examining the relationship between science and society has become essential for understanding how modern societies pursue development and justice. The concept of science–society intersection refers to the point at which scientific knowledge and social needs meet in the process of public decision-making. Scientific research produces knowledge about natural and social problems, while society seeks solutions to issues affecting human welfare and development. The intersection between science and society occurs when this scientific knowledge is used to guide decisions that influence social life. In modern states, this process usually takes place through public policy, where scientific findings are translated into programs, regulations, and institutional actions that affect the lives of citizens.

In developing countries, like India, it provides an important example of this process. Since independence, the Indian state has emphasised the importance of scientific knowledge for addressing the country’s developmental challenges. Political leaders such as Jawaharlal Nehru strongly promoted the idea of a “scientific temper,” encouraging the use of scientific reasoning in governance and public life. The establishment of national research institutions and scientific organisations reflected the belief that scientific knowledge could help the country overcome problems related to poverty, food scarcity, public health, and economic development. Over time, scientific knowledge has increasingly shaped public policy in India. Agricultural policies have relied on scientific research to increase food production and improve farming practices. Public health policies have used medical research to respond to disease outbreaks and improve healthcare systems. Environmental policies have also drawn upon scientific studies to address issues such as pollution and climate change. These developments illustrate that the intersection between science and society in India becomes most visible in the field of public policy, where scientific knowledge is translated into concrete actions that affect society. However, the use of scientific knowledge in policy also raises important questions about justice and equality. Although science-based policies can contribute to development and social welfare, their outcomes are not always equally distributed across society. Some groups may benefit more than others, while certain communities may remain marginalised in the process. This raises a critical question about whether the intersection between science and society through public policy actually leads to socially just outcomes.

In this context, this chapter examines the intersection of science and society in the Indian context, focusing on the role of public policy in shaping this relationship. By analysing how scientific knowledge influences policy decisions and how these policies affect society, the chapter seeks to evaluate whether this intersection contributes to the pursuit of justice.

To examine the relationship more closely, the chapter addresses the following research questions:

1. What is the science–society intersection, and how has it developed in the Indian context?
2. How do science and society intersect through public policy in India?
3. Does this intersection produce socially just outcomes?
4. If justice is not fully achieved, how can science-based policymaking be improved to promote more equitable outcomes?

By addressing these questions, the chapter seeks to demonstrate that the relationship between science and society must be understood through the policies and institutions that translate scientific knowledge into social action. In doing so, it highlights the role of public policy in ensuring that scientific knowledge contributes not only to development but also to the broader goal of social justice.

Understanding the Science–Society Intersection in the Context of India:

Understanding the idea of the science–society intersection is essential for examining how scientific knowledge becomes meaningful in public life. The science–society intersection refers to the point at which scientific knowledge and societal needs come together in the process of decision-making and governance. Science produces knowledge through systematic research and inquiry, while society faces practical problems that require informed solutions. The intersection between science and society, therefore, occurs when scientific knowledge is used to guide decisions that affect social life. In modern states, this connection becomes most visible through public policy, where governments rely on scientific knowledge to design programs, regulations, and interventions that address social challenges. This intersection highlights that science is not an isolated activity carried out only within laboratories or research institutions; it is deeply embedded in social and institutional contexts (Latour, 1987). Scientific knowledge informs the government policies and decisions that influence economic development, social welfare, and environmental sustainability. In this sense, the science–society intersection reflects a process through which scientific understanding becomes part of collective efforts to solve societal problems.

In the Indian context, the idea of linking science with societal development has deep historical roots, particularly in the early years following independence. When India gained independence in 1947, the country faced multiple developmental challenges, including widespread poverty, low industrial capacity, food shortages, and limited access to education and healthcare. Political leaders believed that scientific knowledge could play a crucial role in addressing these problems and guiding national development. Among these leaders, Jawaharlal Nehru strongly emphasised the importance of science in shaping India’s future. Nehru argued that the progress of the nation required the development of a “scientific temper,” which meant encouraging rational thinking, critical inquiry, and the use of scientific knowledge in public life. According to Nehru, science was not only a tool for technological advancement but also a way of approaching social and economic problems systematically and rationally. This vision placed science at the centre of India’s development strategy and encouraged the state to invest heavily in scientific research and education.

As part of this broader vision, the Indian government established several major scientific and research institutions in the years following independence. Organisations such as the Council of Scientific and Industrial Research (CSIR) and the Indian Council of Agricultural Research (ICAR) were established to promote scientific research in areas important to national development. Universities and research laboratories were also expanded to strengthen the country’s scientific capacity. These institutions played a crucial role in generating scientific knowledge that could be applied to agriculture, industry, healthcare, and other sectors affecting society. During this period, the Indian state adopted the view that scientific knowledge should

directly contribute to solving social and economic problems. As a result, scientific research was often closely connected with public policy initiatives. For example, agricultural research was supported to improve farming practices and increase food production. Similarly, scientific studies in medicine and public health were encouraged to address disease and improve healthcare systems. Through these initiatives, scientific knowledge gradually became integrated into the policymaking process.

One of the most significant examples of the science–society intersection in India emerged during the Green Revolution of the 1960s and 1970s. Scientific research in agriculture led to the development of high-yield crop varieties and improved farming techniques. When these scientific findings were incorporated into agricultural policies and supported by government programs, they contributed to a substantial increase in food production across the country. This example demonstrates how scientific knowledge, when combined with policy initiatives, can produce large-scale social and economic change. Over time, similar patterns have appeared in other areas of governance. Public health policies have relied on medical research to respond to disease outbreaks and improve healthcare services. Environmental policies have increasingly drawn upon scientific studies to address issues such as pollution, climate change, and sustainable resource use. In each of these areas, scientific knowledge becomes relevant to society when it is incorporated into policy decisions that influence social outcomes.

These developments illustrate that the science–society intersection in India did not emerge accidentally. Instead, it developed through deliberate efforts by the state to promote scientific research and to connect that research with national development goals. Public policy has played a central role in this process by translating scientific knowledge into programs and initiatives that affect society. At the same time, the growing role of science in policymaking has also raised important questions about how scientific knowledge should be used in addressing social problems. While science can provide valuable insights and solutions, the outcomes of policies based on scientific knowledge are shaped by political decisions, institutional priorities, and social conditions. As a result, the intersection between science and society does not automatically lead to equitable outcomes. Understanding how this intersection operates in practice, therefore, requires examining the specific policies and social contexts in which scientific knowledge is applied. This background provides the foundation for the next part of the chapter, which examines how science and society intersect through public policy in India by analysing specific policy areas where scientific knowledge has influenced decision-making and social outcomes.

How Do Science and Society Intersect Through Public Policy in India?

The intersection between science and society becomes most visible when scientific knowledge is translated into public policy. While science generates knowledge about natural and social problems, this knowledge influences society primarily when governments incorporate it into policies and programs that shape collective action. Public policy, therefore, acts as the practical space where scientific understanding meets societal needs. Research in science and technology studies highlights that public policy is a key arena where scientific expertise and social values interact in shaping governance (Jasanoff, 2004). Through policy decisions, scientific knowledge is used to design interventions that address issues such as food security, public

health, and environmental sustainability. In the Indian context, this intersection between science and society can be observed in several key policy areas where scientific research has guided decision-making and social action.

One important example of this intersection can be seen in agricultural policy, particularly during the Green Revolution. In the decades following independence, India faced severe food shortages and widespread concerns about food security. Agricultural scientists conducted extensive research on crop productivity and developed high-yield varieties of wheat and rice that could significantly increase agricultural output. When this scientific knowledge was incorporated into government policy through programs promoting improved seeds, irrigation systems, and fertiliser use, it led to a major transformation in Indian agriculture. The Green Revolution helped India increase food production and reduce its dependence on food imports, thereby addressing one of the country's most pressing developmental challenges (Shiva, 1991).

Another important area where the intersection between science and society becomes evident is public health policy. Scientific research in medicine and epidemiology plays a crucial role in understanding diseases and designing effective health interventions. Governments rely on this scientific knowledge when developing policies to manage health crises and improve healthcare systems. A recent example of this process can be observed during the COVID-19 pandemic. Scientific research on the spread of the virus, patterns of infection, and methods of prevention guided policy decisions related to lockdown measures, vaccination programs, and public health guidelines. In India, government policies aimed at controlling the spread of the virus and expanding vaccination coverage were heavily informed by medical research and expert recommendations.

The intersection between science and society is also visible in environmental policy. Environmental issues such as air pollution, water scarcity, and climate change require scientific understanding to develop effective policy responses. Scientific studies help identify environmental risks and provide evidence about the long-term consequences of environmental degradation. In India, environmental policies related to pollution control, renewable energy development, and climate change mitigation have increasingly relied on scientific assessments and ecological research. For instance, policies encouraging solar energy and other renewable sources are based on scientific studies that highlight the environmental and economic benefits of reducing dependence on fossil fuels. Therefore, the agricultural research influences farming policies, medical research informs health policies, and environmental science guides sustainability initiatives. In each of these cases, public policy serves as the mechanism that connects scientific understanding with social action. At the same time, the intersection between science and society through public policy is not always straightforward. Policy decisions often involve balancing scientific evidence with economic considerations, political priorities, and social realities. As a result, the outcomes of science-based policies may vary across different regions and social groups. While some policies may successfully address major social problems, others may produce uneven benefits or unintended consequences. For this reason, it is important not only to examine how science and society intersect through policy but also to evaluate the broader social outcomes of these policies.

Understanding these outcomes is particularly important when considering the question of justice. Scientific knowledge may help design policies aimed at improving social welfare, but whether these policies actually lead to fair and equitable outcomes remains an open question. The next section, therefore, examines whether the intersection between science and society through public policy in India contributes to the pursuit of social justice, and to what extent the benefits of science-based policies are distributed across society.

Does the Science–Society Intersection Through Public Policy Produce Socially Just Outcomes?

The intersection between science and society through public policy has contributed significantly to India's development. Scientific knowledge has helped governments design policies that address major social problems such as food shortages, disease outbreaks, and environmental degradation. However, an important question remains: do these science-based policies actually produce socially just outcomes? To answer this question, it is necessary to examine specific policy cases and evaluate whether the benefits generated through scientific knowledge are distributed fairly across society.

One of the most frequently cited examples of science-based policymaking in India is the Green Revolution. Beginning in the late 1960s, agricultural scientists developed high-yield varieties of wheat and rice that significantly increased crop productivity. When these scientific developments were incorporated into agricultural policy through government support for irrigation, fertilisers, and improved seeds, India's food production increased dramatically. Wheat production, for example, rose from about 12 million tonnes in 1965 to more than 55 million tonnes by the early 1990s, transforming India from a food-deficient country into one that was largely self-sufficient in food grains (Government of India, 2018). While this achievement demonstrates the positive role of scientific knowledge in addressing national food security, the benefits of the Green Revolution were not equally distributed. Research shows that regions with better irrigation systems, such as Punjab and Haryana, experienced the greatest gains, while many rain-fed regions saw far less improvement. Larger farmers who had access to credit and resources were better able to adopt the new technologies, whereas small and marginal farmers often faced difficulties in doing so (Shiva, 1991). As a result, although the policy increased overall food production, it also contributed to regional and economic disparities within rural society. From the perspective of justice, this raises concerns about whether the benefits of scientific advancement were shared equally among different social groups. As Amartya Sen argues, development should be evaluated not only by aggregate economic growth but also by the expansion of people's capabilities and opportunities (Sen, 2009). When certain groups are unable to access the benefits of scientific innovation, the outcomes cannot be considered fully just.

A second example of the science–society intersection can be observed in public health policy, particularly during the COVID-19 pandemic. Scientific research played a central role in shaping India's response to the crisis, guiding decisions related to disease prevention, vaccination strategies, and public health measures. India launched one of the largest vaccination programs in the world, administering more than two billion vaccine doses by 2022 (Ministry of Health and Family Welfare, 2022). This effort demonstrated the capacity of

science-based policy to address a large-scale public health emergency. However, the implementation of these policies also revealed significant inequalities. During the early stages of the vaccination campaign, access to vaccines was often linked to digital registration systems, which created barriers for individuals without internet access or digital literacy. Rural populations and economically disadvantaged groups sometimes faced difficulties in accessing vaccination services due to limited healthcare infrastructure. These disparities highlight an important issue identified by John Rawls, who argues that social arrangements should be designed in ways that benefit the least advantaged members of society (Rawls, 1971). When certain groups encounter greater obstacles in accessing public health services, it raises questions about whether policy outcomes meet the standards of fairness and justice.

Environmental policy provides another example where the intersection between science and society produces both positive outcomes and complex challenges. Scientific studies have increasingly highlighted the environmental consequences of rapid industrialisation, including air pollution, water contamination, and climate change. In response, India has introduced several policies aimed at promoting environmental sustainability, including the expansion of renewable energy. By 2023, India had developed more than 170 gigawatts of renewable energy capacity, reflecting a major shift toward cleaner energy sources (International Energy Agency, 2023). These initiatives demonstrate how scientific research can guide policy decisions aimed at protecting environmental resources and ensuring long-term sustainability. At the same time, environmental policies sometimes generate social tensions. Regulations designed to protect ecosystems or reduce pollution may affect industries and communities that depend on natural resources for their livelihoods. For instance, restrictions on certain industrial activities or land-use changes can create economic challenges for workers and local populations. These situations illustrate the complexity of balancing environmental sustainability with social and economic concerns. As scholars of environmental governance have noted, policies based on scientific evidence must also consider issues of social equity in order to avoid creating new forms of marginalisation (Guha, 2000).

These cases demonstrate that the intersection between science and society through public policy can produce important developmental benefits while also generating new challenges. Scientific knowledge provides powerful tools for addressing social problems, but the outcomes of science-based policies depend heavily on how these policies are implemented and how their benefits are distributed. Economic inequality, regional disparities, and institutional limitations can influence whether scientific progress translates into equitable social outcomes. From the perspective of justice, this means that scientific advancement alone is not sufficient to ensure fairness in society. As Sen (2009) emphasises, the evaluation of development must consider whether policies expand people's real freedoms and opportunities. Similarly, Rawls (1971) argues that social institutions should be arranged in ways that protect the interests of the most disadvantaged groups. When the benefits of science-based policies are unevenly distributed, the goal of justice remains only partially achieved. The analysis of these cases, therefore, suggests that the science–society intersection through public policy in India has produced both significant achievements and important limitations. Scientific knowledge has helped address major social problems, but the outcomes of these policies have not always been equally accessible to all sections of society. Recognising these limitations is essential for understanding

how science-based policymaking can be improved so that it contributes more effectively to the pursuit of social justice.

How Can Science-Based Public Policy Better Ensure Social Justice?

If scientific knowledge is to contribute meaningfully to social justice, public policy must ensure that the benefits of science are distributed fairly across society. As the previous discussion demonstrates, science-based policies can generate significant progress in areas such as agriculture, public health, and environmental protection. However, the outcomes of these policies often depend on the social and institutional context in which they are implemented. Ensuring justice, therefore, requires not only scientific innovation but also policy frameworks that prioritise equity, accessibility, and democratic participation.

One important step toward achieving this goal is to adopt a capability-oriented approach to policymaking. According to Amartya Sen, development should be evaluated in terms of the real freedoms and capabilities that individuals possess rather than solely by economic growth or technological progress. When science informs public policy, governments should therefore consider whether scientific innovations expand people's opportunities to live healthy, secure, and dignified lives. Policies should be designed so that marginalised groups - such as small farmers, rural populations, and economically disadvantaged communities - are able to access the benefits generated through scientific advancement.

A second requirement for socially just science-based policy is the principle of fair institutional design. Political philosopher John Rawls argues that social institutions should be arranged in ways that protect the interests of the least advantaged members of society. Applying this idea to science-based policymaking means that governments must actively identify groups that may face barriers in accessing new technologies or public services. Policies should therefore include supportive measures such as subsidies, targeted programs, or institutional reforms that enable disadvantaged populations to benefit from scientific progress.

Another important dimension is inclusive participation in policy formation. Scientific expertise plays a crucial role in informing policy decisions, but policymaking should not remain limited to technical experts alone. Communities affected by scientific policies—such as farmers, workers, or residents—should have opportunities to participate in decision-making processes. Public consultations, community engagement, and transparent communication can help ensure that policies reflect not only scientific knowledge but also the lived experiences of citizens. Such participatory approaches strengthen the democratic legitimacy of science-based policies and help prevent unintended social inequalities.

In addition, governments must invest in institutional capacity and equitable infrastructure to ensure that scientific policies are implemented effectively. For instance, advancements in medical science can only improve public health if healthcare infrastructure, trained professionals, and accessible services are available to all populations. Similarly, agricultural innovations can benefit farmers only when adequate credit systems, irrigation facilities, and extension services exist. Without these institutional supports, scientific knowledge may remain concentrated among those who already possess economic or social advantages.

Finally, policymakers must adopt a long-term perspective that balances innovation with social responsibility. Scientific and technological developments often generate rapid change, but policies must carefully consider their broader social consequences. Ethical evaluation, environmental sustainability, and social equity should be integrated into policy design from the beginning. By doing so, governments can ensure that scientific progress contributes not only to economic development but also to a more inclusive and just society. Therefore, these principles suggest that science-based public policy must integrate scientific expertise with institutional fairness, inclusive participation, and equitable access to contribute meaningfully to the pursuit of social justice.

Conclusion:

The analysis of the science–society intersection through public policy demonstrates that scientific knowledge plays a crucial role in addressing major social challenges such as food security, public health, and environmental sustainability. However, the outcomes of science-based policies are not automatically socially just. Their impact depends on how institutions design, implement, and distribute the benefits of scientific advancement. When issues such as inequality, accessibility, and regional disparities are overlooked, scientific progress may unintentionally reinforce existing social divisions. Therefore, the pursuit of justice requires policymakers to integrate scientific expertise with principles of equity, inclusive participation, and institutional responsibility. Only through such an approach can the intersection of science and society contribute not merely to development, but to the creation of a more just and equitable social order.

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