

**Knowledge Brokers at the Science-Policy interface:
insights from biosecurity and environmental management**

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60 **Abstract**

61 Determining appropriate mechanisms for transferring and translating research into policy has
62 become a major concern for researchers (knowledge producers) and policymakers (knowledge
63 users) worldwide. This has led to the emergence of a new function of brokering between
64 researchers and policymakers, and a new type of agent called *Knowledge Broker*.

65 Understanding these complex multi-agent interactions is critical for an efficient knowledge
66 brokering practice during any given policymaking process. Here we present 1) the current
67 diversity of knowledge broker groups working in the field of biosecurity and environmental
68 management; 2) the incentives linking the different agents involved in the process (knowledge
69 producers, knowledge brokers and knowledge users), and 3) the gaps, needs and challenges to
70 better understand this social ecosystem. We also propose alternatives aimed at improving
71 transparency and efficiency, including future scenarios where the role of artificial intelligence
72 (AI) technologies may become predominant in knowledge-brokering activities.

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74 **Keywords:** knowledge brokering, policymaker, epistemic injustice, values, incentives, artificial
75 intelligence.

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INTRODUCTION

The policymaking process comprises a series of technical steps including, but not limited to, identifying policy need, asking focused questions, searching for evidence, appraising and synthesizing evidence, and implementing it at the appropriate policy level. The whole process assumes that although reliable research evidence will not suffice alone, it will contribute to the building of a successful, unproblematic, more transparent policymaking process (Greenhalgh and Russell 2009). Within this context, policymakers (knowledge users) and researchers (knowledge producers) embody distinct roles within the process. However, it is important to notice that in practice, individuals may fluidly transition between these roles, driven by diverse personal beliefs and ambitions (Pielke 2007), and also that intrinsic factors tied to the disciplinary background of individuals in each role influence how they behave. For instance, while trained researchers commonly prefer and prioritize sound, comprehensive theories and concepts within their fields, policymakers are more inclined to seek evidence that is accessible, easy to understand, and directly applicable to the issues they face, but not necessarily tied to their professional background or disciplines. Moreover, while researchers often need years to complete their work, policymakers require answers quickly. Since both researchers and policymakers use their own highly technical languages, it is widely accepted that neither researchers nor policymakers are ideally placed to drive the translation, transfer, and implementation of the research evidence they need to share with each other. This same breakdown in communication becomes apparent when scientific researchers attempt to share novel first-hand information with policymakers, only to discover that, even when speaking the same language/idiom, they often interpret the same words in different ways including different meanings and implications that vary among scientific disciplines and sometimes within the same discipline (e.g., Guareschi et al. 2024; Soto et al. 2024; Ahmed et al. 2025). Indeed, identifying effective channels and mechanisms for translating research into policy has become a significant concern for researchers and policymakers worldwide (Gluckman et al. 2021). This challenge has ultimately led to the emergence of a new type of intermediary known as a *Knowledge Broker*.

Brokers, in general, act as intermediaries between two or more otherwise disconnected actors or agents (i.e., users and producers of a given type of resource such as information), to translate their different languages but also to align information needs with outputs, and to achieve private and/or collective/public goals (Kwon et al. 2020; Gluckman et al. 2021). It is worth to remark here that, “language” implies different idioms and localisms but most fundamentally it implies frameworks, structures of thoughts, disciplinary perspectives and biases, etc. Knowledge brokers, whether individuals, groups, or organizations, play a key role in

translating knowledge and building connections between researchers and their diverse audiences. By bridging know-how, know-why, and know-who, they operate effectively across both public and private sectors (Ward et al. 2009; Meyer 2010).

Although the knowledge brokering process plays a significant role in facilitating the creation, finding, translating, and spreading of research (Ward et al. 2009), good synchrony and coordination between knowledge producers and knowledge users is not always achieved. The policymakers' agenda is critically important in this process because, even when knowledge producers and brokers identify new needs or gaps in existing practices or policies, these must first be incorporated into the agenda of the knowledge users, before any action can be taken to address the identified issues. Mastering this complex multi-agent interaction is critical for an efficient knowledge brokering practice during any given policymaking process (Pielke 2007; Ward et al. 2009).

Activities like producing, searching, gathering, reviewing, and translating evidence consume/occupy precious resources like time, funding, logistics, and personnel. Absorbing these costs is neither easy nor inexpensive and is often considered difficult and even impossible in many societies facing economic difficulties. Hence it is critical to have good incentives in sight. In this context, incentives are anything that motivates, or encourages, people to do something despite the costs (Rubin et al. 2025). During the knowledge brokering process, knowledge users face the challenge of providing the right incentives to engage the most effective knowledge producers. Identifying these incentives is particularly difficult, as it requires a deep understanding of the agents' values (i.e., the criteria or standards with which people evaluate, judge, and justify their own and others' choices; Schwartz 1992; Sagiv et al. 2017; Sagiv and Schwartz 2022) and especially considering that the type of incentives used can either strengthen positive relationships or exacerbate negative ones (Kislov et al. 2017; Halevy et al. 2019). These incentives and motivations are closely tied to the values and priorities of each society, which in turn are shaped by human needs that commonly vary across the world and among different socioeconomic groups (Maslow 1943).

Despite the critical role that knowledge brokers have throughout the policymaking process, relatively little attention has been directed to identifying different types of knowledge brokers and defining their workflows and the different incentives they have. Our research efforts aim to delve into questions such as who is designated knowledge broker? Why do these people get to play that role?, and how/why they do it? We explored these questions through intensive interdisciplinary debate to examine the process of knowledge brokering and the emergence of

knowledge brokers through transdisciplinary workshops and dialogues encompassing the fields of Philosophy, Ecology, Sociology, Biomedical Sciences, Environmental management, Law, and Political Science, and including policymakers (see Schneider et al. 2024; Heesen et al. 2024; Schneider et al. 2025, for further details). The identification of knowledge broker groups in the following section, and the incentives we associate with them, are based on different factors such as the diverse disciplinary and sociocultural backgrounds of the project collaborators and our empirical expertise and experience in national and international aspects of knowledge brokerage and policymaking. We also based on insights gained from internal debates throughout 2023, following a series of structured workshops at ZiF (Zentrum für Interdisziplinäre Forschung, Bielefeld, Germany) that included both virtual and in-person discussions with expert knowledge producers and users from around the world, whom we invited to expand the range of our expertise. In addition, we identified knowledge brokers as authors of journal articles during two evidence mapping exercises undertaken during 2023/4 (see Chukwu et al. 2024; Hewitt et al. 2025). Finally, we received suggestions and complementary feedback after the oral presentation of our preliminary findings during three open workshops at ZiF, which featured structured debates and keynote presentations by invited speakers especially selected for their expertise in knowledge brokerage and/or policymaking (<http://bit.ly/42tjRNI>). We identified the knowledge groups we considered to be most active and influential, however, despite the intensive work conducted during this project, we do not claim to have identified all possible/existing groups or their incentives. We include specific examples that we consider important to understand the least known groups. In this work, we embrace an inclusive perspective, acknowledging that the complexity of the knowledge brokering landscape varies significantly across regions, countries, and cultures (Wiegler and Bruns 2025). It ranges from relatively new or nascent systems, as is common in much of the Global South, to those with long-established histories, deeply embedded traditions, and high levels of sophistication, such as in most of North America and Europe. The definitions we explain in this article are derived not only from the cited references but also from the conclusions drawn from our internal debates and workshops during this project.

Here, we identify:

- 1- the current diversity of knowledge broker groups operating in the field of biosecurity and environmental management;
- 2- the incentives connecting the various agents involved in the process—namely, knowledge producers, brokers, and users; and
- 3- the gaps, needs, and challenges that still deserve urgent attention to improving the workflow sustaining this social ecosystem. We also explore potential alternatives to enhance its transparency and efficiency, including disruptive technologies such as

artificial intelligence (AI), which may either improve—or complicate—knowledge exchange.

KNOWLEDGE BROKER GROUPS

Over the course of this project, we identified seven knowledge broker groups currently involved in policymaking within the field of biosecurity and environmental management, along with a set of twenty relevant incentives linking them to both policymakers and knowledge producers (Fig 1, Table 1). It is worth clarifying that membership in these groups is generally not to be taken as precluding simultaneous membership or participation in other groups.

Professional societies and academies are typically discipline- or subject-specific non-profit organizations with the mission of supporting the professional development of their members through meetings, symposia and conferences; setting standards; publishing journals and/or policy briefs; promoting the use of science or evidence in policymaking and lobbying on behalf of the membership (Singleton 1981; Scott et al. 2008). Professional Societies and Academies often work with open memberships based on collected dues. However, some learned societies vet prospective members who are invited to join as fellows, academics, etc. By actively engaging policy/decision makers, professional societies and academies increase their influence as sources of reliable, rigorously collected, and synthesized evidence (Gluckman et al. 2021). However, academies and societies do not play the same role worldwide as there are regional and national political and socio-economic factors preventing that from happening. For instance, while national academies in rich powerful countries usually run prestigious scientific journals (Singleton 1981) and events that lead global scientific and academic mainstreams, in less powerful and influential regions, these organizations tend to play a more limited role, often confined to small events and celebrations and having little to no impact on the scientific community or the advancement of science and technology both domestically and internationally.

Expert groups with governmental mandates are initiatives coordinated by governments following specific issues of the policymaker's agenda that need to be addressed with evidence. These initiatives can be directly organized by policymakers as ad hoc committees (e.g., the National Strategies for Invasive Alien Species - NSIAS) or standing groups (e.g., the International Council for the Exploration of the Seas - ICES), or indirectly through international organizations (e.g., the Intergovernmental Platform on Biodiversity and Ecosystem Services - IPBES, or the Intergovernmental Panel on Climate Change - IPCC). Researchers that participate in these groups are invited, selected and/or nominated directly by their governments. Some researchers do not directly participate as part of the expert group but contribute through specific tasks. They can benefit by earning participation credit in new publications and/or

increasing the visibility of their existing work (e.g., through citations). Although most people joining these expert groups contribute their labor voluntarily, there are exceptions in which some members working on specific tasks receive monetary compensation (e.g., ad-hoc groups members). To ensure broad participation, funding support is often available for early-career researchers, minority groups, and individuals from less wealthy and influential nations.

Non-governmental organizations (NGOs), Foundations and Think-tanks. NGOs (e.g., World Wildlife Fund - WWF, or the International Union for Conservation of Nature - IUCN) and Foundations are probably among the most traditional and best-known knowledge broker groups. In general, they are non-profit organizations that perform research and advocacy, with some additional functions of philanthropy and/or grant funding. These groups and their members can directly and indirectly influence policy decisions through strong advocacy with government officials, industry and public, impacting on public opinion regardless of the soundness of the evidence or argumentation they use (Gluckman et al. 2021; Balza et al. 2023). Think-tanks are relatively newer entities in this scenario, but increasingly common. They are distinct from government, and although many are nonprofit organizations their work may be conducted for (and paid by) governments as well as private clients (Planells-Artigot et al. 2021).

Research organizations, institutes, universities encompass another well-known group of knowledge brokers because they are the most classic source of scientific information worldwide. Formed mostly of researchers, their mission is the production of novel results and the synthesis of new knowledge that pushes forward science and technology, with the ambition of elevating the quality of life of people, among other things. These institutions commonly educate professionals with proper background and expertise and confer academic degrees. A recent example showing the information brokerage power concentrated in these institutions is South Africa's "Centre for Invasion Biology", an academic and research entity of the Stellenbosch University that provides information brokerage and knowledge transfer through publications, scientific talks, media interactions, newspaper articles, popular articles and talks, web pages, and social media platforms (Richardson et al. 2020).

Indigenous Organizations (also known in English as *Native People Organizations*, or *Indigenous Peoples and Local Communities*, among other names) are intermediary groups or institutions that use diverse strategies, such as indigenous research outputs and consensus building approaches, to inform policymaking decisions (Zurba et al. 2019). These groups have been historically overlooked or ignored in most nations worldwide due to a variety of reasons including prejudices based on discrepancies with the use of traditional western scientific method (Black and Tylianakis 2024), but often also due to plain covert racism (*sensu* Coates 2008) and lack of social inclusion. Nevertheless, indigenous researchers and community-based

teams have been practicing knowledge brokering for many years without proper/formal recognition as knowledge brokers (Fornssler et al. 2014). This group presents a variety of working flows, and types of work, depending on its composition. The researchers with which these organizations interact may not always be indigenous, although they are fervent advocates of the indigenous people and devoted to working on their behalf.

Industrial Organizations are those that support companies and employers of different types of industry, protect their rights, and collaborate with the government to achieve socioeconomic growth, as well as the generation and (re-)distribution of wealth. These groups are often opaque in their analysis, probably due to the confidential nature of the affairs commonly engaging them with different government offices and their intermixed agendas. Examples of these organizations are the shipping companies working with/for International Maritime Organization (IMO) or the many organizations grouping different oil and gas companies worldwide (e.g., Scientific and Environmental ROV Partnership using Existing Industrial Technology - SERPENT; Influence of man-made Structures in The Ecosystem – INSITE North Sea; National Decommissioning Research Initiative – NDRI Australia).

Consultants are people or groups of people who provide advice on a given process within a specialized field. They acquire, process, synthesize, and sell specific knowledge that is to be applied, or acted on, by their clients, and they are usually bound by a contract that demands confidentiality (Evers and Menkhoff 2004). Consultant groups are mostly incentivized by the fee they charge to their clients in exchange for their advice. However, members of consultancy groups may also follow the principles, incentives, and agendas of other groups they are members of (e.g., Academics, NGOs, etc.).

ESSENTIAL AND PARTICULAR INCENTIVES

We were able to identify twenty top incentives (Table 1) linking the different agents participating in a policymaking process within the field of biosecurity and environmental management. We also found that the incentives linking two specific agents (e.g., policymakers and a knowledge broker group, or one of these groups and knowledge producers) are often asymmetrical (Fig. 1). For instance, what incentivizes a policymaker to engage with a particular knowledge broker is not necessarily the same as what incentivizes that knowledge broker to engage with the policymaker. This asymmetry requires the initiating agent to understand how to motivate the other party, regardless of their own motivations. In this context, a policymaker might have different incentives to engage with different knowledge broker groups depending on the potential outputs of the interaction. There are, however, what we call *essential incentives* because they are invariable and always present. Regardless of what specific agents are involved in a policymaking process (or their values, interests, etc.), the essential incentives

are considered basic intrinsic components of the process. For instance, an essential incentive for policymakers to engage with knowledge broker groups in our study was *Translation* (see Table 1; Fig. 1). In a similar vein, we found that *Influence/Impact/Power*, and *Financial Gain*, were essential incentives for knowledge brokers to engage with policymakers. In contrast to essential incentives, which are crucial for all groups, we define *particular incentives* as those that are critically important but only for a minority of knowledge broker groups. In other words, particular incentives impact only one or a small number of groups. While each knowledge broker group is expected to have its own set of particular incentives, identifying them can be challenging. This is because memberships in different knowledge broker groups are not mutually exclusive, and individuals with multiple affiliations may participate in a specific knowledge brokering process on behalf of more than one group—each with its own distinct set of incentives (although, holding multiple affiliations with different groups involved in the same process may create conflicts of interest for the individuals involved.). In this work, we identified *Positive Social Perception* as a case that we found to be critically important only for the Indigenous Organizations group (Fig. 1).

SPECIAL FOCUS ON INDIGENOUS ORGANIZATIONS

Indigenous Organizations as knowledge brokers require a more detailed discussion for two specific reasons. First, indigenous research methodologies tend to differ considerably from the mainstream methodologies employed in global policymaking and evidence collection (Chilisa 2012, Smith 2021). Second, indigenous knowledge systems have been historically marginalized (e.g., Tengö et al. 2017; Diaz et al. 2018; Black and Tylianakis 2024). We would, thus, expect at least some different workflows and incentives to motivate indigenous knowledge producers and brokers, including kinship, self-determination, and social justice (Gordon and Datta 2022).

For indigenous researchers, kinship represent ties to family and tribe, but also with one's land and ancestors (see Salmón 2000). Kinship is important as an expression of both the researchers' indigenous identity and of their community-centered conception of knowledge (Diaz et al. 2018). Although indigenous worldviews, naturally, differ across geographic locations, an essential communal dimension is attributed to knowledge across places as far from each other as New Zealand (Smith 2021), Southern Africa (Chilisa 2012), Alaska, and South Asia (Gordon and Datta 2022). This conception is often contrasted with more individualistic ideas about knowledge production worldwide. It is thus important for indigenous researchers to both feel connected and serviceable to their kin (where that includes the land) in conducting research, and to foreground this connectedness as an essential element of knowledge production in their dealings with policymakers.

The notion of self-determination in the context of scientific research implies the need to stop being the object of research and become the subject (researcher). In this sense, indigenous peoples proclaim their right to tell their own stories, write their own versions, in their own ways, for their own purposes (Smith 2021), with control over what information is valid, as well as over how and when to share it (Black and Tylanakis 2024). For indigenous knowledge brokers and producers, fulfilling these aspirations constitutes a treasured and requisite incentive.

GAPS, NEEDS AND CHALLENGES IN KNOWLEDGE BROKERING

Although knowledge brokerage is now an essential part of the policymaking process, it is also among the least regulated activities, and only recently gaining global visibility (MacKillop and Downe 2023; MacKillop et al. 2023; Cvitanovic et al. 2025). The lack of tradition in the formal use of knowledge brokering in many countries not only explains the lack of proper regulatory frameworks but also the existence of deep social and epistemic injustices rooted in biases associated with the inadequate use of scientific evidence. Indeed, there are several gaps and needs that caught our attention during our project and that we think that should be addressed to 1) improve the transparency of the policymaking process, 2) better understand the values that interplay with the different agents and the evidence they handle, 3) improve epistemic justice throughout the process, and 4) monitor and regulate the impact of AI technologies, especially on the intersection with transparency, values, and epistemic justice.

Transparency

Knowledge brokering requires high standards of trans- and inter-disciplinarity. The success of a policymaking process will be largely determined by the quality of the knowledge broker groups involved. However, there is little we currently know about how these groups are created, or when and how exactly they operate (MacKillop and Downe 2023; Cvitanovic et al. 2025). Transparency is an essential part of the policymaking process, helping people to answer basic questions like: How are knowledge brokers selected? What are their motivations to participate? What methods do they use to select the evidence they harvest? What knowledge producers (researchers) do they engage with, and why? What do they consider valid evidence, and why?, etc. The fact that most of these questions lack an answer shows the urgent need for protocols to standardize how the different agents (i.e., policymakers, knowledge brokers, and researchers) are selected, and how they operate and interact with each other. Not only a mechanism but, perhaps, a whole new field of social science research is required to oversee and ensure a satisfactory performance of the policymaking process, while also spotting bad

behavior and misconduct. In fact, the absence of such a mechanism could serve as a red flag, indicating potential issues with correctness, legitimacy, and credibility in knowledge brokerage. Conversely, its presence could play a crucial role in fostering trust throughout the entire process (Cvitanovic et al. 2021).

Values

There are knowledge broker groups, like the Expert Groups or Research Organizations, that build their agendas with or around the mandates given by policymakers. Others, like the Industrial Groups, Consultants, NGOs and ThinkTanks, have prefixed agendas strongly influenced by their supporters, sponsors, regardless of the mandate. The way these agendas are created, the values they promote (whether private or public), and how evidence is weighed in these processes are often confusing and/or poorly known. However, since these factors influence the performance of each knowledge broker group and the success of the policymaking process, addressing this gap by improving our understanding of potential scenarios is an urgent necessity. Great care must be taken at this point, as the values upheld by different human societies can vary greatly in relation to the needs and priorities that guide them (see Maslow 1943).

Some knowledge broker groups have members who, because of their profession, can also be knowledge producers. However, shifting between these two roles while involved in policymaking may create conflicts of interest due to overlapping and potentially unstated agendas and interests. There is a widespread perception, often promoted by policymakers, that values play no role in the process of handling the evidence during the policymaking process (Khosrowi 2018). However, despite this “value free” normative ideal, there is consensus that ethical values enter the identification, selection and the weighting of evidence done by all the stakeholders involved in a policymaking process (Gluckman et al. 2021; Schwenkenbecher et al. 2023; Schwenkenbecher et al. under review). Similarly, we identified several such values as tantamount incentives relevant at various stages of the knowledge brokering process, including *justice* and *inclusion* in knowledge production (Fig. 1; Table 1). Indeed, knowledge brokering activities ought to be transparent at all levels and inform the ethical values involved during the policymaking process. However, since researchers’ values are an intrinsic part of the knowledge production, for instance in selecting the question they study, the methods, subject, time scale, and in the interpretation of their findings (Gluckman et al. 2021), regulatory frameworks should focus on revealing the internal working flows and rationale (e.g., transparency of reasoning; Heesen et al. 2024). Moreover, knowledge broker groups need ethical frameworks not only to standardize the way they are created as a group

(for example, detailing why and how members are invited by policymakers), but also to regulate the way they operate and interact with policymakers and knowledge producers, including the acquisition, consideration, and selection of the evidence they harvest.

Epistemic justice

Several epistemic injustices typically occur when different stakeholders are embedded in differential power structures (e.g., Oduaran et al. 2024). A researcher based in a developing nation is prone to several potential injustices at the hands of knowledge brokers based in the more powerful nations. The working hypothesis here is that socio-economic power shapes knowledge resources in line with the interests of the powerful (Harding 1991). Given the existence of uneven, unequal, and unjust global structures in which we live, such as the structures that sustain racism and post-colonial exploitation, the interests of the more rich and powerful nations tend to be pursued at the disadvantage of the less rich and powerful ones. This comes with distinctive consequences for knowledge production. One common consequence is that the knowledge and, more generally, the interpretative resources of developing nations are not considered when the evidence gathering is led by powerful rich nations (something known as *contributory injustice*; Dotson 2012). For instance, the findings made by indigenous researchers, such as traditional healers or indigenous conservationists, are typically ignored as ‘non-scientific’ when knowledge brokers present evidence to policymakers (Khan et al. 2021). Even when research produced in the less developed nations of the world is conducted in accordance with scientific norms pushed forward by the more powerful nations, or when researchers in low income nations find a way to pay the incredibly high fees imposed by scientific publishing enterprises, it often fails to turn up on the evidence radar because it differs from the academic mainstream (for instance by supporting alternative hypotheses, using alternative materials and methods, or citing local authorities instead of those dominating the international literature, etc.) or simply because the research is not published in English (Bortolus 2012; Oduaran et al. 2024). This scenario neglects the legitimacy of the less developed nations as knowledge-producers while it also excludes them from policymaking process, harming their interests.

Including the knowledge constantly produced in the least powerful nations is not a guarantee of justice if this inclusion is exploitative or appropriative. The former is a variety of what is known in the literature as ‘epistemic exploitation’ (Berenstain 2016), as researchers from less powerful nations are compelled to invest time, effort and resources in educating colleagues from more powerful nations about the implications of their lack of power (e.g., Bortolus 2012). The latter goes by the labels of ‘extractivist epistemologies’ (Alcoff 2022) or ‘epistemic

appropriation' (Davis 2018). This occurs when marginalized knowledge resources, such as indigenous research, are included without proper compensation for, or acknowledgement of, their intellectual labor. Inclusion can also be unjust if marginalized researchers are merely exploited to address logistical or administrative challenges, thereby enabling parachute science. All of these factors contribute to the exclusion of marginalized researchers from shaping the research agenda, thereby denying them influence over how their interests impact knowledge production and policymaking. These sorts of injustices are likely to occur at the top level of our knowledge broker diagram (Fig. 1). That is, knowledge brokers themselves may have a marginalized status (e.g., indigenous organizations, non-native English speaker scientists who publish in their native language alone, etc.). They can hence be excluded from policymaking or included in exploitative or appropriative ways by other knowledge broker groups and by the policymakers. Therefore, achieving an epistemically just knowledge brokering process would require a true integration of marginalized knowledge, its original producers, and brokers -as partners rather than subordinates or invisible contributors- in setting research agendas and conducting the research that generates evidence for policymakers.

Incorporation of AI technologies in policymaking

Artificial Intelligence (AI) technologies try to simulate the human intelligence process by using specialized hardware and software designed for writing and training machine learning algorithms. This kind of technology is increasingly used by individuals, groups, NGOs, and GOs, to search, select, compile, store, analyze, translate -including but not limited to idiomatic translation-, and synthesize scientific and non-scientific evidence imitating the procedures performed by human knowledge brokers and producers (Smith et al. 2023). AI technologies, indeed, has the potential to significantly enhance traditional decision-making processes by mitigating inherent human cognitive limitations and biases (Hisham et al. 2024). However, it may also act as a disruptor by diminishing the prominence of human knowledge brokers in acquiring and translating knowledge. In this context, despite ongoing efforts to understand the political and social aspects of AI governance or to forecast AI development timelines (Perry and Uuk 2019; Hisham et al. 2024), the role of AI technologies in policymaking has yet to be fully understood, defined, and regulated by knowledge users operating at different social scales (Criado et al. 2024) in order to ensure transparency, proper ethical values and the prevalence of epistemic justice.

It is widely accepted that AI technologies have rapidly expanded influence in domains such as fine arts, automobile industry, telecommunications, lethal weapon systems, robotics and alike

(Taeihagh 2021). However, little attention has been given to the fact that AI is already influencing not only private communication, news consumption, and commercial advertisements (Chauchard and Garimella 2024) but also core norms and values in the conduct of science (Blau et al. 2024). Certainly, AI has the potential to elevate the quality of knowledge brokering and policymaking processes; however, it can also selectively alter the availability and accessibility of information and evidence, ultimately leading to a concentration of power, inequality, and discrimination (Ulnicane et al. 2021). Furthermore, the role of AI technologies remains worryingly uncertain in scenarios where evidence is insufficient or entirely absent, especially given that assisting algorithms are often designed to prioritize information aligned with a client's or user's history and interests, rather than presenting a comprehensive and diverse range of perspectives. Indeed, until regulatory frameworks are agreed and established for the proper governance of AI, the likelihood of its misuse and unlawful application is expected to rise as rapidly as technologies evolve. Not even the largest technology companies worldwide (e.g., Alphabet, Amazon, Apple, Meta Platforms, IBM, and Microsoft), which invest billions in developing their AI capabilities and strategies for managing knowledge (Djeffal et al. 2022; Singh Chawla 2022; Rikap 2024), currently have solid frameworks for AI governance across the nations in which they operate.

It is important to clarify that AI technologies are merely tools and do not inherently threaten knowledge brokering or policymaking activities. Instead, the responsibility lies with those who control the spaces where their design and operation are defined. For example, Google's 1998 founding mission statement included a commitment to 'organizing the world's information and making it universally accessible and useful'. However, like most business enterprises, many of its services come with costs that not everyone can afford. The commercial nature of such companies interferes with the principle of "universal accessibility," ultimately disadvantaging less wealthy users. This sort of challenge has led companies like Google to reconsider their mission, objectives, and societal responsibilities (Gibbs 2014). Furthermore, these companies, their owners and directors, may eventually hold ideological positions (e.g., political, religious, moral) that could hinder the goal of universal access to information. To prevent such injustices from occurring or being overlooked, it will be essential to appoint independent oversight bodies to monitor the entire process, establishing clear protocols for action and codes of conduct to ensure fair and responsible AI governance.

It is likely that the use of AI technologies in policymaking will soon shift from optional to mandatory or at least unavoidable, as the exponential increase in the publication rate of both scientific and non-scientific knowledge continues to outpace human capacity to process it

(Bornmann and Mutz 2015; Gui et al. 2019; Park et al. 2023). In this scenario, while a growing body of information is generally desirable for those seeking knowledge, the limited human capacity to process vast amounts of data from diverse sources will inevitably compel knowledge producers and brokers to rely on AI technologies regularly. If the production and publication of knowledge continue to expand at such a rapid pace, AI could eventually replace all other knowledge broker groups in tasks such as identifying and selecting relevant information and evidence, synthesizing it, and translating it to suit the needs of each policymaking process. Given the rapid evolution of AI technologies and its user-friendly design, this transition could occur within a few years. Therefore, we support the experts' idea that establishing appropriate local, regional, and international regulations for the governance of AI in policymaking is imperative (Perry and Uuk 2019; Wirtz et al. 2019; Hisham et al. 2024).

CONCLUDING REMARKS

Although far from exhaustive, the spectrum of knowledge broker groups we present in this work is, to our knowledge, the most diverse and inclusive ever recorded (see Gluckman et al. 2021; MacKillop and Downe 2023; Sarkki et al. 2020), incorporating social actors (e.g., indigenous organizations) who, until recently, were often marginalized or entirely overlooked (see Zhang et al. 2022). However, there is no clear evidence to suggest that most current policymaking and knowledge brokering processes are, in practice, as diverse and inclusive as we might hope or expect them to be. Indeed, the correctness and justice in each policymaking process depend not only on how diverse or inclusive are the knowledge broker groups involved but also on factors like how the different groups' inputs are weighted, the way each claim legitimacy through using selected evidence (Schneider et al. 2025), or the way social and epistemic justices are ensured throughout the process.

We urge those involved in policymaking and knowledge brokerage to establish local, regional, and international regulatory frameworks (Criado et al. 2024) that include, for instance, codes of conduct and protocols to ensure transparency and correctness in knowledge brokering activities throughout the policymaking process. These regulatory frameworks should address—but not be limited to—the following aspects:

a) Strive for transparency of reasoning (Heesen et al. 2024), ensuring that the ethical values guiding the policymaking process are clearly articulated (Schwenkenbecher et al. under review).

b) Explicitly define and publicly disclose the rationale and criteria used to select the different agents involved in the process.

c) Conduct a thorough identification of the incentives linking the various agents and actively identify potential conflicts of interest among them.

d) Clearly define and publicly disclose the criteria used to determine, identify, and weigh the evidence utilized in the process.

Another major issue is that the effectiveness and impact of different knowledge broker groups involved in each policymaking process will likely vary significantly, depending on how epistemic injustices— whether contributory, extractivist, or exploitative—are addressed. Therefore, every policymaking process should provide details on the actions taken to mitigate inequalities in the distribution of evidence across different time periods, regions, languages, cultures, and ethical contexts.

Indeed, the policymaking process can be virtuous but also can be tricky and messy (Kitson et al. 1998) with an intensity that can vary greatly across time, regions and nations. Governments often need to make decisions in absence of conclusive evidence, and that is when the brokers must do their best to determine the sufficiency of evidence or warn about the consequences of using insufficient evidence. Individual brokers should never take a role in the policy choice process but to present the best possible alternatives supported by the evidence available. It is of critical importance to designate viewers that can monitor the transparency and correctness of the mechanisms mentioned above including the invitation of the knowledge broker groups (i.e., choosing what members and groups will participate), detailing the internal working flow and the rationale used to support the decision making. This is a call for a whole field of programmatic study, as we have almost no grasp on this social ecosystem and a little sense of what monitoring or interventions will be helpful, irrelevant, or even damaging!

Finally, as AI technologies become a full-fledged participant in knowledge brokerage, it must adhere to the same standards and requirements as traditional knowledge brokers. AI applications will likely soon surpass human knowledge brokers in speed and efficiency, processing and synthesizing vast amounts of evidence at an unprecedented pace. However, it must be made perfectly clear how AI will navigate decisions involving complex moral dimensions that only humans fully comprehend and that vary across cultural, regional, and temporal contexts.

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Figure 1. Conceptualization model of the agents involved in the policymaking process, and the incentives linking them in the field of Biosecurity and Environmental Management (“+” marks presence). The arrow-ends point in the direction that each specific agent follows with a given set of incentives to engage another specific agent. 1: grants, awards, etc. 2: logistics, operational, etc. 3: only for standing groups. 4: comp. funding. 5: travels, awards, etc. 6: social inclusion

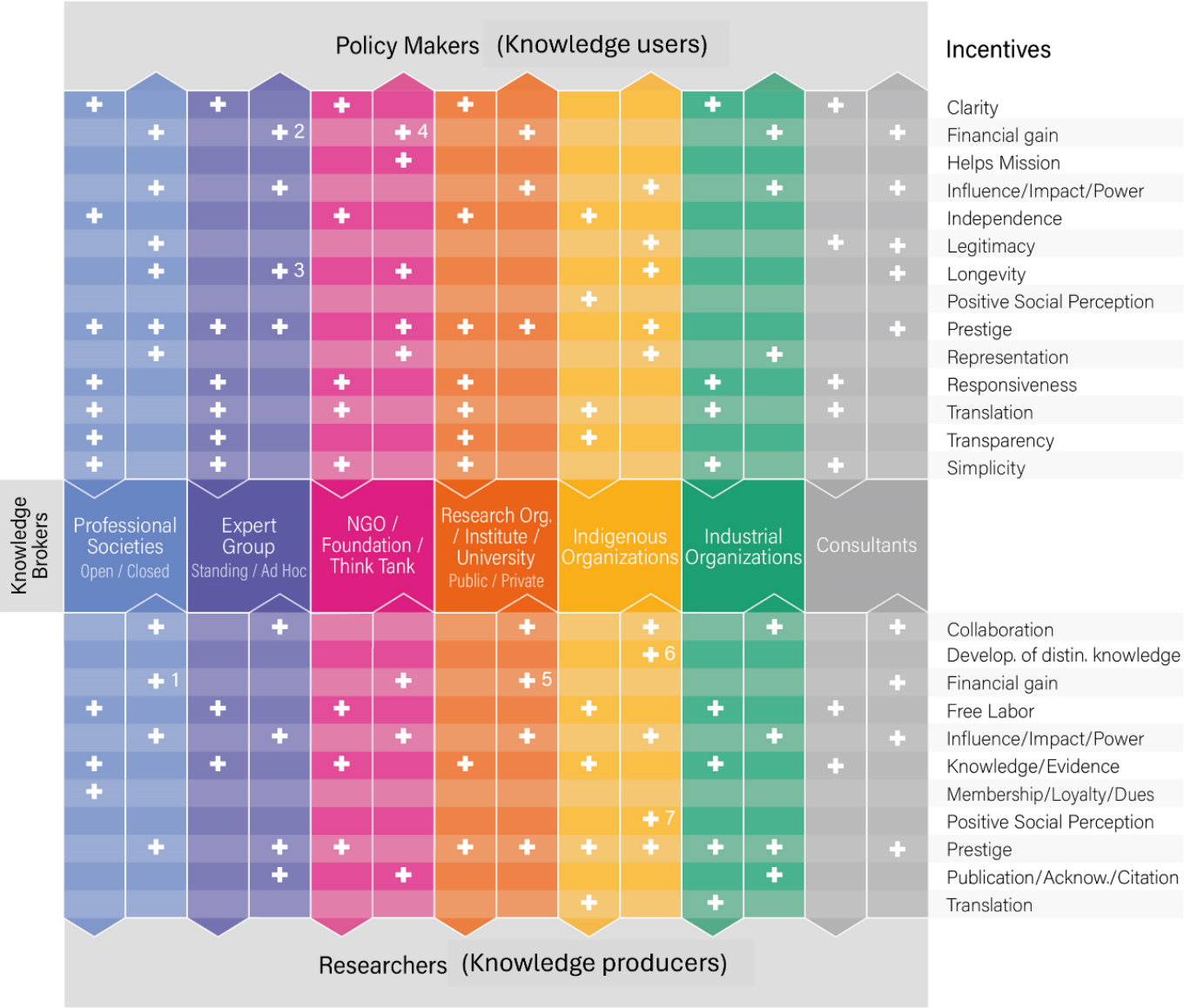


Table 1. List of the top twenty incentives connecting various agents/stakeholders involved in the policymaking process within the fields of biosecurity and environmental management. The right column presents the interpretations as understood during the course of this work.

Incentive	Meaning
Clarity	Ability to explain complex technicalities to non-expert interlocutors.
Collaboration	Interaction with colleagues and/or their institutions.
Development of distinctive knowledge	Actions directed to achieve epistemic decolonization.
Financial Gain (money, logistics, operational, Grants, Awards)	Reception of money or similar values/goods in exchange for a given activity, advice, material, or service.
Free labor	Collaboration ad honorem/pro bono.
Helps Mission	Aligned with, or aiming at, the same goals specified in the group/subject's Mission.
Independence	Lack of conflict of interest with, or influence from, external groups or individuals.
Influence / Impact / Power	Ability to cause an effect in direct, indirect or intangible ways.
Knowledge / Evidence	Result/product of the professional work of researchers.
Legitimacy	Accordant with law and/or with established legal forms, protocols, and requirements. Demonstrative of being genuinely good and capable of success.
Longevity	Time of existence, permanence, or durability.
Membership/Loyalty/Dues	The state of being a member of a group after the payment of a fee.
Positive Social Perception	Collective agreement on the fact that a subject has the best qualities in a given human dimension.
Prestige	Widespread respect and admiration normally based on the perception of the subject's achievements or quality.
Publication / Acknowledgement / Citation	Facilitating/propitiating the writing of new research or the explicit mention of past research currently published or not.
Representation	Act of speaking or acting on behalf of a group, its perspectives, and its interests.
Responsiveness	Ability to respond fast to a given demand for research/evidence.
Simplicity	Ability to reduce the technical and disciplinary complexity of the research/evidence to a minimum without losing meaning.
Translation	Change the idiom and technical language to match the needs of knowledge users.
Transparency	Open access of explicit protocols and internal working flows.