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SCIENCE, POWER, AND DEMOCRACY: A CRITICAL PERSPECTIVE OF POLITICAL INFLUENCE ON KNOWLEDGE PRODUCTION

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Abstrak

Studi ini bertujuan untuk mengeksplorasi relasi ilmu, kekuasaan serta demokrasi. Relasi tersebut berangkat dari argumen dasar bahwa ilmu selalu terkait dengan nilai, baik kepentingan politik, ideologi, bahkan ekonomi. Di satu sisi ilmu memang dapat berkontribusi positif dalam mentransformasikan kehidupan publik yang lebih baik, tetapi di satu sisi juga justru memunculkan eksklusivitas dan elitisme komunitas ilmiah yang dapat melemahkan prinsip serta nilai demokrasi. Studi ini menunjukkan bahwa relasi ilmu dan politik bersifat ambivalen karena dapat memperkuat legitimasi tata kelola publik sekaligus menimbulkan risiko teknokrasi dan dominasi pakar yang mengakibatkan publik dianggap tidak memiliki kapasitas epistemik yang memadai terkait bidang ilmu tertentu. Atas dasar itu, diperlukan upaya mengarahkan ilmu agar benar-benar berpihak pada kepentingan publik melalui demokratisasi ilmu, baik secara prosedural maupun substantif. Meskipun demikian, batas normatif tetap penting: ketika nilai-nilai publik yang muncul justru bersifat diskriminatif, ilmuwan berkewajiban menolaknya karena bertentangan dengan prinsip egalitarian yang menjadi dasar demokrasi. Selain itu, kepercayaan publik terhadap ilmu juga harus dijaga dengan memastikan bahwa publik benar-benar diimajinasikan dan dilibatkan dalam proses produksi pengetahuan. Dengan demikian, ilmu yang berkepentingan publik harus berkomitmen pada nilai kemanusiaan dan kesetaraan.

***Kata kunci**: politik ilmu, demokrasi, kepakaran ilmiah, demokratisasi ilmu, kajian sains dan teknologi.*

Abstract

This study aims to explore the relationship between science, power, and democracy. This relationship stems from the fundamental argument that science is always linked to values, whether political, ideological, or even economic interests. While science can contribute positively to transforming public life for the better, it can also give rise to exclusivity and elitism in the scientific community, which can undermine democratic principles and values. This study demonstrates that the relationship between science and politics is ambivalent, as it can both strengthen the legitimacy of public governance and create the risk of technocracy and expert dominance, leading to the public being perceived as lacking adequate epistemic capacity in certain scientific fields. Therefore, efforts are needed to steer science toward a true public interest through the democratization of science, both procedurally and substantively. However, normative boundaries remain crucial: when emerging public values are discriminatory, scientists are obligated to reject them, as they contradict the egalitarian principles that underlie democracy. Furthermore, public trust in science must be maintained by ensuring that the public is fully imagined and involved in the knowledge production process. Thus, public-oriented science must be committed to the values of humanity and equality.

Keywords: *politics of science, democracy, scientific expertise, democratization of science, science and technology studies*.

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INTRODUCTION

Scientific research today plays a central role in shaping policy—particularly in areas such as climate change, health, and technology—making it a powerful instrument of governance. The influence of science extends far beyond laboratories, but it also carries significant social and political implications. However, the authority of science raises concerns about how it undermines

democratic principles, particularly as knowledge becomes more like a product, which can harm its reputation and the notion that it is neutral and impartial (Jonsson & Mósesdóttir, 2023: 231-232). This situation implies that the closeness between science and the state often excludes the public voice, thus limiting knowledge production to the experts. Such practices undermine democratic principles in science, which tends to serve the interests of a small, privileged elite without considering the active perspectives of the public.

To understand this tension historically, it is useful to recall that since the Enlightenment in the eighteenth century, science has been celebrated as a hallmark of human progress. This age opens up new possibilities for people's lives that were impossible in the past. Enlightenment philosophers regarded knowledge as the peak of human achievement and the foundation of social progress. The dominant discourse established a paradigm of "neutral" and "reasonable" justification, one that continues to privilege scientific findings across public debates (Stenmark, 2013: 13). Nevertheless, the concept of scientific autonomy, which holds that science will only progress when scientists are free to "pursue the truth" without the distortion of external factors and values that risk distorting research, certainly raises difficult and fundamental questions: Who determines which truths are legitimate, and to what ends? This debate calls for recognizing society's role in shaping scientific agendas, especially since non-experts or laypeople are frequently marginalized due to assumptions about their epistemic incompetence (Barker & Kitcher, 2014: 141).

Since the early twentieth century, the connection between capital and scientific research has intensified significantly. Scientists, particularly natural scientists, came to be regarded as trusted authorities, their expertise lending credibility to public debates and state projects (Kitcher, 2011: 11). Yet in recent decades, this authority has become more contested: challenges to scientific results have produced growing ambiguity around the reliability of expertise, especially in the natural sciences. Under the banner of truth and objectivity, knowledge has sometimes been

instrumentalized as a resource for power rather than a pursuit of understanding (Longino, 2002: 560).

The tension between scientific authority and democratic norms is often described through the idea of a "social contract for science." Guston (2000: 6) explains that this contract grants science substantial funding and autonomy from direct political control in exchange for producing socially valuable outcomes in medicine, defense, and technology. This implicit accord elevates science above other knowledge domains, resembling an "invisible hand" that supposedly safeguards integrity without constant oversight. In practice, however, this arrangement delineates shifting boundaries between politics and science, making their relationship contingent rather than absolute.

At the same time, science and society engage in continuous co-production. Research generates new knowledge and technologies, cultivates expertise, and shapes lifestyles and social practices. This reciprocal process is inseparable from the circulation of wealth and power, which can threaten and reinforce democracy depending on how authority is legitimized (Pamuk, 2021: 19).

The central problem motivating this article is how political influence on science can simultaneously enable societal progress and undermine democratic values. The scope of inquiry is philosophical, focusing on the normative tensions between scientific authority and democratic participation.

The debate over the relationship between science, power, and democracy centers on scientific authority versus public legitimacy. Funtowicz & Ravetz (1990: 10) argued that in post-normal science, scientific claims are linked to political perspectives and interests, whereas Greenberg (2001) and McGarity (2012) emphasized how funding and industry influence research direction. More recent studies also showed the same tension in the relationship between science and politics. Marques et al. (2025) investigated the impact of scientific politics on research priorities and interpretations. Moynihan & Herd (2025) showed that technical authority is increasingly used as a political tool. While the public trusts scientists

highly, distrust grows when research is perceived to benefit elite or industrial interests (Younger-Khan et al., 2024: 3).

The main argument in this study is that political influence on science is inevitable; what matters is how such influence is legitimized. If elites capture science, it produces technocracy and exclusion. But if it is governed as a common good, it can instead foster democratic participation and collective welfare. This study is expected to show that political influence generates both risks—such as technocracy and scientism, where decision-making is monopolized by experts detached from citizens—and opportunities to reimagine science as a democratic common good.

This study consists of four main parts. The first part examines the interrelationship between science and politics, showing that science is never free from the influence of power and social interests. The second part explores how ideologies—such as capitalism and authoritarianism—shape the direction of science-based policy and how science is used to justify political decisions. The third part highlights the tension between scientific authority and democratic values, emphasizing the risks of technocracy and the neglect of public voice in scientific decision-making. The fourth part reimagines science as a common good, which reflects how science can contribute meaningfully to democratic life.

DISCUSSION

1. Science and Politics: A Fragile Autonomy

The relationship between science and politics is fundamentally established in how science is influenced by and shapes broader societal frameworks. The sociology of science examines the interconnectedness of science with political, economic, and cultural institutions that influence its evolution and implementation. This relationship is apparent in studies showing mutual influence: politics conditions scientific agendas, while scientific findings inform political choices. Classic themes include the origins of science in society, conditions of advancement, scientists' roles, and

science's interaction with economic, political, and religious institutions (Ben-David, 1970: 8).

Merton's account clarified how values such as communalism and disinterestedness are institutionalized, though their expression differs between academic and industrial settings, with consequences for scientific autonomy (Panofsky, 2010: 142-143). The sociology of science began to formalize as a distinct study in the late 1940s. The field was institutionalized late by the American Sociological Association (ASA) in 1978, partly due to limited recognition of science's social function despite growing state dependence on research and technology. This work frames science as both method and institution embedded in wider structures, whose norms enable progress while buffering (not isolating) it from outside pressures (Bucchi, 2004: 14). Merton's research established a foundation for comprehending science as both a methodological endeavor and a structured institution integrated within larger social frameworks, whose norms and ethical standards facilitate scientific advancement while safeguarding it from external disruptions.

Later critiques emphasized that this autonomy is fragile rather than absolute. Ziman (1984: 1-3) distinguishes internal (methods, peer communities, documentation) and external (economic, social, political, religious) drivers. The key paradox is that even when science aims for autonomy, it is routinely mobilized to meet societal goals—revealing its political entanglement. As science and technology advance swiftly, they are integral to several domains; yet, their capacity to overshadow human existence prompts apprehension. The external dimension, especially political impact, demonstrates that scientific inquiry is intertwined with power dynamics and societal agendas, making science political.

These tensions become visible in public controversies. Nuclear energy, genetically modified organisms (GMOs), stem cell research, and geoengineering illustrate how rapid advances heighten ethical scrutiny. These disputes reflect not ignorance alone but conflicting values and interests around risk, distributional effects, and legitimacy. Key tensions emerge around existential risk and public

trust (nuclear), ecological safety and corporate power (GMOs), moral boundaries of life (stem cells), and governance of planetary-scale interventions (geoengineering). These ethical dilemmas remain central to contemporary debates and will likely persist as perennial issues in science–society relations. As scientific discoveries accelerate, public awareness has grown more critical, questioning not only the promises of innovation but also its unintended consequences. This is evident in recurring protests against genetically modified foods, opposition to nuclear waste disposal, heated disputes over embryonic research, and global controversies surrounding geoengineering, all of which underscore how scientific authority is continually negotiated in the public sphere.

These controversies reveal that science's authority is not given but continually negotiated. Following Blume (1974: 227), science has dual functions: educational (internal reproduction of the scientific field) and political (external engagements across social, economic, and state arenas). The two functions are interdependent and inseparable. Understanding the internal requires analyzing the external; the functions are interdependent rather than separable. The objective is to comprehend the formation of science's internal structure; this can only be achieved by analyzing its external relations and the socio-political framework that underpins its development.

Historically, this interdependence deepened over time. States relied on science for regulation and capacity-building from the seventeenth to the nineteenth century. In the 19th century, the discourse surrounding science and politics intensified as the application of scientific knowledge for political objectives expanded, particularly in regulating society, citizens, and policymaking overall. The relationship between science and politics, stemming from the advancement of modern science, must be linked to the increasing public reliability of scientific knowledge. Nonetheless, this issue extends beyond the general populace; the state encompasses social, political, and economic concerns,

necessitating the establishment of modern science as the primary advocate for knowledge reproduction in the evolving modern state. Modern science—rooted in rationalism and empiricism—became a template for public justification, but this epistemic ascendancy also recalibrated political authority (Yuliantoro, 2016: 64).

In the twentieth century, the entanglement grew sharper with technological development. Barney (2000: 54-57) identifies three axioms linking technology and politics: purposiveness (subject to political assessment), context-dependence (economic/epistemic regimes), and capability-shaping (technologies open/close political possibilities). This extends classic views (Aristotle, Marx, Heidegger, McLuhan) by treating technology as constitutive of political cognition and behavior. First, technology and politics are fundamentally interconnected due to their alignment with common societal objectives, a perspective endorsed by Aristotle, who regarded technical endeavors as subject to political assessment because they are purpose-driven and enhance civic life. Technology's impact transcends the physical realm, influencing human cognition and conduct, as seen by the theories of Marx and Heidegger, who contend that technology modifies not only the exterior environment but also how humans perceive and engage with it. Second, the political consequences of technology are influenced by the economic, epistemological, and political contexts in which it evolves. Marx perceived industrial capitalism as leveraging technology to exploit labor for capitalist profit, emphasizing profits over worker welfare, hence linking technological advancement to overarching political and economic dynamics. Third, Barney contends that technology shapes political possibilities by facilitating or constraining particular acts. McLuhan's concept that "the medium is the message" exemplifies how technology fosters new relationships and cultural identities, fundamentally influencing human society politically. Technological breakthroughs are inherently political, significantly impacting societal structures and individual behaviors.

Because science and technology co-evolve, governance becomes a reflection of social priorities. Tegegn (2024: 8) notes that science is oriented toward a culture's collective welfare, while Yuliantoro (2016: 68) outlines four historical stages of the knowledge–interest nexus: (1) science and myth, (2) science and state politics, (3) science and colonialism, and (4) science and capitalism. From the second stage onwards, knowledge is entangled with power and capital. The interplay between science and industry profoundly shapes contemporary research organizations, which increasingly integrate market logics (microelectronics, nano/biotech), intensifying competition and interest-driven innovation (Bucchi, 2004: 135; Collingridge, 1980: 63). Barney's third premise pertains to the potential for scientific advances to transform human culture, which is intrinsically linked to the political component. The advancement of science necessitates that human culture and civilization adapt to the specific context and era in which scientific progress occurs. As research advances more substantially, the community must likewise be oriented toward scientific advancement. This transition reframes "autonomy" as a regulatory ideal rather than a sociological fact—useful to claim impartiality yet routinely negotiated in practice.

This dynamic interplay has consequences for how knowledge is produced and validated. The strong connection between science and politics leads to distinct knowledge production and validation methods that diverge markedly from the Mertonian sociological model. Merton recognized that the sociology of science tradition must safeguard science from external pressures. Scientific institutions must be established autonomously and independently from societal influences, as "the objective of institutional science is to cultivate validated knowledge," namely pure scientific information (Merton, 1979: 260). The result is hybrid knowledge regimes (regulatory, trans-, mandated science) that depart from Mertonian autonomy. These indicate that science is no longer an autonomous authority but is situated inside a social context that influences its development. Examining the external components of

science, including authority and ideology, is a crucial issue in the contemporary sociology of science. The political aspect of science has altered the public perception of science, enhancing its authority.

Hilgartner (2000) captures this shift through the metaphor of dramaturgy. In *Science on Stage: Expert Advice as Public Drama*, he shows that the authority of science increasingly relies on rhetoric and presentation rather than self-evident truth. This dramaturgy is not merely cosmetic but a governance mechanism that allocates legitimacy among experts, agencies, and publics. Scientific authority, therefore, functions not only as epistemic validity but also as a performative practice embedded in political arenas.

2. When Science Serves Power

The political dimensions of science become salient when it collaborates with the state. The connection between science and politics is evident in industrialized nations. Graham (1992: 50) notably illustrates this in the former Soviet Union, where knowledge was disseminated through three principal hierarchies: the university system, the Academy of Sciences, and the industrial and defense ministry frameworks. Following the 1917 revolution, the Soviet Union centralized science through these institutions, with the Academy of Sciences as the main research hub and the State Planning Commission allocating budgets. Each tier had relative autonomy but remained subject to political control. After World War II, Big Science transformed further, as "science cities" gathered thousands of researchers for state-sponsored projects such as space exploration and nuclear armament. This case underscores how the science–state social contract is historically contingent rather than absolute.

Moving from this example, scholars such as Don K. Price argue that science and politics often operate with different logics. Price maintains that pure science is oriented toward knowledge and truth, whereas politics is oriented toward power and action (Bernal, 1966: 115). Prutsch (2019: 6-7) extends this, noting that politicians seek power and legitimacy, while scientists pursue systemic knowledge

and credibility. Yet these domains inevitably intersect, producing hybrid forms of authority where truth and power overlap.

Weingart (1983: 231) identifies two structural tendencies at this interface: the scientization of politics, in which decision-making increasingly relies on expert knowledge, and the politicization of science, in which authorities shape research agendas, funding, and methods. Prutsch (2019: 7) warns that these dynamics carry risks: scientized politics can lead to technocracy, reducing policy to technical criteria, while politicized science can erode credibility by aligning knowledge with partisan interests. These dynamics show that science is never fully autonomous; its claims are refracted through the priorities of those in power. This is most visible in regulatory domains, where technical assessments and political calculations are inseparable. As Brown (2009: 12) observes, politicized science may entrench conflict and sustain power rather than resolve it.

These dynamics are not confined to regulatory institutions; they extend into scientific practice. Feminist philosophy of science, for instance, highlights persistent gender bias in biological research, while social constructivist critiques show how racially oriented sciences are socially constructed to reinforce racism (Zack, 2018: 123). Numerous further cases reveal how science becomes politicized in relation to race, class, and gender dynamics within business, religion, academia, and family life. Such critiques expand the discussion by showing that scientific authority depends on institutional structures and embeds social values and exclusions. They imply that "bias correction" must be institutional and methodological—determining who sets the questions, which risks are recognized, and whose harms are acknowledged.

This recognition of embedded bias links to a broader dilemma about how science relates to power. Reeve & Collingridge (1986: 356-357) show that attempts to "speak truth to power" often trade autonomy for influence. The paradox is that knowledge, which seeks to confront power, must surrender some safeguards that protect scientific independence. When science enters political

arenas, it accommodates policymakers' priorities, making research more complex and less autonomous. Latour (2004: 10) reframes this not as corruption but as inescapable co-production: once science operates in political arenas, it necessarily mixes standards of proof, persuasion, and coalition-building.

This recognition naturally raises the question of how science concretely shapes policy outcomes. Edler et al. (2022: 210) identify four patterned impacts: (1) persistent dissatisfaction with research uptake; (2) mission-oriented funding tied to grand challenges; (3) impact regimes that discipline topic selection; and (4) translation work that converts technical claims into policy-relevant narratives. First, despite long-standing debate on the science–policy nexus, there remains persistent frustration regarding how academic research genuinely informs policy decisions. Secondly, since World War II, science, technology, and innovation policies have become increasingly mission-oriented, designed to address global crises and collective challenges. Over the past decade, this approach has been institutionalized in Europe, where funding programs explicitly align research with societal imperatives such as climate change, health, and digital transformation. Here, whether framed as a crisis or an opportunity, urgency becomes a central driver of research agendas. Consequently, the influence of science on politics and society has resurfaced as the principal rationale for scientific endeavors.

Third, the rise of performance-based funding regimes illustrates how impact has become a metric of legitimacy. Organizations such as the UK Research and Innovation Council, the US National Science Foundation, and the European Framework Programme increasingly demand demonstrable "impact," forcing scientists to orient research topics toward measurable societal outcomes. For example, the UK's Research Excellence Framework ties institutional evaluation to explicit proof of impact, institutionalizing a culture of accountability. Fourth, translation work highlights that science influences policy through discovery and re-articulation: technical claims must be reformulated into

narratives legible to policymakers and publics. The more persuasive this translation, the greater the likelihood of uptake. These patterns reveal that legitimacy and reward are not separate spheres but co-designed, embedding science ever more deeply into political rationalities of funding, accountability, and governance.

Blume, as cited by Yuliantoro (2016: 86), asserts that the connection between science and politics facilitates reward-based exchanges when two instrumental criteria are satisfied: "professionalism" and "social control." Professionalism within the scientific community reacts to the contemporary economic and political framework. By adhering to professionalism, scientific goods can be seamlessly integrated and exchanged for various external benefits, including monetary compensation and accolades. Under these preconditions, scientific endeavors and their outcomes can remain congruent with the structural requirements of contemporary society. The second instrumental prerequisite is "social control" from the scientific community and other entities. The form may include awards or prizes, such as the Nobel Prize, government regulations or research grants, publication of research findings by journals and mass media, and other control mechanisms designed to ensure that science remains relevant and aligned with the structural conditions of contemporary society. In both instruments, it is evident that science is methodically aligned with the essence of modernity by positioning it as the institutional perspective of modern society. These mechanisms demonstrate that science is never insulated but continually legitimized through recognition, regulation, and reward.

Extending this institutional perspective leads to another important dimension: quantification. Where professionalism and social control emphasize norms and recognition, quantification emphasizes numbers and measurement as instruments of legitimacy. The framework of the intimate connection between science and the political sphere in policymaking is inextricably linked to the epistemological concepts of contemporary society grounded in rationality. The relationship between rationality in the

framework of scientification links it to modern societal life, which has consistently maintained the connection between science and politics, both grounded in the same epistemological foundation. Contemporarily, existence is profoundly linked to quantification, a crucial element for contemporary science and politics. Researchers and scientists across various disciplines employ quantitative methodologies and numerical data. The allure of quantification is seen in academics, scientific inquiry, and politics, where quantitative facts typically guide decisions. Quantitative probability analysis and impact evaluation are employed to ascertain the probable consequences of a decision in quantitative terms. The pursuit of "measurement" is seen in the aspiration to establish numerically-based policy objectives, with the degree of their attainment serving as a benchmark for political success. Thus, quantification legitimizes political authority, forging a shared epistemological ground where science and politics converge.

Prutsch (2019: 11) describes "working numbers" as capturing the life-cycle of quantification—from production to translation to application in policymaking. Advocates of data-driven governance argue that numerical indicators enhance transparency for decision-makers while improving objectivity, scalability, and comparability. Some even contend that formulating policies without relying on numerical evidence is virtually impossible. In 2014, former New York City mayor Michael Bloomberg captured this logic in his widely cited remark: "If you cannot measure it, you cannot manage it, and you cannot fix it." Bloomberg's aphorism is emblematic not as truth but as a governing heuristic, reflecting a broader rationality in which what cannot be quantified struggles to be acknowledged, funded, or governed.

Quantification thus becomes an effective instrument for rendering scientific research "relevant" to politics. Numbers summarize complex phenomena and function as connective devices linking scientific inquiry with political decision-making. Prutsch (2019: 11-13) highlights three processes: the production of numbers within science, their conversion into standardized indicators, and

their application as benchmarks in political agendas. Yet numbers do not carry authority independently; they acquire legitimacy only when embedded in broader frameworks of value and ideology. This means that quantification is never purely technical but always situated—mobilized to justify certain interests, prioritize particular risks, and exclude alternative ways of knowing.

The discourse framework about politicized science or scientized politics must be linked to values and ideology. Numbers and indicators may appear neutral, yet their authority depends on the normative frameworks that underpin them. Examining this relationship helps explain how knowledge is structured and mobilized in society. Blume (1974: 229) argues that ideology connects scientific and technological rationality with political engagement. Yuliantoro (2016: 99) emphasizes that science and technology emerge from ideological and political dialectics, enabling communities to express scientific rationality more effectively. Rabkin & Mirskaya (2003: 21-22) further contend that science and state tyranny have become defining features of the 21st century, with industrial nations heavily relying on natural scientists for civil and military purposes. As a result, the state enables scientists to acknowledge the increasingly transnational nature of natural research and demonstrates a stronger alignment with scientific internationalism than the social sciences. This is predicated on the premise that the natural sciences have specific technological and political espionage applications. An illustration is the Soviet Union, where scientists functioned as intelligence analysts and channels for sensitive information from foreign nations. Rabkin & Mirskaya (2003: 23) assert that science has evolved into a structure of authoritarian ideology, serving as a constitutive rather than merely instrumental element. Modernity, frequently associated with authoritarian ideology, is also infused with scientific discourses. This ideology is characterized by reductionism, which entails simplifying complicated political and social concerns into a finite set of variables subsequently framed as a scientific problem.

Building on this, the discourse on science in policymaking is inextricably linked to examining science's role in development, which subsequently influences the macroeconomy. It is indisputable that science and technology have substantially influenced economic growth (Audretsch et al., 2002: 155). The interplay between science and political economy is crucial to contemporary human civilization. Modernization theorists assert that knowledge yields advantages in knowledge and technology transfer. The innovation in scientific and technological discoveries in contemporary times is intrinsically linked to the interplay between knowledge and capital. Thus, ideology and political economy intersect: the way science is valued and mobilized is not only cultural, but also material, shaping which forms of knowledge are legitimized, funded, and institutionalized.

The advancements in science and technology aimed at capital acquisition have prompted more focused research on knowledge management to address certain difficulties. Consequently, Science Policy and Innovation Studies (SPIS) are essential for managing and organizing scientific development and its innovations. The notion of innovation is significant when science or technology depends on advantageous interests, leading to new developments that serve both the scientific community and the financial supporters. This indicates that science is no longer a passive or isolated pursuit. Research has evolved into an endeavor that requires organization and management, including intricate issues, particularly politics and the economy. Scientific and technological innovation is influenced by the societal environment, which affects the dynamics of various actor types, the structure of labor division, and the nature of the spatial organization. The strategy and dynamics of business innovation mirror societal traits (Vinck, 2010: 250). Here, the shift from "knowledge as a public good" to "knowledge as capital" becomes explicit, revealing how research increasingly aligns with market interests rather than purely epistemic goals.

From a Marxian lens, science is shaped by material conditions; fields expand to solve production problems. The Marxist

perspective on scientific advancement aligns with the principle of historical materialism. According to Marxism, the economic foundation shapes political, legal, and social structures and scientific endeavors (Sheehan, 2007: 207). Science does not evolve solely due to internal knowledge dynamics or the scientific community; rather, it is a social endeavor influenced by economic factors. Consequently, Marxists do not perceive science as a catalyst for social transformation. Conversely, particular scientific fields evolve due to societal challenges in production. This materialist critique underscores that the trajectory of science is inseparable from production and capital accumulation, positioning economic conditions—not abstract ideals—as the decisive force shaping knowledge.

The amalgamation of science and capitalism into a formidable force prompts critical inquiries regarding democratic values, as Rogers observes (2008: 20-22). The principles of liberal capitalism emphasize open markets, individual liberty, and prosperity; yet, capital accumulation via structured science and technology transitions liberal capitalism into industrial capitalism. This shift generally neglects disparities in research capabilities and access to technology infrastructure. Individual entrepreneurs or innovators are regarded as having equivalent market access to huge multinational businesses, resulting in an inelastic market where capital accumulation and access costs facilitate market dominance by economic elites. This concentration of power leads to the supremacy of oligopolies and monopolies over market structure, legislation, and technological advancement rather than fostering a genuinely open and competitive economy. The democratic implications here are stark: what begins as innovation in the name of progress consolidates as exclusion in the name of capital.

The consolidation of economic power enables elites to dictate societal progress, frequently restricting the majority's options for economic engagement. Most individuals perceive their economic conditions as dictated by a privileged minority, while democratic involvement is relegated to consumer decisions rather than

substantive engagement in governance. Capital accumulation results in the proliferation of corporate dominance over industry and services, rendering the free market merely a competitive arena for economic elites. State regulations frequently advance the interests of elites, safeguarding private property and supporting established power structures. The resultant system, wherein multinational corporations dominate critical products and services like food, utilities, healthcare, and education, propels society towards technocratic and dictatorial dynamics, undermining the liberal capitalism tradition. In this context, civil society is progressively integrated into a centralized system of production and consumption that favors the economic elite, eroding democratic norms and public autonomy. This explains why public skepticism can grow even as states "invest in science": the benefits of progress appear captured by the few, while its risks are borne by the many.

3. Scientific Expertise and the Democratic Deficit

Democracy is the collective formation and execution of inclusive decisions that transform citizen preferences into policy outcomes while safeguarding rights and liberties (Müller-Rommel & Geißel, 2020: 227). Democratic accountability rests on standards such as citizen authority, individual rights, limitation of power, tolerance, institutional forbearance, truthfulness, and professional discretion (Koliba, 2025: 21). It also requires tolerance of diverse values and responsiveness to new social challenges (Dahl, 2000: 57). From this perspective, no single actor or institution should monopolize truth. Yet this is precisely where scientific expertise becomes problematic: expertise claims epistemic authority, while democracy depends on epistemic equality.

In science, expertise is associated with individuals who gain authority through education, training, publications, and professional affiliation. While experts may appear politically neutral, their knowledge often becomes institutionalized in policymaking. In this sense, experts act as "representatives of

nature," while political actors represent citizens (Brown, 2009: 109). This duality produces a legitimacy tension: scientific representation rests on claims of accuracy, while political representation rests on inclusivity.

The involvement of expertise as scientific "representatives" inevitably generates conflict and power struggles among institutions. In science and politics, representation carries different logics: scientific authority rests on claims of factual truth, while political authority rests on inclusivity and negotiation (Yuliantoro, 2016: 90-91). Neither can be inherently superior; both seek legitimacy within their respective domains. From this perspective, the science–politics nexus is less about process than outcomes: when scientists and political actors mobilize resources in conflict, science becomes "political," even within the laboratory.

Brown (2009: 188) clarifies that representation becomes political when it entails the interdependence of power, conflict, and collective action in a concrete setting. This refutes the simplistic view that "everything is political," showing that politicization is contextual and institutionally specific. In this sense, political salience emerges not from the content of science alone but from the conditions under which it enters arenas of contestation.

The presence of experts has undeniably facilitated the specialization of scientific study, providing essential input for government decisions in fields such as medicine approvals, agricultural biotechnology, energy innovation, and consumer regulation. Research in genetic engineering and nanotechnology illustrates both the promise and risks of expertise: genetic modification may transform ecosystems and human health. In contrast, nanotechnology carries implications for clean energy and remediation. These examples show how science contributes significantly to public life and why expertise cannot be treated as value-free. When experts claim authority over such high-stakes issues, their role extends beyond technical advice into the political sphere. In this way, scientific expertise functions as a representation

of knowledge and a political force that may challenge democratic equality.

At the same time, expertise becomes contentious when viewed through the lens of "public ignorance." Most citizens lack detailed knowledge of scientific processes, policies, or institutional actors, reinforcing a persistent dichotomy between experts and laypeople (Weinberg & Elliott, 2012: 84). Turner (2001: 123-124) warns that when expertise is treated as a form of property, it grants privileges that are neither easily shared nor democratically accountable, thereby undermining equality. This problem is especially visible in debates on biotechnology: while genetic engineering or similar innovations carry profound social consequences, publics often lack the tools to assess them fully. As a result, democratic societies face a dilemma between deferring to expert governance or defaulting to populist resistance.

The growing involvement of scientific expertise in democratic decision-making raises tensions with the liberal ideal of equality, which assumes that all citizens hold equal standing and influence in political life. When complex issues demand specialized knowledge, the gap between experts and laypeople creates asymmetry in participation, often sidelining citizens and weakening the responsiveness of democratic institutions. This dynamic fosters reliance on technocratic frameworks where authority rests disproportionately on experts rather than elected representatives. As Foltz (1999: 118) observes, governments frequently delegate decision-making authority to technical specialists, treating expertise not merely as advice but as policy itself. Christophorou (2002: 21) similarly cautions that this concentration of competence risks rendering science and technology into a form of despotism, stripping individuals of their role as democratic agents.

These risks are not merely theoretical but manifest in what Bertsou (2020: 266) identifies as the "façade of neutrality" within technocratic governance. Expert judgments often appear impartial and scientific, yet when detached from societal interests, they may produce illiberal or unresponsive outcomes. The core problem lies

in the exclusivity of specialized knowledge: expertise is a property that grants power while remaining largely unaccountable to the public (Turner, 2001: 123-124). As the cognitive gap between scientists and citizens widens, democracy risks becoming hollow, reduced to consumer-like choices rather than meaningful participation. Salomon (2000: 229) highlights two structural drivers of this discord: the increasing complexity of issues that necessitate scientific input in policymaking, and the persistent asymmetry of knowledge between experts and the public. Taken together, these dynamics illustrate how expertise, while indispensable, can simultaneously empower governance and erode the democratic ideals of equality and legitimacy.

Expert representation in the political sphere is often justified as advancing the public interest by addressing harms that individuals or small groups cannot resolve alone. Yet representation does not merely mirror the pre-existing public will; it actively constructs and expresses it. In this sense, scientists act as "representatives of nature," frequently embedded within collective organizations that lend authority to their claims. Political authority rests on the voluntary assent of citizens. In contrast, scientific authority is grounded in objectivity and the presumption of impartiality so long as it remains independent from overt political interests. This duality illustrates how science and politics draw legitimacy from distinct but interrelated forms of representation.

However, recognizing scientific authority also implies endorsing the ideology embedded within it. As Turner (2001: 127) argues, even liberal regimes rely on authoritative claims that are no less ideological than other doctrinal systems. Stenmark (1997: 31) terms this orientation "scientism," the belief that science has no absolute boundaries and that all dimensions of human existence can, in principle, be explained or resolved through scientific inquiry. The problem with scientism is not only epistemic but political: it extends scientific authority into domains of meaning, value, and human fulfillment, dictating how reality is to be understood. In

doing so, scientism risks displacing alternative ways of knowing and undermining the pluralism that democracy depends on.

Stenmark (1997: 16-19) distinguishes between two types of scientism. Internal academic scientism seeks to subsume diverse academic subjects under the umbrella of science. In contrast, external scientism goes further, reducing non-academic domains of human existence into objects of scientific inquiry. The latter poses the sharpest challenge to democracy, as it risks diminishing cultural, ethical, and experiential dimensions of life into technical problems. Macrae (1973: 229) underscores two dangers that arise when such scientism enters policymaking: first, the increasing complexity of issues that demand political resolution, compounded by scientific advancement; and second, the widening informational gap between scientists and lay citizens. Both dynamics reveal how unchecked scientism transforms scientific representation into a form of epistemic dominance that strains democratic legitimacy.

At this point, the debate reconnects with earlier discussions of politicization and scientization. Brown (2009: 10-12) underscores that truth claims inevitably become entangled with power and conflict when science enters political arenas. Politicized science arises when inquiry is situated within political contexts, so knowledge becomes a terrain of contestation across domains such as class, racism, gender, corporations, religion, and even laboratories. Scientized politics, conversely, seeks to render politics itself scientific, often reducing democratic deliberation to technical authority. Brown observes that the rise of scientized politics can foster more politicized science, generating a feedback loop. The paradox is clear: policymakers rely on experts to bolster legitimacy, yet this reliance often deepens public mistrust—a tension at the heart of democracy's struggle to integrate expertise.

This tension brings into focus the broader question of how expertise coexists with democratic equality. Samaržija (2016: 71) frames the issue as a form of *epistocracy*—the preferential treatment of scientific authorities in political decision-making. Critics raise three objections. First, even if some actors hold superior objective

knowledge, expertise cannot substitute for democratic choice, since self-government requires that citizens decide for themselves. Second, experts in political and ethical matters are not neutral; their judgments are often shaped by collective interests, biases, and blind spots (Kitcher, 2011: 146). Third, the processes through which beliefs and decisions are formed in society weaken the claim that experts could ever deliver epistemically optimal conclusions. In short, even if objective expertise existed, the structure of democratic life makes it unlikely that expert authority could align seamlessly with legitimacy. This creates a normative demand for science to reorient itself toward the public interest, grounding political life in a shared commitment to the common good.

4. Reimagining Science for the Common Good

The common good is essential to democratic processes and objectives within the political community. Science, understood as a collective benefit, can foster an inclusive political sphere that aligns with the interests of the broader public. Frank (2007: 818) suggests that conceiving science as a pursuit of the common good motivates individual participation in civic life and the institutional frameworks that sustain society. In this view, science extends its influence beyond the laboratory by generating societal advantages. State entities have therefore established institutional frameworks to promote science via public investment that reflects the logic of public goods (Stiglitz, 1999: 310). Like other public goods, research funded by taxation should remain accessible to all, making the public the ultimate stakeholder in scientific organization. This implies that science carries a moral obligation toward those who sustain it, reinforcing the principle that research must serve public interest as part of the democratic commitment to the common good.

Building on this principle, Bouter (2010: 4) argues that publicly funded research must satisfy two conditions: first, it should address problems that matter directly to people's lives by situating inquiries in relevant contexts; and second, its quality should be assessed by its pertinence to public life, especially the clarity of its aims and

outcomes. Bouter (2010: 9-11) offers indicators of social values in scientific research that demonstrate how science produces knowledge and contributes to broader social processes. From a *product perspective*, science's contributions are evident through scholarly and popular publications, policy guidelines, and the developing services, methods, and technologies. From a *process perspective*, the social value of science is manifested through scientists' involvement in professional or public committees, the provision of information to the public, ongoing education, and the role of public opinion in political decision-making.

Research, therefore, cannot remain an isolated pursuit but must generate tangible societal benefits. Radder (2017: 444-445) likewise contends that science qualifies as a common good because it is non-exhaustible and universally beneficial. From this perspective, publicly sponsored research should be transparent, inclusive, and explicitly oriented toward collective welfare, resisting privatization or capture by narrow interests.

Directing science toward the common good essentially leads to efforts to democratize science. In this discourse, Kitcher emphasizes that science can only be called democratic when it allows for active public participation in research and when the scientific agenda is explicitly aligned with societal needs (Islami & Muthmainnah, 2023: 263). The meaning of democratization of science also encompasses several aspects: from expanding access to knowledge (Folguera, 2017: 231), to redistributing epistemic authority between scientists and the general public, to expanding social control over scientific decisions (Kurtulmuş, 2021: 145; Vasquez-Muriel & Escobar-Ortiz, 2022: 2).

However, transparency alone is insufficient—in some contexts, it can even undermine public trust. Similarly, directly aligning the values of scientists with those of members of the public is unrealistic and risks politicizing science. Similarly, Schroeder (2021: 545) asserts that public trust can be restored if value-based decisions in science are based on democratic values, namely, values that represent the public interest. These values can be determined

through deliberative democracy, citizen science, and public opinion surveys, followed by filtering (removing discriminatory values) and laundering (cleaning up values based on factual errors).

However, Schroeder (2022) in *The Limits of Democratizing Science: When Scientists Should Ignore the Public* cautions that democratizing science does not mean accommodating all public values. When emerging values are racist, misogynistic, or discriminatory, scientists are obligated to reject them, as they contradict the egalitarian principles that underlie democracy. Therefore, making science a common good requires an orientation toward inclusive democratic values while maintaining normative boundaries to prevent science from being guided by values that undermine humanity and equality. This means that the common good needs to be understood through exploring societal values about what is truly needed. If these values align with principles of inclusivity and collective well-being, research should be directed to support them; if not, they should be abandoned.

This linkage is crucial for sustaining public trust in scientific expertise. A recent global survey by Cologna et al. (2025) in *Nature* illustrates this tension: Indonesians report relatively high trust in scientists (3.62 out of 5 on average), yet skepticism emerges when science is perceived as serving elite or industrial agendas rather than public welfare. Notably, 84% of respondents wanted scientists to communicate more openly, and 73% supported their involvement in policymaking. These figures show that public expectations of science are remarkably high, with a strong hope that it can help resolve urgent social challenges such as healthcare, clean energy, and poverty alleviation. In the Indonesian context, such expectations have been acknowledged, for instance, through the government's *Kampus Berdampak* program, which was launched in April 2025 (Kementerian Pendidikan Tinggi, Sains, dan Teknologi, 2025). Yet, initiatives of this kind must move beyond philosophy and slogans, translating into concrete practices that ensure science genuinely contributes to societal transformation.

The effort to redirect Indonesia's scientific culture also creates a particular challenge: how to transform the research culture into one genuinely oriented toward the common good. The problem is also institutional. Heavy administrative and publication burdens push scientists to prioritize metrics and personal recognition over societal relevance. As Macháček & Srholec (2022) demonstrate, Indonesia ranked second globally in predatory Scopus publications (16.73% between 2015–2017), a symptom of systemic pressures that distort research priorities. These conditions highlight that democratizing science requires more than rhetorical appeals; it demands structural reforms that reduce perverse incentives, strengthen institutional integrity, and reorient scientific practice toward collective welfare. Only by addressing these foundations can science in Indonesia fulfill its role as a democratic common good.

Several key elements are essential if the *common good* is the basis for democratizing science, particularly by ensuring the public is genuinely engaged in the research process. Policy frameworks have offered different pathways to achieve this. For example, Responsible Research and Innovation (RRI) explicitly links democratization to inclusivity, participatory governance, and ethical judgment (Reber, 2018: 38). Its core principles—anticipation, reflexivity, inclusion, and responsiveness—encourage broad public engagement in decisions about emerging science and technologies (Stilgoe et al., 2013: 1568), making it a practical framework for aligning innovation with social values.

Reorienting science toward the common good requires structural reform to correct institutional incentives, cultural transformation to normalize public participation, and procedural openness to guarantee accountability. These efforts mark a decisive shift: from treating science as the privilege of experts to reimagining it as a shared societal enterprise that safeguards both epistemic quality and democratic legitimacy.

CONCLUSION

This study critically underscores the complex relationship between science, politics, and democracy, which can give rise to politicized science and scientized politics, which risk undermining democratic values in a democratic society. This politicization of science can weaken scientific credibility, while political scientization can strengthen technocratic governments that tend to ignore public participation. The challenge here is mediating so that the relationship between science and political discourse always serves the public interest, the common good. However, it is also important to remember that the public interest aligns with egalitarian democratic values without denigrating other excluded groups. Democratizing science as a basis for achieving this common good requires public participation in scientific decision-making, and the concept of societal impact must be emphasized as the basis for scientific research goals, not merely scientific curiosity. Thus, this study seeks to remind us that the contribution of democratic discourse and studies in science has received insufficient attention, especially in Indonesia. This topic still presents a great opportunity for future scholars to explore the challenges and opportunities for democratizing science in Indonesia in depth.

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