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ARTICLE

Anti-Colonial Science? The Politics of Indigenous Knowledge Inclusion in Science-Based Policy

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Abstract
An aspect of the Indigenous struggle against colonial oppression is the struggle for the inclusion of their knowledge in policymaking. Perceived as epistemically inferior to science, Indigenous knowledge and subsequently interests are systematically excluded in science-based policy. This article advances an anti-colonial political philosophy of science. As Indigenous knowledge feeds into the necessary political value judgments in policy-relevant science, Indigenous knowledge inclusion, I contend, should be treated as a political, not solely epistemic, matter. I further argue that Indigenous peoples, not just scientists, should have the power to make such political value judgments given the politics of representation under coloniality.

Keywords: Indigenous knowledge; regulatory science; policy-relevant science; impact assessment; values in science; social epistemology

1. Introduction

An aspect of the Indigenous struggle against colonial oppression is the struggle for the inclusion of their knowledge in policymaking. To remedy the ongoing injustices of territorial dispossession, exploitation, and political disenfranchisement, governments need to take seriously Indigenous knowledge and perspectives in policy decisions that vitally affect Indigenous peoples. Indigenous knowledge is deeply entwined with and inseparable from Indigenous values and interests. For policy decisions in Indigenous territories, Indigenous peoples often draw on Indigenous knowledge to articulate their interests, inform decision making, and challenge the actions of colonial governments. However, Indigenous knowledge remains systemically excluded in policy-relevant science (Ludwig et al., 2024, 8). As much as there is growing institutional recognition of the value of Indigenous knowledge for research and policymaking, there are still widespread assumptions that scientific knowledge (conceived by colonial institutions as entirely distinct from Indigenous knowledge) has more epistemic authority and thus should be used to evaluate whether Indigenous knowledge should be incorporated into policymaking. Disputes between Indigenous peoples and the colonial states in the policy arena are often treated as an epistemic problem—a problem of which knowledge system is of greater epistemic merit and is to be used in policy considerations.

This impression of science in the public discourse on Indigenous knowledge inclusion stands in stark contrast with the consensus in contemporary philosophy of science. Science, as it deeply affects public life and policymaking, plays a political role in democracy. The current consensus is that science is not only value-laden, but also, as a social institution with an important role in shaping our society, should uphold democratic principles. There is further recognition that science should be pluralistic for epistemic (e.g., pluralism in methods and concepts contributes to scientific

progress) or political reasons (e.g., pluralism in values ensures social legitimacy). Despite these developments, there is not yet an account of pluralism of knowledge systems in policy-relevant science. How should we be pluralistic with different ways of knowing? Given this pluralism, how should science qua social institution be organized in non-ideal societies? Reflecting on the proper roles that science and scientists should play in colonial states, this article thus hopes to advance an anti-colonial political philosophy of science (see Lusk, 2021; Schroeder, 2022).

My anti-colonial approach to Indigenous knowledge inclusion has two central claims:

(i) Inclusion of Indigenous knowledge, as it feeds into value judgments in policy-relevant science, should be treated as a political, but not solely epistemic, matter.
(ii) Indigenous peoples (i.e., the affected public), not just scientists, should have the power to make such political judgments in scientific inquiry.

To make concrete my approach, I use impact assessment policy, which involves natural and social science research determining whether construction projects should proceed in Indigenous territories, as the key case study. Section 2 introduces the question of Indigenous knowledge inclusion in policy-relevant science. Section 3 establishes Claim (i). As Indigenous knowledge is often called for in value-laden steps of inquiry that directly shape policymaking, I contend that the question of inclusion should be settled, at least in part, on political grounds. Section 4 establishes Claim (ii). In oppressive societies like settler-colonial states, I argue that it is politically problematic for scientists to act as informal political representatives of the colonized and instead Indigenous peoples (i.e., the affected public) should have the power to shape these political matters in scientific inquiry. The democratic organization of science not only concerns what values to use or how values are selected, but also the political structures relating to *who* has the power to perform and execute the value judgments.

2. Indigenous Knowledge Inclusion in Policy-Relevant Science

Science plays an important social and political role in democratic society. Philosophers of science have now come to the consensus that science is not and should not be value-free: non-epistemic values have (at the least) an instrumental role in scientific practice (Brown, 2024). Neglecting the role of non-epistemic values in science has also led to many undesirable social consequences, especially for socially marginalized groups (Longino, 2004). The question of value management remains: "how ought the role of values in science be managed, that is, when and how should values be permitted to operate in science?" (Brown, 2024, 2). As scientists often act as experts in policy-making contexts, science qua social institution should aim at contributing to democratic decision making and social reform by inquiring about phenomena significant to society (Douglas, 2014; Du Bois, 1898; Weber, 1949). In some settler-colonial states, however, the value management question is complicated by the fact that there are multiple knowledge systems at play in the public sphere beyond science. How should the social institution of science be organized such that it fulfils its democratic role in non-ideal societies?

2.1. Policy-relevant science: The case of impact assessment policy

A crucial instance of policy-relevant science concerning Indigenous knowledge inclusion is impact assessment policy in settler-colonial states. This article takes an especial focus on Canada as a case study. Impact assessment (IA) is a common policy vehicle in many democracies for evaluating the impact of a specific proposed development project (e.g., building roads, gas pipelines, mines) and determining whether the government should approve said project. To understand a particular development's impact on the affected local environment (e.g., ecology, biodiversity) and community (e.g., health, economy, rights), IAs not only utilize existing natural or social scientific evidence,

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but also require conducting new scientific studies tailored to the setting of the project (Government of Canada, 2024a). Thus, scientific inquiries in IAs are policy relevant in the sense that they are often commissioned specifically by the government for the expressed purpose of settling particular local policy questions. IA is an area of focus here because this science-based policy regime calls for Indigenous knowledge inclusion and has significant impact on Indigenous peoples' livelihoods and their broader political struggle against territorial dispossession, forced displacement, and exploitation (Lajoie-O'Malley et al., 2023).

There are two key stages of scientific inquiry in IA: the planning stage and the impact assessment stage. The planning stage concerns the project design and scoping of IAs, in which key issues of concern with the development project and studies to be undertaken are identified. Notably, IA scoping sets out what are the valued components, "the elements of human and natural environment that are important to participants in an impact assessment process" (Government of Canada, 2024c), which provide the foundation for impact assessment. Potential examples of valued components include animal species at risk, the well-being of Indigenous peoples, and project contribution to sustainability (Government of Canada, 2024c). At the impact assessment stage, an IA report is created to identify, describe, and assess the impacts of the project on different valued components based on the studies conducted for IA and other information, for example, Indigenous knowledge. The IA report then characterizes the adverse effects on valued components by their extent of significance into the categories of "high," "moderate," and "low" (Government of Canada, 2024c). Weighing between impacts to different valued components, the conclusion of the IA report offers overall policy recommendations on whether the proposed project should be approved and/or on the mitigation measures required (Government of Canada, 2024c).

2.2. Indigenous knowledge in the policy context

For policy decisions and outcomes to be effective, policy processes should ensure both that the best available environmental and social knowledge are considered and that the diverse interests and needs of impacted communities are accounted for. The same goes for IA policy. Some social groups, such as Indigenous peoples, articulate their knowledge, needs, and interests in knowledge systems other than science. The value of Indigenous knowledge in informing better decision making in IA thus is emphasized in policy studies literature (Eckert et al., 2020).

While specific to each Indigenous community and their local environments, Indigenous knowledge is generally understood as holistic systems of knowledge from Indigenous peoples' cross-generational association with their land, which encompasses socioecological systems and empirical observations, Indigenous ethics and spirituality, Indigenous governance and traditional laws, etc. (Agrawal, 2002; Beaulieu-Guay, 2022; Houde, 2007; Wheeler et al., 2020). There is growing international recognition that Indigenous knowledge can play a valuable role in policy-making and academic research, such as in social science and environmental management (Singleton et al., 2023; International Council for Science, 2002). Notably, the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) (2007) states that "respect for Indigenous knowledge, cultures and traditional practices contributes to sustainable and equitable development and proper management of the environment" (4).

Given these developments, Canada's IA policy explicitly seeks to incorporate Indigenous peoples and Indigenous knowledge in the IA process as specified in the 2019 Impact Assessment Act. Aimed at restoring trust and credibility to the IA regime, the Act makes the inclusion of Indigenous knowledge in IA decision making and upholding the rights of Indigenous peoples explicit legislative purposes (Impact Assessment Act, 2019, c.28. s.1(6)). Thus, Canadian IA policy in its inclusion of Indigenous knowledge has the goal of allowing for more holistic perspectives "to ensure that impact assessments of designated projects take into account all effects—both positive and adverse—that may be caused by the carrying out of designated projects" (Impact Assessment Act, 2019, c.28, s.1 (6)). The policy also aims to ensure that Indigenous rights and interests are adequately considered in

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IA decisions owing to the government's (legal) duty to meaningfully consult Indigenous peoples (Eckert et al., 2020).

2.3. Epistemic-first approach to Indigenous knowledge inclusion

As much as settler-colonial governments recognize that science-based policy needs to take into account Indigenous knowledge, the question of how to include different ways of knowing alongside science remains. The dominant way to resolve this question of inclusion is with what I call the epistemic-first approach.

The epistemic-first approach qua normative ideal treats the question of Indigenous knowledge inclusion in science-based policy as an *epistemic* matter: whether Indigenous knowledge should be included in science-based policy depends on the epistemic status of that purported knowledge. One reflection of this approach is that the current IA policy guidance on Indigenous knowledge justifies inclusion via its epistemic benefits: "considering Indigenous knowledge in assessment processes can contribute to better assessments and project outcomes" (Government of Canada, 2024b). The epistemic-first approach qua normative ideal is a plausible and sensible one: ultimately, conducting an IA is about knowing what the impacts of a proposed development project are; the stated benefits of Indigenous knowledge inclusion are epistemic in nature (i.e., more effective predictions of impacts). This approach is also reflective in much contemporary transdisciplinary research involving indigenous knowledge, wherein epistemic diversity in knowledge systems is taken to contribute to more robust research (Ludwig & El-Hani, 2025, 20–22).

The *actual ways* in which the epistemic-first approach has played out, however, fall short of facilitating meaningful inclusion of Indigenous knowledge. Currently, the epistemic-first approach means that IA scientists[1] and policymakers are mainly concerned with the credibility of Indigenous knowledge from the perspective of science (i.e., Indigenous knowledge needs to be validated or verified by science) in order for it to be used in policymaking (Needham et al., 2020; Wheeler et al., 2020; Wheeler & Root-Bernstein, 2020). When Indigenous knowledge and science come to conflicting verdicts on, for example, whether the proposed development has certain adverse effects, scientists and policymakers consider the conflict as a purely epistemic one in which resolving it is to decide which knowledge system has greater epistemic merit. Given the general perception that science is the knowledge system with greater epistemic authority, policymakers generally underutilize Indigenous knowledge in comparison to scientific knowledge despite them acknowledging that Indigenous knowledge can be beneficial for decision making (Kadykalo et al., 2021).[2] For IA policy, Beaulieu-Guay (2022) finds in 62 impact analysis statements that Indigenous knowledge is often consulted just for the purpose of validating policymakers' or IA scientists' support for a particular policy outcome, as opposed to being consulted for independent expertise. So, *in practice*, the epistemic-first approach means only the Indigenous knowledge claims that concur with scientific knowledge are included, thus effectively only scientific knowledge is being utilized in policymaking. This strays away from the pluralistic ambitions of science-based policy regimes like IA. The persistent failure of IA policy to account for Indigenous knowledge was met with high-profile resistance by Indigenous peoples and the general public. For instance, there were large-scale demonstrations, blockades, and rail disruptions across Canada in 2020 in solidarity with the Wet'suwet'en nation against the Coastal Gaslink Pipeline project (Lajoie-O'Malley et al., 2023).

[1]Henceforth, I use the term "IA scientists" to refer to scientists conducting inquiries for IA decisions, typically hired by the Canadian settler-colonial government or the proponents of the development project.

[2]See also Ludwig et al. (2024) on how "demarcation-based" accounts of Indigenous knowledge in transdisciplinary inquiry (i.e., accounts of Indigenous knowledge primarily concerned with whether Indigenous knowledge is scientific) are practically, epistemically, and politically misleading.

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What are the failings of the current implementation of the epistemic-first approach? Eckert et al. (2020) conducted a systematic review of 19 papers to identify the systemic obstacles preventing meaningful engagement of Indigenous knowledge in Canadian IA policy.

First is the problem of knowledge hierarchies. IA scientists and policymakers often hold biased beliefs which construe Indigenous knowledge to be inferior or supplementary to scientific knowledge (Eckert et al., 2020, 74; Lajoie-O'Malley et al., 2023, 551). In focusing on integrating different Indigenous knowledge systems into science, Ludwig and El-Hani (2025) argue that integrationist transdisciplinary research leaves existing hierarchies between knowledge systems unquestioned (43). As such, IA scientists and policymakers only accept Indigenous knowledge as valuable and legitimate for inclusion in science-based policy after scientization (i.e., being validated by science or adapted to scientific discourse).

Second is the problem of knowledge extraction. Another issue with scientization is that this process of separating "useful" epistemic elements of Indigenous knowledge from other "useless" non-epistemic elements of the knowledge system (e.g., practices, values, customs) distorts the knowledge itself (Agrawal, 2002). Anishinaabe legal scholar Deborah McGregor (2021) emphasizes that Indigenous knowledge is a way of life for Indigenous peoples and this knowledge cannot be tethered from broader Indigenous societal goals and aspirations. Indigenous knowledge and Indigenous values and interests are inseparable: one cannot only dispense of Indigenous knowledge altogether and only extract Indigenous values or interests for policymaking and vice versa for only extracting Indigenous knowledge for prediction of impacts while dispensing Indigenous values and interests. Notably, Indigenous ethics, law, and governance systems are closely entwined with many Indigenous knowledge claims but become detached from scientization (Lajoie-O'Malley et al., 2023, 553). Knowledge extraction is thus seen by Indigenous peoples as a form of neo-colonization in which the complexities of Indigenous knowledge are to be "subsumed with the cultural assumptions of science and the management structures that support these systems" (Eckert et al., 2020, 73).

Third is the consequences of power imbalance. The suppression of Indigenous knowledge in policymaking and colonial practices are inherent in the broader political power structure in Canada (Eckert et al., 2020, 76). The political powerlessness of Indigenous peoples prevents them from being in a position to influence IA processes and outcomes with their expertise in Indigenous knowledge (Eckert et al., 2020, 76). This contributes to Indigenous peoples' distrust of IA scientists, making them hesitant to engage with IA inquiries more broadly. Due to the historical and ongoing impacts of colonization, Indigenous peoples worry that scientists conducting inquiries for IA decisions are "potential government co-conspirators" (Baker & Westman, 2018, 148) with colonial political agendas.

The social science literature nonetheless leaves open what is to be done with this evidenced failure. After all, some challenges are not necessarily tied to the epistemic-first approach qua normative ideal but rather to its non-ideal implementation and the broader non-ideal political context of settler colonialism. One could conceive of reforming the epistemic-first approach so that IA practice achieves the epistemic-first approach's normative ideal. I first introduce my preferred political-first approach before returning to this suggestion.

3. Political-First Approach to Indigenous Knowledge Inclusion

This section sets out the political-first approach to Indigenous knowledge inclusion (i.e., Claim (i)): Inclusion of Indigenous knowledge is a political, not merely epistemic, matter. There is an appropriate role for Indigenous knowledge in two value-laden steps of inquiry—conceptualization of inquiry and determination of findings. The appropriateness of this role primarily owes to the political valence of including Indigenous knowledge, but not dependent solely on its epistemic merits. I first establish that non-epistemic value judgments in policy-relevant science are political in nature. I then argue that Indigenous knowledge precisely affects these political value judgments.

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The epistemic-first approach qua normative ideal, therefore, misconstrues the question of Indigenous knowledge inclusion and the role of scientific experts.

3.1. Value judgments are political judgments

Pervasive value judgments are inevitable in policy-relevant science. Many stages of scientific inquiry involve ineliminable value judgments: determining the subject of inquiry, defining concepts, choosing measurement methods, creating classification systems, managing inductive risks, and so forth, all require and benefit from the use of non-epistemic values (Brown, 2024; Elloitt, 2019). Two stages of policy-relevant scientific inquiry, I argue, involve non-epistemic value judgments that are political in nature: conceptualization of inquiry and determination of findings. These value judgments are political in two ways: they involve the use of political values, and they have significant political consequences. Thus, making these value-laden choices in inquiry requires the consideration of political, not solely epistemic, reasons.

Before I proceed, it is worth clarifying the chosen typology of values here. Following Ward (2021), the notion of values utilized here concerns the role of values acting as (justifying) reasons for choices in scientific inquiry. I take a broad view of what constitutes "political": political values concern how our collective coordination and decision making in the policy context ought to proceed. Thus, other types of values (e.g., ethical, cultural, religious values) can be understood here as political values as long as they affect policy decision making. The settler-colonial state often depoliticizes Indigenous peoples' assertions of their rights, values, and interests (especially those contesting colonialism) as merely cultural or spiritual so as to rationalize the hegemony of settler-colonial economic and political interests (Coulthard, 2014, 65–67). Calling non-epistemic values political is thus an intentional choice so as to foreground the political nature of contestations between Indigenous peoples and the settler-colonial state.

A stage of inquiry concerning political value judgments is the conceptualization of inquiry, which involves determining the areas of research focus and research methodology (e.g., concepts to be used and how they are to be measured) in the particular policy context. These judgments in regulatory science are value laden as scientists end up promoting particular non-epistemic values depending on how they settle on these questions (Elloitt, 2019, 2). To serve its role in democracy, areas of research focus should be chosen in a way such that scientists' inquiries provide policy-relevant information (Du Bois, 1898; Intemann, 2015). Determining what is *policy-relevant* thus turns on political values. Moreover, research also often involves thick concepts, in which making them operationalizable via choices of evaluative standards requires non-epistemic value judgments. As these thick concepts are used to shape and guide policy choices, this value-laden choice should reflect the interests of the public (i.e., political values) (Alexandrova & Fabian, 2022). Furthermore, these value judgments can potentially have significant adverse political consequences. Scientific information in policy-relevant science not only directly informs policymaking, but also is necessary for the public to challenge policy decisions and hold governments accountable in public deliberations. If the interests or political values of particular segments of the public are systematically not considered in the inquiry and thus the resulting policy, this can create poor policy outcomes for these social groups and thus substantive issues of justice. Value judgments can also create distributive epistemic injustices: citizens who do not share the values inherent in scientific inquiries are deprived of adequate scientific information on issues central to their interests (Thoma, 2023, 27). This epistemic inequality is politically undesirable for it implies a difference in power in public deliberation and thus creates relationships of domination (Thoma, 2023, 27). Therefore, value judgments in the conceptualization of inquiry are political in nature in these two senses.

The planning stage of IA policy which scopes and designs inquiries to be conducted for a particular proposed development requires political value judgments of such kind. Although the stated aims of IA policy are to "foster sustainability" (Impact Assessment Act, 2019, c.28, s1(6)) and to manage the impacts to valued components, conceptualizing the aims of IA inquiry requires

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explicating the sense of sustainability in contention. This requires defining what the valued components are and how impacts to valued components are conceptualized and measured (O'Faircheallaigh & MacDonald, 2022). "Sustainability," "valued components," and "positive/negative impacts" are thick concepts in which making them measurable requires context-specific political judgments of what the affected public values. If particular valued components or senses of sustainability of the affected public are not studied in IA inquiry, this will mean that the policy decisions concerning project approval and mitigation measures have not adequately accounted for their interests. This will also put those who care about these valued components at an epistemic disadvantage in deliberations on whether the proposed project should proceed or in challenging an approval decision. Thus, judgments concerning conceptualization of policy-relevant inquiry are political, not merely epistemic, matters.

Another stage of inquiry which concerns political value judgments is the determination of findings. This stage of inquiry involves assessing and interpreting findings, giving an overall account of all the evidence, and offering policy recommendations based on findings. In making policy recommendations, scientific knowledge alone cannot sufficiently answer what is needed for a policy decision to be made due to the Humean gap between descriptive and normative analysis (e.g., Betz, 2013; Steele, 2012; Thoma, 2023). The assessment and interpretation of knowledge claims likewise concern political values as the creation of scientific information in the policy context determines what issues are open to democratic contestation and what the possible policy options are (Jasanoff and Simmet, 2017, 751). These value judgments, evidently, are political in nature as they directly concern policy outcomes and shape the policy options available to the public or policy-makers in decision making. Similar to the case of the conceptualization of inquiry, these value judgments can have significant political consequences for justice, equality, and the well functioning of democracy. Therefore, the determination of findings involves value judgments with political values, which have far-reaching political consequences.

The impact assessment stage, in which the IA report offers an overall account of the impacts based on diverse sources of evidence and provides policy recommendations, requires political value judgments of such kind. These steps of IA inquiry are political in nature because interpreting whether certain impacts are significant directly affects policy judgments on whether the impacts and thus the project are acceptable to the community (O'Faircheallaigh & MacDonald, 2022). Questions on how to characterize the overall impact to a valued component (e.g., whether it is a positive or negative effect based on a variety of knowledge claims), how to put impacts into the categories of significance, and how to weigh between different kinds of impact (e.g., weighing more heavily environmental or social factors) turn on value judgments of the affected public on what they value. Policy recommendations on whether to proceed with the proposed development and the mitigation strategies required are also political in nature. Even though the government is not bound to follow the final policy recommendations in the IA report, the recommendations still strongly sway the ultimate decision, and the government follows the recommendations in most cases. The policy recommendations and mitigation measures thus going to be highly politically contentious matters. Therefore, in IAs, how knowledge claims are assessed and adopted in determining findings and policy recommendations are deeply political matters and cannot be settled purely epistemically.

3.2. Indigenous knowledge inclusion as a political matter

Granting that value judgments in policy-relevant scientific inquiry are political matters, this section argues for Claim (i): Inclusion of Indigenous knowledge, as it feeds into value judgments in policy-relevant science, should be treated as a political but not epistemic matter. When we examine the ways Indigenous knowledge are mobilized by Indigenous peoples in science-based policy, we realize that Indigenous knowledge is mostly called for in value judgments that, per Section 3.1, are political in nature. In illustrating the political nature of Indigenous knowledge

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inclusion, I focus on instances in which Indigenous knowledge and science conflict as this is the key point of contention for approaches to inclusion.

For IAs, Indigenous knowledge provides evidence and understanding on, for example, the biophysical environment, socioeconomic issues, Indigenous culture, laws, and governance, and thus contributes to the understanding of impacts in both the planning and impact assessment phases (Government of Canada, 2024b). It is important to note that Indigenous knowledge, due to its integrated and holistic nature, is closely tied to Indigenous peoples' values and worldviews. Disentangling the epistemic elements of Indigenous knowledge from its broader context neglects the ethical, political, and economic demands of Indigenous peoples (Alcoff, 2022, 5). So, the inclusion of Indigenous knowledge is politically important for Indigenous peoples to articulate their interests in terms of their values and worldviews. Excluding or marginalizing Indigenous knowledge in policy-relevant science thus has the direct effect of excluding or marginalizing Indigenous interests in the political decision-making process. Inclusion of Indigenous knowledge is thus a substantive political issue: in a democracy, people have to be able to advocate for their interests in policymaking or challenge governmental actions; if science does not produce knowledge that allows them to do so or exclude particular ways of articulating their interests, then substantive political principles of justice, equality, and democracy are undermined (Thoma, 2023).

In the conceptualization of IA inquiry (i.e., the planning stage), science and Indigenous knowledge systems not only may present different areas of focus (e.g., focus on the biophysical environment vs. the interrelationship between the community and the environment), but also different directions of study. For instance, in evaluating the impact of mining developments, IA scientists typically focus on the direct impacts from the mining operation only, while Indigenous knowledge systems often focus on the cumulative impacts resulted from the broader mining infrastructure and associated population changes (O'Faircheallaigh & MacDonald, 2022, 225). In an Indigenous-led IA on an oil sand mine in Alberta, the Mikisew Cree First Nation drew on their Indigenous knowledge on the community's 50-year experience living alongside oil sands operations in project scoping, emphasizing the detrimental cumulative effects from the oil sands industry on their environment, way of life, sustenance, and sovereignty as research focus (Candler et al., 2015, 21). The difference between the two knowledge systems here is driven not only by different political values (e.g., on the notion of sustainability pursued), but also by different epistemic values (e.g., prioritizing evaluation of direct or cumulative effects). Which approach to adopt (i.e., which set of epistemic and non-epistemic values to prioritize) depends on each community's needs and interests in understanding how the proposed project affects them. Therefore, whether the conceptualization of inquiry utilizes Indigenous knowledge has a direct bearing on the political question of whether the proposed project in Indigenous territories should proceed.

In the determination of findings and policy recommendations (i.e., the impact assessment stage), science and Indigenous knowledge systems may present different approaches to evaluate whether impacts are significant or acceptable. In assessments of the significance of impacts on, for example, fishery, IA scientists tend to utilize standardized definitions of acceptability from the general profession, whereas Indigenous knowledge systems tend to base the assessment on the well-being and sustainability of environments and indigenous peoples (O'Faircheallaigh & MacDonald, 2022, 231). Science and Indigenous knowledge systems can also diverge in the evaluation of the quality of fishery: while scientific knowledge and Indigenous knowledge systems both value attributes, for example, run-timing, size, abundance of a stock, Indigenous knowledge systems tend to additionally value attributes of kinship to fish, for example, markings on fish, flavor, color, texture, and place of capture (Kadykalo et al., 2021, 621). Take the example of IAs concerning the transformation of Teztan Biny (Fish Lake) in Tsilhqot'in Indigenous territory into waste rock areas. IA scientists evaluated the proposals' impact on rainbow trout as acceptable by scientific benchmarks, for example, total population of the species, population of brood stock required for species survival, economic value of old versus new fish population (Hoogeveen, 2016, 361–363). On the other hand, Tsilhqot'in Indigenous knowledge evaluated the impact as unacceptable due to the

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importance of Teztan Biny as a place for cultural transmission, the species' importance as historic and contemporary source of sustenance, and more fundamentally, the Tsilhqot'in people value fish as *fish* beyond mere resource disposable for short-term economic benefits (Hoogeveen, 2016, 361–364). Whether an adverse impact due to a proposed project is acceptable depends, to an extent at least, on what the affected population finds acceptable. Which approach to evaluation to adopt in providing the final policy recommendation (i.e., whether an impact is interpreted as significant) here is a political matter, as whether a change is important depends on the polity's views and values. Excluding Indigenous knowledge in these scenarios excludes certain impacts and perspectives on their significance. Therefore, whether the determination of findings, especially in offering policy recommendations, utilizes Indigenous knowledge directly bears on the political question concerning the policy decision to approve a proposed project.

If we grant that the conflicts between Indigenous knowledge and science in IAs are political, not merely epistemic, in nature, then we agree that the problem of Indigenous knowledge inclusion in policy-relevant science is a political matter. Epistemic reasons alone are insufficient in such conflicts to resolve the disagreements over value judgments. Therefore, the inclusion or exclusion of Indigenous knowledge in science-based policy requires political justification.

3.3. Primacy of the political

The epistemic-first approach qua normative ideal takes the question of Indigenous knowledge inclusion as a matter of epistemology, hence conflicts between scientific and Indigenous knowledge systems call for choosing between them on epistemic grounds. Given that Indigenous knowledge inclusion is, at least in part, a political matter, the epistemic-first approach qua normative ideal mischaracterizes the nature of conflicts between Indigenous knowledge and science and also resolves these matters in a politically problematic manner.

When Indigenous knowledge systems and science conflict on how policy-relevant inquiry should be conducted, it may be tempting, per the epistemic-first approach qua normative ideal, to simply choose the "epistemically better" knowledge system. Section 3.2 demonstrates that these disagreements between Indigenous knowledge systems and science are disagreements over value judgments. In these disagreements, we see that the conflict of values is not simply an epistemic one (about which epistemic values should be prioritized), but substantively also a political one (about what policy outcomes are desirable or untenable, what interests should be prioritized, etc.).

When one chooses a knowledge system over another (i.e., privileging scientific knowledge claims over Indigenous knowledge claims) on merely epistemic grounds, one is privileging one set of political values and considerations over another—one is, in fact, making a political choice. This is problematic for two reasons. First, epistemic reasons alone are insufficient to provide justification for a political choice. This is the case even if the epistemic evaluation criteria are collaboratively created. Settling political conflicts only by appeal of greater epistemic authority neglects substantive issues of justice, equality, and legitimacy value judgments may create. Second, and more importantly, the epistemic-first approach creates a false dichotomy that it is either science or Indigenous knowledge. We are used to, in the political context, having values conflicting with each other. Even in the case of epistemic values, we often find epistemic values to conflict in scientific theories and accept that there is room for reasonable disagreement (Hilligardt, 2022, 3). It is not the case that we must choose one knowledge system over another—we have many different clashing value judgments in the public sphere and even within scientific practice itself. If we think that value pluralism is necessary in policy-relevant science (Thoma, 2023), we must take seriously how "pluralist approaches to value determination will involve accepting […] pluralist approaches to knowledge processes" (Alcoff, 2022, 4). We must thus take seriously the fundamental, inseparable connection between Indigenous knowledge systems and Indigenous values. This extends also to how we ought to approach conflicts between different Indigenous knowledge systems. There is no one "universal" "homogenous" set of Indigenous values given there are over 600 Indigenous communities in Canada. Addressing conflicts between

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Indigenous knowledge systems requires attending to the place-based and community-specific nature of Indigenous knowledge and, therefore, the sphere of epistemic and political values distinctive to each Indigenous community. Settling these conflicts of value judgments requires not just political considerations, but also political negotiations (see Section 4.1).

Furthermore, the epistemic-first approach qua normative ideal misconstrues the role of scientific expertise in policy-relevant science. For the epistemic-first approach to run, what could be the nature of scientific expertise that warrants scientists to have trumping judgments on whether Indigenous knowledge should be included in policy-relevant science? To start, it is obvious that (most) scientists qua scientists are not experts in Indigenous knowledge as they do not have expertise in this different knowledge system. After all, scientists are trained in and practice science, not Indigenous knowledge. If we (erroneously) assume that Indigenous knowledge lies completely in the same domain of knowledge as science (hence lies wholly within the remit for scientists' epistemic expertise), the arguments earlier suggest that scientists qua epistemic experts are not the right persons to make judgments about the inclusion of Indigenous knowledge. Activities such as giving an account of all the evidence, interpreting the extent of significance in light of the evidence, and providing policy recommendations determine the basis for policy action. These activities relating to the inclusion of Indigenous knowledge concern questions of value and are at least in part political matters in the IA context. As such, these activities go beyond the epistemic expertise scientists gain from their specialized training (Solomon, 2009, 57), and instead call for moral or political expertise and authority. However, scientists, as unelected officials, do not have the necessary moral or political expertise and authority on questions of value (Betz, 2013; Bright, 2018; de Melo-Martín & Intemann, 2016). There is also much contention on whether there is moral expertise (Holst & Molander, 2017, 239–241). The epistemic-first approach thus encounters the problem of technocracy: scientists' value judgments that directly influence or form part of public policy are made in a way that bypasses usual democratic processes (Thoma, 2023, 17). As scientists have unjustified disproportionate power over other citizens in decision making, this raises problems of relational inequality, illegitimacy, and (epistemic) injustice (Lusk, 2021; Thoma, 2023). So even if we grant that scientists have the epistemic expertise to ascertain the epistemic status of Indigenous knowledge and that scientists are unprejudiced in their judgments, it is still politically problematic for scientists to do so in policy-relevant science. Scientists cannot permissibly offer judgments qua epistemic experts on the political terrain about the political disagreements between science and Indigenous knowledge. Therefore, as the inclusion of Indigenous knowledge in IA is a political matter, scientists do not have the relevant expertise to evaluate Indigenous knowledge in IAs. To ask them to evaluate Indigenous knowledge in IA is a politically objectionable exercise of scientific expertise in democracy.

At the heart of Indigenous knowledge inclusion in science-based policy is not an epistemic problem, but a political problem. While the epistemic-first approach qua normative ideal may be sensible given the epistemic benefits of including Indigenous knowledge, its non-ideal implementation in settler-colonial societies often resulted in superficial forms of inclusion (Ludwig & El-Hani, 2025, 40). The policymaking process is not to settle the epistemic questions of what knowledge system or claims to adopt simpliciter. Decision making is first and foremost a political problem of contending between different rights and interests given the different policy options. The lack of complete commensurability between science and Indigenous knowledge should not prevent us from utilizing these systems of knowledge in informing policy decisions, especially when Indigenous scientists and peoples have long proven the possibility of being guided by both, for example, via "Two-Eyed Seeing" (Bartlett et al., 2012). Furthermore, what is often conceived of as the conflict between science and Indigenous knowledge is in fact the conflict between the settler-colonial and extractivist capitalist interests and values of the state and/or industry proponents (embodied by the IA scientists they hire) and the values and interests of Indigenous peoples in resisting ongoing colonial oppression. Foregrounding the political stakes, the political-first approach highlights that the Indigenous knowledge inclusion is not merely epistemically beneficial but, most crucially, politically necessary for taking seriously Indigenous peoples' rights to shape

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political decisions in their sovereign territories. This renewed understanding of Indigenous knowledge inclusion thus introduces further political desiderata for how policy-relevant inquiry should proceed. Especially important are the power structures which underpin these political value judgments—the focus of the next section.

4. Anti-Colonial Justice: A Question of Power

Thus far, I argue that the inclusion of Indigenous knowledge is a political, but not merely epistemic, matter (i.e., Claim (i)). It is politically problematic both for Indigenous knowledge to be excluded on solely epistemic grounds and for scientists qua epistemic experts to settle these political judgments on their own. One question remains: How should we settle political matters concerning Indigenous knowledge inclusion in policy-relevant inquiry? This section argues for Claim (ii): Indigenous peoples (i.e., the affected public), but not just scientists, should have the power to make such judgments in scientific inquiry.

In response to the technocratic challenge with value-laden science, philosophers of science have put forward two proposals for the democratic organization of science: democratic participation (i.e., affected public making the value judgments) and democratic alignment (i.e., scientists using democratically selected values). I consider these two proposals in the context of Indigenous knowledge inclusion. I argue that, in non-ideal societies such as settler-colonial states, it is more desirable for the colonized to make such judgments themselves (i.e., democratic participation). This is because scientists cannot permissibly act as informal political representatives of Indigenous peoples due to the structural and discursive political harms of scientists "speaking for" the colonized. In restoring Indigenous peoples' political agency in science-based policy, my approach thus requires that we disrupt colonial power relations.

To note, this article takes a broad conception of democracy in which the decision-making process should be appropriately responsive to the wills of the (Indigenous) sovereign groups involved. Operationalizing the notion of democracy in Indigenous territories should proceed on a case-by-case basis, depending on the Indigenous governance and legal practices of each Indigenous community. In so doing, it is imperative that the democratic decision-making process should not uncritically adopt the current structures in place, especially those imposed by the settler-colonial state. For example, the current system of elected chiefs and band councils, instated by the Indian Act, may not always be appropriately responsive hence sufficiently democratic due to the genocidal and sexist exclusion of Non-Status Indians and the distinction between reserve and traditional territories (Collis, 2022; Palmater, 2014). Therefore, it is important that the conception of democracy is determined on a case-by-case basis insofar as it is appropriately responsive and non-colonial. For imposing a particular preferred notion of democracy is antithetical to promoting the sovereignty and self-determination of Indigenous peoples.

It is worth noting that Indigenous peoples have long practiced and proposed democratic alternatives to the settler-colonial state's liberal constitutional democracy. Dene political theorist Glen Coulthard (2014) draws attention to the Indigenous direct democracy of the Dene Nation: the 1975 Dene Declaration proposes the construction of "political institutions on the traditional principle of popular sovereignty and consensus decision-making, thus including as wide a spectrum of Dene as possible" (68). Under this Declaration, the principle of direct democracy applies to all political and economic decisions and the principle of mutual self-determination structures the Dene's relationship with non-Indigenous populations (Coulthard, 2014, 68–69). This is just one example among many of how such Indigenous democratic processes make up.

4.1. Democratic participation: Affected public in policy-relevant science

One obvious solution to the technocratic challenge is to have the affected public directly participate in these political value judgments in scientific inquiry. Such proposal was raised by W.E.B. Du Bois.

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As social scientists, Du Bois and Eaton (1899) conducted sociological research concerning black Americans in Philadelphia in a non-ideal context like that of IA policy. Black Americans then faced severe oppression and exploitation under a form of internal colonialism (Du Bois, 1948; Gutiérrez, 2004). Considering the role of science in deeply oppressive societies, Du Bois contends that, if science is to contribute to social reform, the affected public should have a direct say in how science is organized (Du Bois & Eaton, 1899, 1). Recent proposals of citizen science suggest the same for other marginalized groups. For instance, Alexandrova and Fabian (2022) have people suffering from poverty (i.e., the affected public) coproduce the measure of well-being so that scientific findings serve their needs.

The affected public are "those to whose lives stand to be affected by this research" (Alexandrova & Fabian, 2022, 6) as the findings are used to rearrange their lives through new policies. The affected public, with an actual and direct say in the political judgments inherent in scientific inquiry, can ensure that the outcomes of policy-relevant science align with their interests (Thoma, 2023, 22). This proposal can also yield further instrumental benefits of democracy. On highly divisive political matters, it can be hard for dominant groups, for example, policymakers or scientists to ascertain the interests of affected marginalized groups. People understand their own needs best (Du Bois, 1996, 83–84). The affected public has "lived expertise" that comes with a unique understanding and perspective on conceptualizing inquiry (Alexandrova & Fabian, 2022, 13–14). They also have special (ethical) insights into the meaning, importance, and consequences of problems associated with different policy options (Schroeder, 2022, 9). Scientists, in their inquiry, should have a deference to the affected public especially if they are marginalized by oppression: the marginalized are socially situated in a way that they have an (epistemic) advantage in asking and answering pertinent questions and governing their own affairs (Bright, 2024, 84). For these reasons, the affected public ought to be the persons making political value judgments in policy-relevant science and scientists ought to defer to the public on these matters.

Those who stand to be affected by an IA inquiry are also those who stand to be affected by the proposed development project. For development projects in Indigenous territories, the affected public for IA inquiry is Indigenous peoples. As such, the democratic participation proposal will hold that Indigenous peoples, as the affected public for IA inquiries in Indigenous territories, should decide on the political judgments in scientific inquiry. Ultimately, the decisions of whether to approve a construction project hugely affect the local population, who needs to bear with any positive or adverse effects associated with that proposed development. The affected public should have the power to decide what is important to them (i.e., the valued components and extent of significance of impacts) and how things should be done (i.e., policy recommendations and mitigation measures). This aligns with many Indigenous researchers' call for Indigenous peoples to be repositioned as active participants in the entire research process, including the identification of research questions, analysis and interpretation of evidence, and dissemination of findings (Braun et al., 2014; Hart, 2010; Iddy, 2021; Kovach, 2009; Olsen, 2018; Wilson, 2008). The observed instances of superficial inclusion of Indigenous knowledge often "confined Indigenous and local actors to symbolic participation, leaving actual decision-making to the dominant industry and state actors" (Ludwig & El-Hani, 2025, 22). As Eckert et al. (2020) noted, "until real decision-making and political power is conferred upon Indigenous participants in IA, it is not feasible to harmonize the two knowledge types towards informed decision-making" (80). Offering Indigenous peoples political influence over the IA inquiry process helps recenter the focus of science-based policy on the sociopolitical impact of the decisions on the affected public. To have a democratic consensus over the project approval decision, how the inquiry is conducted, and how different kinds of evidence and considerations inform the ultimate decision should be subject to democratic control.[3]

[3]This article offers normative arguments on how inquiry *should* proceed and, notably, what role scientists *should* play in policy-relevant science. In practice, these normative ambitions can be more effectively and reliably pursued by the affected public having the ability to choose the scientists working on the IAs (e.g., someone with professional experience working with Indigenous knowledge) (O'Faircheallaigh & MacDonald, 2022, 226–227).

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Therefore, for science-based policy to be democratic, Indigenous peoples, as the affected public, should have the political power to shape key political value judgments in IA inquiry, including questions concerning Indigenous knowledge inclusion.

Of course, this definition of the affected public is only straightforwardly applied when the development project only involves Indigenous territories. The case for larger scale projects, for example, gas pipelines, will be complicated by the greater territorial scope and thus a wider set of stakeholders in addition to Indigenous peoples. This brings us to the broader political problem of how deliberation and decision making ought to proceed between colonized and settler-colonial populations and states. Currently, IA policy tends to recognize Indigenous groups as "stakeholders" as opposed to rightsholders among other interested parties in deliberations (Darling et al., 2023). This stakeholder-based approach to deliberation, Kyle Whyte argues, is politically problematic: Indigenous peoples have sovereignty and treaty rights over particular locations and environmental resources so framing Indigenous peoples as "stakeholders" with particular "interests" obscures the stronger claim they have over these policy-relevant scientific decisions—one based on sovereignty and rights (Douglas et al., 2024, 10).[4]

In order to properly account for the rights of and obligations toward sovereign treaty rightsholders, Douglas et al. (2024) suggest organizing cross-border engagement panels for working among multiple sovereign entities (10). In other words, each sovereign entity constitutes its own affected public.[5] This suggestion can be productively applied to IAs. An existing practice in Indigenous nations, especially for such larger scale projects, is to conduct Indigenous-led impact assessments (i.e., IAs where the affected public are only those in Indigenous territories) to ensure Indigenous values and interests are thoroughly captured (O'Faircheallaigh & MacDonald, 2022).[6] Having regional IAs specific to each Indigenous sovereign group and their territories is particularly important given the place-based and community-specific nature of each Indigenous knowledge system. As such, the overall decision on whether to approve the proposed project and the remedies required should involve cross-border engagement and negotiation across multiple sovereign entities based on their respective regional IAs.

Currently, the settler-colonial state tends to center the overall value of the project to the "broader public" and the economy in approving development projects at the expense of the territorial dispossession of Indigenous sovereign groups (Hoogeveen, 2016; O'Faircheallaigh & MacDonald, 2022). This rhetoric, however, does not take seriously Indigenous sovereignty. In such cases, taking seriously Indigenous sovereignty requires separate IAs for the settler-colonial state and impacted Indigenous nations. The settler-colonial state may persuade other Indigenous sovereign groups of these broader benefits in political negotiations, but IAs of Indigenous sovereign groups can always diverge as Indigenous communities, as sovereign groups, retain independent decision-making powers. The same goes for disagreements between different Indigenous sovereign groups.

4.2. Democratic alignment: Scientists as informal political representatives

Another prominent proposal for the democratic organization of science is democratic alignment (Douglas, 2009; Intemann, 2015; Kitcher, 2011; Lusk, 2021; Schroeder, 2021). The core commitment

[4]Participatory research sometimes maintains a distinction between stakeholders (who contribute values guiding inquiry) and experts (who are sources of knowledge) (Solomon, 2009). This distinction, Koskinen (2017) argues, cannot be clear-cut for Indigenous knowledge as values cannot be separated from Indigenous knowledge (4674).

[5]Here, I take the individuation of sovereign entities as based on Indigenous self-determination, and not that imposed by the settler-colonial state and its juridical mechanisms of, for example, recognition of Aboriginal title.

[6]As noted earlier, I leave open the precise form in which democratic decision making should take when the Indigenous sovereign territory has a (sizeable) non-Indigenous population. For that depends on the particular sovereign Indigenous group's governance and legal structures (e.g., Dene principle of mutual self-determination).

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of the democratic alignment proposal, despite the variety of formulations, is that: "Scientists ought to use the appropriate democratic values—that is, the values held or endorsed by the public or its representatives" (Schroeder, 2017, 1045). The democratic alignment proposal responds to the technocratic challenge by legitimating scientists' value judgments through democratic value selection mechanisms (Intemann, 2015; Lusk, 2020). Scientists' value judgments, according to this proposal, should be evaluated with respect to the degree to which the value selection process aligns with other substantive ideals or norms of democracy. For instance, Lusk (2020) argues that scientific democratic deliberations should satisfy the relevant procedural ideals of deliberative democracy (e.g., fairness, reciprocity) (997); Intemann (2015) argues that democratic value-selection mechanisms should "secure the representative participation of stakeholders affected by the research" (219).

What will the democratic alignment proposal look like in the case of IA? To start, I assume that the notion of "the public" here to be that of the affected public. The reasons are twofold. First, the current IA policy framework on public participation has an overarching principle to "prioritize the participation of those who are most affected by the proposed project" (Government of Canada, 2024d). Second, proponents of the democratic alignment view typically "identif[y] community-engaged research as a crucial location for deliberation" (Lusk, 2021, 108). In IAs in Indigenous territories, the affected public is Indigenous peoples. So the democratic alignment proposal will suggest that scientists in IAs in Indigenous territories ought to use the values democratically selected or held by Indigenous peoples (I henceforth call these Indigenous or anti-colonial values) in making the political judgments in policy-relevant inquiry. In turn, the democratic alignment proposal seems to also entail a model of policy-relevant science that is supportive of Indigenous struggles against coloniality.

One underappreciated feature of the democratic alignment proposal is that scientists, in using democratically selected values in research, are in fact acting as informal political representatives. Salkin (2022) defines an informal political representative as "a person or group who, though neither elected nor selected by means of a systematised election or selection procedure, speaks or acts on behalf of some individual or group beside themself in a given context" (943). In the democratic alignment proposal, scientists are informal political representatives in the sense that they are, as unelected officials (i.e., informal), acting on behalf of the affected public in the context of *executing* value judgments in policy-relevant inquiry.

To understand the representative activity of scientists here, it is important to distinguish between *selecting* values and *executing* value judgments. Interpretation of values is a source of value disagreements given the multiplicity of ways of operationalizing said values (Ward, 2024, 299–300). Executing value judgments involves a significant interpretative step: operationalizing the democratically selected values to the specific research tasks and hence value judgments at hand. Although the affected public democratically selects values for a particular inquiry, scientists under the democratic alignment proposal take on a representative role insofar as they act *on behalf of* the public when executing the value judgments (as opposed to the public directly executing these judgments themselves). This is the case even if scientists faithfully execute these judgments per the democratically selected values. Take the water management example offered by Lusk (2020): "The deliberative body concludes that research should focus on worst-case scenarios to protect human livelihood. Thus, when providers are forced to choose between available rainfall projections, the only legitimate choice is the worst-case scenario" (998). Here the climate service providers (i.e., scientists), though they ought to "use democratically endorsed values" (Lusk, 2020, 998), are still interpreting and choosing on behalf of the deliberative body what constitutes the "worst-case scenario" among all projections: what is the class of projections that scientists choose the worst-case from, what are important considerations to human livelihood, how to weigh between these considerations with respect to different projections, and so forth. As such, the scientist qua informal political representative makes value-laden choices on behalf of the public with democratically selected values.

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Although this gap between values selection and execution of value judgments has been overlooked in the democratic alignment proposal, this representative role of scientists, when implicitly acknowledged by some proponents, is often justified from an epistemic angle. Concerning the consequences of error in science policy advice, Douglas (2009) suggests that "[s]cientists are best qualified" (75) to make the necessary (ethical) value judgments as opposed to the policymaker or the public. Similarly, Intemann (2015) argues that "scientists are actually in the best position to make these sorts of value assessments because they possess the necessary expertise to assess […] scientific considerations relevant to advancing social aims" (227–228). As such, the democratic alignment proposal's arrangement that scientists (instead of the affected public) execute value judgments is, at least implicitly, grounded on scientists' privileged epistemic position. In sum, the democratic alignment proposal for IA has two parts: the affected public democratically selects the values to be used in IA inquiry; scientists execute these value judgments with democratically selected values (i.e., act as informal political representatives) on behalf of the affected public.

4.3. Politics of representation under coloniality

So far, the democratic alignment proposal only focuses on the political questions pertaining to what values to use and what process by which values should be chosen. The question of *who* to act on such values, however, is not given due attention. Even if scientists are supposed to only incorporate values democratically selected by the public per the democratic alignment proposal, scientists are still in a position of political power over other segments of the public in interpreting and executing the democratically selected values in these politically salient judgments and thus political power in influencing policy outcomes. Even though scientists ought to abide by the outcomes of democratic deliberation, they, as informal political representatives in executing value judgments, *can* always choose not to or fail to faithfully use democratically selected values. It then comes to question whether scientists are politically the best persons to make such judgments. If scientists are not the right persons to execute such value judgments, scientists should defer to the appropriate persons in these judgments instead.

For the context of IA or other science-based policies in Indigenous territories, Eckert et al.'s (2020) findings suggest the need to reflexively consider the social position scientists occupy—scientists, whether self-conscious or not, have been a critical part of the imperial machinery in facilitating and reinforcing colonial oppression. Contending with the context of coloniality, I raise the following questions: Are scientists the best persons to decide what is best for Indigenous peoples? Is it desirable that scientists hold this position of power over Indigenous peoples? Is this political arrangement truly representative of anti-colonial justice? In deeply oppressive, non-ideal societies, I contend that three considerations in the political dimension should convince us to adopt the democratic participation proposal instead.

First, sociological research shows that scientists who set out to embody the anti-colonial and Indigenous values and standpoints failed to truly do so. Reviewing 112 publications by environmental scientists on Indigenous knowledge, Singleton et al. (2023) identify potentially problematic tendencies toward essentialism and minimizing power relationships in the literature. While the environmental scientists are motivated by the goal of addressing the harms of past colonialism and are sensitive to power relations between themselves and Indigenous peoples, Singleton et al. (2023) note that the scientists ultimately regrettably reinforce colonial representations of the "noble savage" and neglect the issues with contemporary colonialism in their work. This finding particularly puts pressure on the feasibility of the democratic alignment proposal: scientists may seek to embody certain values, but still could fail to evaluate what it means to choose and produce outcomes in line with said values due to their social positioning and ultimately act against said values. The following two considerations I raise, however, still hold even if scientists can indeed uphold the anti-colonial or Indigenous values in value judgments—for these considerations, problematize the act of representation itself in colonial society.

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Second, the political arrangement which considers scientists do know qua scientists what is sociopolitically good for Indigenous peoples reinforces colonial governmentality. Under imperialism, colonial administrators and researchers often decide "what is in the best interest" of the colonized because the colonized are "incapable" of doing so themselves. In turn, the colonized is to be indebted to the colonial administrators for the "progress" and "liberation" they see. To have scientists "decide what is best for Indigenous peoples" because they "embody the values of Indigenous peoples," regardless of the intents of the scientists and regardless of the outcome of such decisions, is reinforcing a colonial power structure. My proposed approach, on the other hand, suggests that such salient political decisions should be made by Indigenous peoples, that is, the relevant public for IA decisions. Hence, my proposed approach is preferable as it helps to break away from colonial governmentality.

Third and most importantly, scientists are simply not the right persons to speak for colonized Indigenous peoples, especially considering the historical role of scientists in the colonial enterprise Eckert et al. (2020) highlight. In *Can the Subaltern Speak?* (Spivak, 1988), Spivak challenges how could an intellectual truly "speak for" and "channel" the views of the subaltern for the intellectual does not occupy a "transparent" position—the intellectual is situated in the very institutions of power that oppress the subaltern. This is because the very act of speaking is situated by political power relations of domination and subordination (Alcoff, 1991, 15). I shall raise the same worry to ask—how much could a scientist really "speak for" the Indigenous peoples given the inextricable ties between empire and science? How could scientists working for the colonial government in IAs "speak for" the colonized peoples? For Indigenous peoples have frequently asked to speak for themselves (Eckert et al., 2020, 76), why must we insist that it is best for scientists to speak for them? The practice of powerful interlocutors speaking for the oppressed is discursively dangerous as it reinforces oppression (Alcoff, 1991, 7). Alcoff (1991) emphasizes that the discursive context is a political struggle and "certain contexts and locations are allied with structures of oppression" (15). The social location of the scientist is allied with colonial oppression as a historical matter of fact and, especially in the IA context, the scientist is working for the colonial government. It is thus discursively problematic for scientists to speak for Indigenous peoples. Considering the scientists' discursive location, one should opt for my proposed approach to empower Indigenous peoples to speak for themselves.

The critic may protest: these issues only occur because scientists are not truly embodying an anti-colonial or Indigenous standpoint; if the scientist genuinely possesses an anti-colonial or Indigenous standpoint, these political problems will dissolve. Of course, I do not mean to suggest that non-Indigenous peoples, including those in the class of the "colonizers," cannot or should not support the colonized's struggle against oppression. However, such support for Indigenous peoples should come with a sensitivity to the very political structures one is situated in. Alcoff (1991) suggests that if one has to speak for others, one must interrogate their impetus to speak is not motivated by a "desire for mastery and domination" (24) and one must recognize the effects of their speech on the discursive and material context of those represented (26). If scientists genuinely embody an anti-colonial or Indigenous standpoint, if they interrogate their impetus to speak, then they will be sensitive to the colonial power structures they are situated in and be reflexive about how the critic's proposed arrangement is inherently colonial. Regardless of whatever political goods the scientists themselves believe they can bring, they must recognize that the justice and liberation of Indigenous peoples under colonialism demands that "the oppressed control the conditions of their own emancipation […], not in reliance on the alleged competence of those who claim to know better" (Ypi, 2020, 282). If scientists qua informal political representatives insist on not deferring to the represented owing to their special knowledge or expertise, this makes their relationship with the represented impermissibly inegalitarian and oppressive, hence failing their duties as informal political representatives to the represented marginalized group (Salkin, 2024, 245). When colonizers justified colonial oppression based on their view that the colonized are incapable of self-governance, it is particularly necessary to regard and treat the colonized as capable of speaking and

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acting for themselves (Salkin, 2024, 255–256). Therefore, if scientists truly embody an anti-colonial or Indigenous standpoint, they will rather defer to the colonized and restore the agency and power that Indigenous peoples have been deprived of under colonialism.

The Indigenous/Science network research collaboration with the Penelakut nation is an instance of scientists adopting my proposed approach. The residential school system in Canada is a state-backed program of cultural genocide in which children were forcibly removed from their homes. In residential schools, Indigenous children faced severe institutionalized child abuse with acknowledged mortality rates reaching 30–60% (Wylie, 2023, 1489). As many of these children's graves are either unknown or unmarked, the Penelakut reached out to the Indigenous/Science network at the University of British Columbia. The Penelakut requested researchers to locate the unmarked graves with a ground-penetrating radar (GPR) survey so as to memorialize these children for community healing (Wylie, 2023, 1490). Reflecting on her experience working with the Penelakut, Wylie (2023) remarks on a challenge: "How do we bear witness […] without reinscribing settler-colonial systems of oppression, speaking about, speaking for?" (1491). In turn, the Indigenous/Science network deferred value judgments concerning the design of inquiry to the Penelakut leadership rather than themselves taking the lead. The research agenda was set by the Penelakut leadership: the researchers followed the Penelakut elders' decision on whether and how to proceed with research activities and on what areas of research to prioritize (Wylie, 2023, 1490). Notably, the researchers followed the Penelakut's request to focus on surveying areas slated for development so that the children's graves would not be disrupted during construction (Wylie, 2023, 1490). This deference also extends to how scientists determine and communicate their findings. Wylie (2023) asks "How do we ensure that our tools of inquiry, legible as scientific in settler contexts, do not reinforce norms that marginalize what Indigenous communities have long known" (1491). Reflexive of how the GPR survey physical evidence may carry more authority than the testimony of survivors and archives, the scientists sought guidance from the community on how to communicate the results to the public (Wylie, 2023, 1491). The approach endorsed here is not only feasible, but is also necessary for scientists and science to achieve these anti-colonial visions.

"Infinite is human nature. We make it finite by choking back the mass of men, by attempting to speak for others, to interpret and act for them," Du Bois proclaims (Du Bois, 1920/1996, 81–82). Existing arguments concerning democratic alignment mainly focus on what are the appropriate values and how such values should be chosen through ideal theories of democracy. The colonial context brings to the fore the politics of representation in the value management problem for science. Acts of representation, which are otherwise legitimate and permissible according to ideal theories of democratic deliberation, can be deeply unjust and harmful in oppressive societies. The democratic participation approach, as it advocates for material transfers of political power, better attends to the need to break from colonial governance and discursive structures. Achieving anti-colonial justice requires, at the least, placing Indigenous peoples in positions of power to speak for and decide for themselves scientific inquiries and related policy decisions that directly affect them. Overcoming the settler-colonial capitalist hegemony, however, will not be easy. Developmental studies have long observed cases of participatory research being captured by bureaucratic and/or corporate interests, impeding genuine empowerment of the marginalized and oppressed (Cooke & Kothari, 2001). Nevertheless, transforming the mode in which policy-relevant inquiry is conducted is necessary for ameliorating and resisting further settler-colonial territorial dispossession, material exploitation, and systemic political disempowerment of Indigenous peoples. If we want to ground an anti-colonial philosophy of science, disrupting colonial power structures is a place to start.

5. Conclusion

There are instances in science-based policy that involve using different knowledge systems at the same time. Oftentimes, these instances are construed as epistemic problems of deciding which knowledge system to adopt or has greater epistemic authority. I argue that these in fact are, by large,

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political problems. Developing an anti-colonial approach toward Indigenous knowledge inclusion, I argue that the conceptualization of inquiry as well as the determination of findings involve political judgments that should be made by the affected public but not just scientists. Since Indigenous knowledge is often utilized in these value-laden stages of inquiry, this approach to policy-relevant science implies that Indigenous knowledge inclusion is a political matter for the affected public to decide. Situating policy-relevant science under the colonial politics of representation, my anti-colonial approach to Indigenous knowledge inclusion attends to the structural and discursive political harms in arrangements where the scientist "speaks for" the colonized. In empowering Indigenous peoples to make value judgments in scientific inquiries that directly affect policy outcomes, my proposed approach advocates for restoring Indigenous peoples' political agency and is more constructive toward anti-colonial justice.

Science is deeply implicated in the legacy of colonialism: science has been used as justification for and means of reinforcing colonial rule. We may like to think colonialism and these oppressive effects of science are things in the past. These are, however, still live and pressing problems for many contemporary colonial states. Questions of how we ought to organize science alongside other knowledge traditions are not just epistemological problems for philosophical contemplation. They are active sites of political struggle. Part of reckoning with this oppressive legacy of science is to understand the colonial structure science and scientists are situated in and to upend these power relations. Should science be of aid to realize emancipatory ends, we must place the colonized in an empowered position to challenge extant oppressive systems. Should science be anti-colonial, we must reconfigure the social institution of science.

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