A Rapid Systematic Literature Review of the Influence of Language and Culture on Science Advice

Abstract

This review analyses relevant literature that contributes to understating the influence of language and culture on science advice. It is a rapid systematic review using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses framework. Four themes were identified for categorizing culture: ethnic, national, organizational, and disciplinary (scientific) culture. Language was grouped into two main groups: native and disciplinary, with another sub-category identified by linguistic markers. The need for reliable scientific advice is mounting due to the numerous global challenges and uncertainties associated with them. The complexities of the challenges require that all useful knowledge sources and evidence are utilized to provide solutions. Additionally, there is often limited time to provide scientific advice, as seen during the COVID-19 pandemic. This review analyzed these uncertainties within the theory of post-normal science. There are questions as to whose knowledge should be relevant and legitimate, especially within the perspectives of cultures and languages. Some advocate for the use of plain language in communicating scientific advice and the avoidance of the use of technical or scientific jargon. Others suggest the use of native or indigenous language known as multilingual language in communicating science advice. What is not clear, from the literature is the framework within which these aspirations can be achieved without any dilution of the science. There are suggestions for the use of boundary organizations like the Intergovernmental Panel on Climate Change (IPCC) to act as an intermediary between the two different cultural communities of science and policy. Some have faulted the IPCC due to its disconnection from local cultural values in policymaking. There is also a proposed alternative such as the use of brokers. Legitimacy could guarantee the sustainability of useful indigenous knowledge. There seems to be an epistemic injustice that has denied the global science advice systems the benefit of gaining from tested marginalized knowledge. The narrow framing of language and culture is shown to contribute to marginalization or disregard for some kind of knowledge.

Keywords: Language, culture, science advice, scientific advice, legitimacy, knowledge sources.

Methodology

The rapid systematic review was based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework (19). The framework follows four stages of "identification", "screening", "eligibility" and 'included" for the selection of the final peer-reviewed papers. The systematic search for relevant literature at the identification stage was conducted in four databases: Scopus, ScienceDirect, PubMed and Web of Science, using the flowing keywords: "culture and science advice", "culture and scientific advice", "language and science advice", and "language and scientific advice". The search covered publications written from the inception of the databases to March 2023 when the review was done. The selection criteria were adopted to account for relevant literature on culture and language influence on science advice in the following field: social sciences, decision science, arts, and humanities, multidisciplinary, history, philosophy, and philosophy of science. The search was not restricted to any country. The quality assessment was performed on original research articles, letters, comments, and book chapters. The abstracts were initially reviewed for inclusion and exclusion. The evaluation was limited to publications written only in English Language. Duplicate records were removed. The complete articles were reviewed for extraction of the included peer-reviewed papers. Some other relevant literature not found in the searched databases but were cited in some of the reviewed papers were directly retrieved from the publication journals and grey literature websites.

Scope

The science advisory mechanism and its stakeholders are evolving with time owing to "wicked" problems arising from global challenges in public health, climate change, food-water security, and biodiversity in general (1–3). These are complex problems that require a multifaceted approach in trying to provide solutions. It has, therefore, put enormous pressure on science advisers and has given rise to a plethora of actors in providing advice to stakeholders in the policymaking ecosystems such as the legislatures, diplomats, policymakers, government parastatals and agencies, end users and international organizations (1,3–5) like the World Health Organization and the United Nations.

The legitimacy, credibility, salience, and sustainability of scientific advice are major concerns to stakeholders in the policymaking process (2,6–9). There are questions about whose expertise counts, who delivers the expertise, and what knowledge sources are considered credible and admissible. The COVID-19 pandemic has exemplified some lacunas that exist in the current science advisory mechanisms and

policymaking systems such as the narrow epistemic framing of knowledge and its sources (10–14). Nonetheless, the pandemic has only exposed a long-standing challenge of how different global cultures and languages in different contexts impact knowledge production for science advice. Very limited literature exists with a focus on understanding the influence of culture and language on scientific advice. It has not been given significant policy attention.

Language and culture within different contexts could affect the delivery and acceptance of scientific advice. They could shape the interpretation and understanding of scientific information. Therefore, the contextualization and conceptualization of both language and culture are important in tailoring science advice. Language forms the primary tool of communication and the medium through which scientific information is transmitted. However, the use of jargon and complicated terminology in science communication can lead to miscommunication or a misinterpretation of the intended message. Some authors advocate for the use of clear and understandable language in the communication of scientific knowledge with the target audience in view (15). Some have also stressed the importance of communicating science in different native or indigenous languages referred to as multilingual language (16). On the other hand, cultural differences also play a critical role in shaping the acceptance of scientific advice (2,3,9) and this could assume different perspectives (1,17). Different cultures are associated with varying attitudes, beliefs, values, and norms that can directly impact how the public understands and interprets scientific information. The inclusion of such diversity in a policy context helps to secure credibility, legitimacy, and salience (2,18). It also helps to build trust. Science and policy interaction is characterized by two different cultures. For science advice to benefit from these two communities, an understanding of the factors and how they can influence science advice is required to help in effective bidirectional communication and information flow. Although most of the literature suggests the use of plain language for communicating scientific knowledge and facilitating interactions across the science-policy interface, there is no clear understanding of how this can be achieved.

This review examines available literature that provides insight and evidence on how culture and language influence scientific advice. It also attempts to provide narratives on what constitutes legitimate expertise and scientific knowledge sources. The methodology followed a systemic literature search, and the results are presented based on sourced data. The discussion section examines the common theories and frameworks such as post-normal science and boundary organizations. Since the work is a rapid systematic literature review, there are limitations to the papers captured for the review due to the limited search

terminologies used. The database search was also limited. The literature on the concept of legitimacy and knowledge sources was limited to those found in the content of the papers reviewed for cultural and language influence on science advice. Similarly, the discussions on port-normal science and boundary organizations were examined as a theme from the reviewed papers.

Results

This section presents an overview of the extracted results. The PRISMA flow chart in Figure 1.0 provides an overview of the search results. A total of 94 papers from the databases passed the selection process defined in the methodology section. An additional 13 publications that were referenced elsewhere in the reviewed papers, were sourced directly from the publication journal. After excluding duplicates and off-topic papers, 55 papers were scanned for the eligibility test. Many papers did not clearly contribute to the research questions such as how culture and language influence science advice, and what could be considered legitimate expertise and knowledge source. Therefore, only 43 peer-reviewed papers were considered. The distribution of the papers in the various databases is presented in Figure 2.0. Most of the papers were retrieved from ScienceDirect. None of the papers from the Web of Science was captured. Many of the publications are articles and book chapters as shown in Figure 3.0.

Figure 4.0 shows that the scarce literature spans the period 1986 to 2022. Researchers' interest in understanding the cultural and language influence on science advice tends to be more recent with few relevant publications increasing from around 2007. Based on first author analysis, the United States and the United Kingdom have the highest number of publications contributing to the study's understanding. The contribution by countries is presented in Table 1.0. Most of the published papers have case studies drawn from health and the environment. For example, one of the oldest papers by Stone (20) in 1986 discusses how the implementation of a Public Health Policy in the Indo-Nepalese groups of Nepal did not optimally achieve its goal due to poor and narrow conceptualization and contextualization of culture by the experts. The review also shows relevant publications that examine the importance of a process, a common and understandable language, or a layperson's language to aid communication between knowledge producers and those seeking advice (21–26).

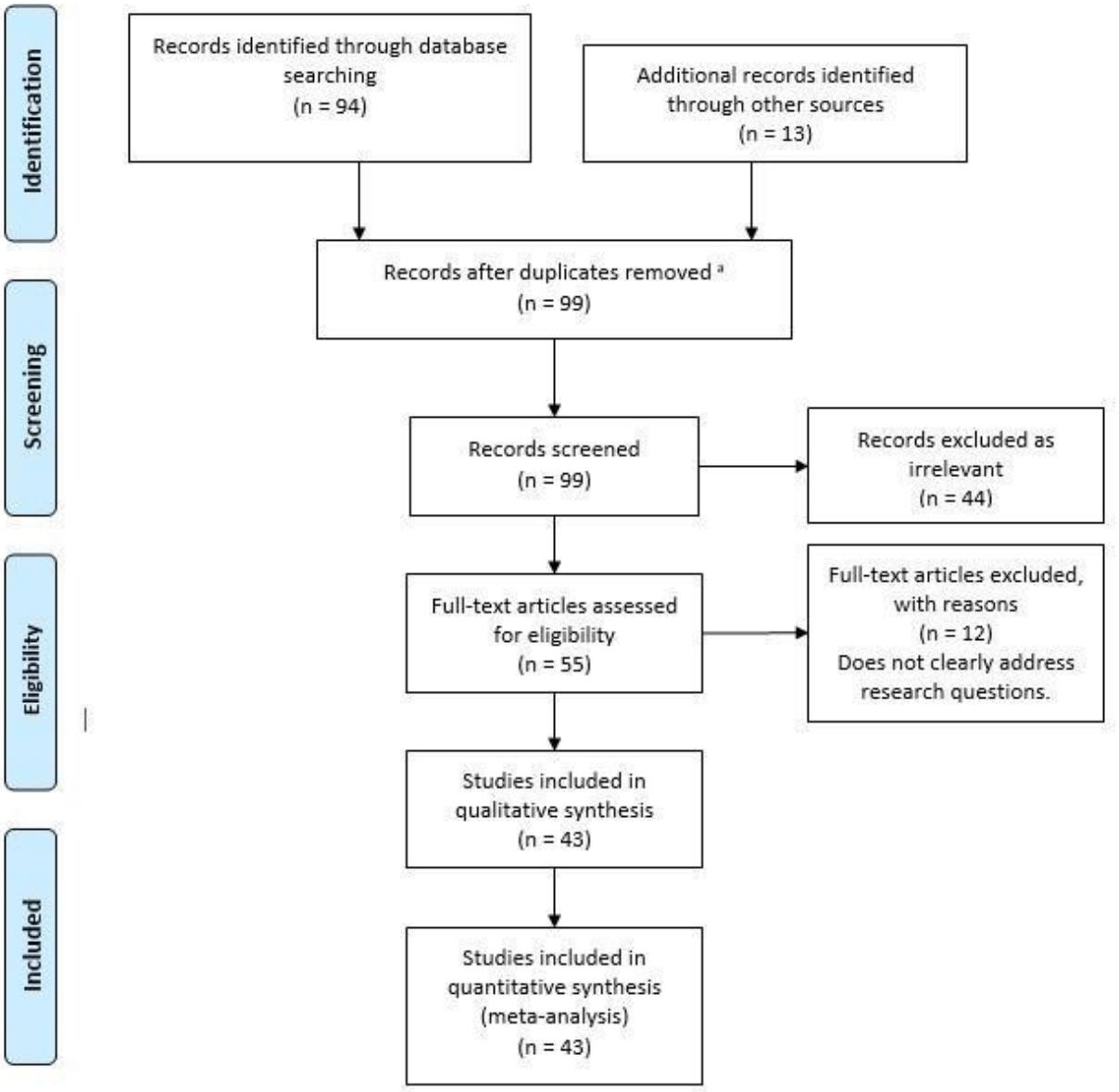

Figure 1. Study flow chart diagram using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (19).

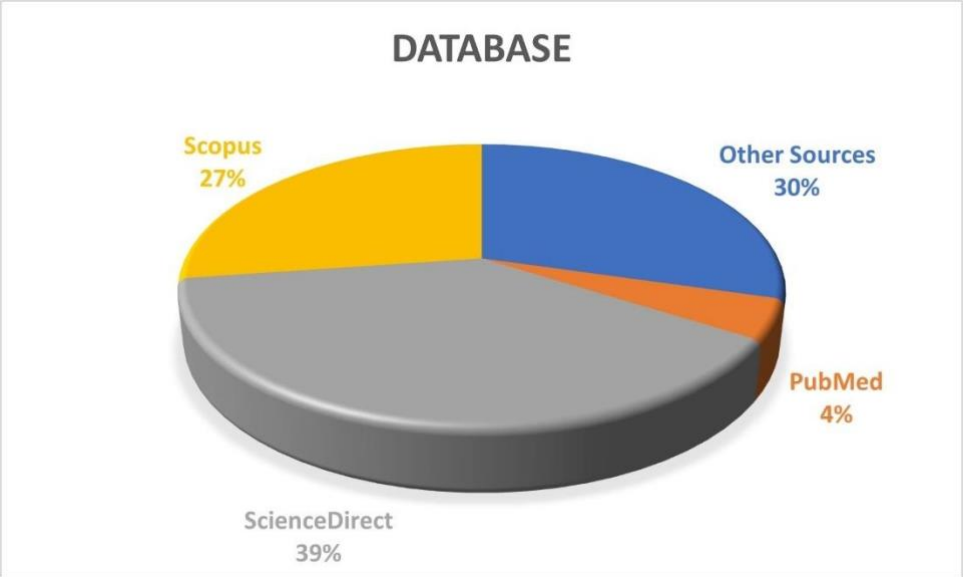

Figure 2.0. Publication distribution across databases.

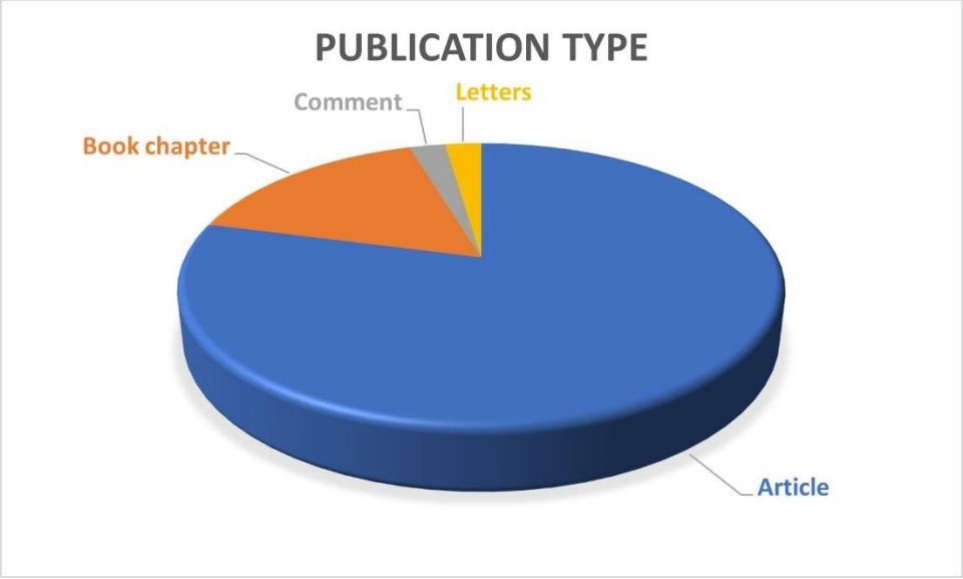

Figure 3.0. Publication type distribution.

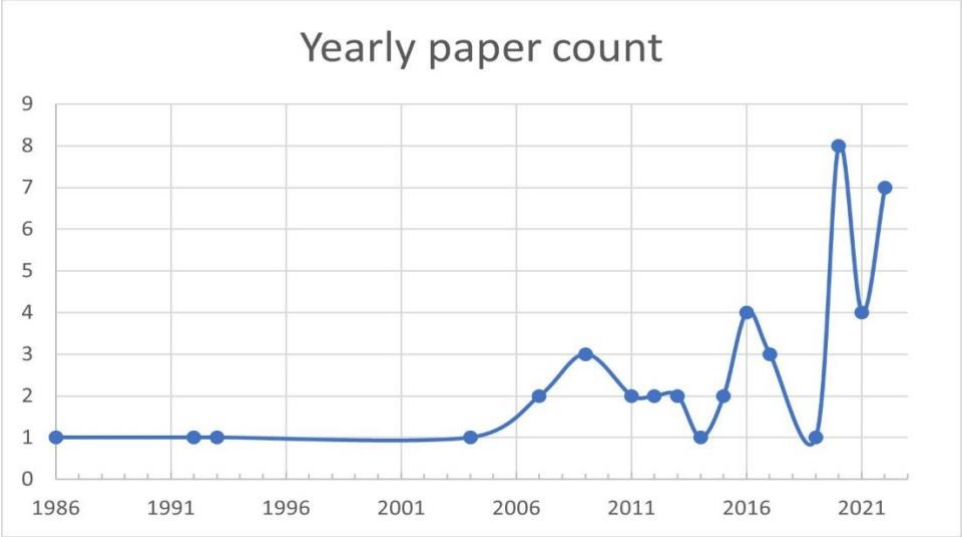

Figure 4.0. Yearly distribution of peer-reviewed publications in understanding the influence of culture and language on science advice.

Table 1.0. **Paper distribution by country based on first authorship.**

SN	**Country**	**No of articles**
1	Sweden	2
2	United Kingdom	11
3	France	1
4	Netherlands	2
5	Canada	3
6	Germany	1
7	United States	11
8	Australia	1
9	Norway	3
10	Philippines	1
11	Israel	1
12	Spain	1
13	New Zealand	1
14	Panama	1
15	Italy	1
16	Ethiopia	1

Away from the professional or technical language in communicating science, Melissa *et. al.'s* (16) paper expresses a perspective of communicating scientific knowledge in different indigenous languages. The authors argue with evidence that this has prevented a robust engagement of non-English speakers' scientists. A few of the papers also attempt to characterize what could be regarded as legitimate expertise and the identification of different sources of knowledge (22,27,28). An analysis of the papers' arguments is examined in the discussion section. The paper titles and citations are presented in Table 2.0.

Table 2.0. Publication titles and citations.

SN	Title	Citation
1	Evaluation of science advice during the COVID-19 pandemic in Sweden	17
2	Knowledge, Expertise and Science Advice During COVID-19: In Search of Epistemic Justice for the 'Wicked' Problems of Post-Normal Times	36
3	Science Advisors and "Good Evidence": A Case Study	0
4	Revealing a paradox in scientific advice to governments: The struggle between modernist and reflexive logics within the PBL Netherlands Environmental Assessment Agency	9
5	The science-policy interface in fisheries management: Insights about the influence of organizational structure and culture on information pathways	20
6	Cultural Imprints on Scientific Policy Advice: Climate science-policy interactions within Austrian neo-corporatism	6
7	Post-normal institutional identities: Quality assurance, reflexivity, and ethos of care	14
8	Exploring the science–policy interface on climate change: The role of the IPCC in informing local decision-making in the UK	35
9	Nomenclature, chemical abstracts service numbers, isomer enumeration, ring strain, and stereochemistry: What does any of this have to do with an international chemical disarmament and nonproliferation treaty?	6
10	Communicating Science in a Policy Context to a Broader Audience	2
11	Communicating soil carbon science to farmers: Incorporating credibility, salience, and legitimacy	45
12	Assessing the use and weight of information and evidence in U.S. state policy decisions	13
13	Primary health care for whom? Village perspectives from Nepal	62
14	Climate change and community fisheries in the arctic: A case study from Pangnirtung, Canada	36
15	Environmental Policy	2
16	Science, New Forms of	3
17	Culturally sensitive boundary work: A framework for linking knowledge to climate action	5
18	Policy responses and government science advice for the COVID-19 pandemic in the Philippines: January to April 2020	55
19	Understanding the science-policy interface: Case studies on the role of information in fisheries management	19
20	Extended Peer Communities: Appraising the Contributions of tacit knowledge in climate change decision-making	5

21	Institutional Framework for the Science–Policy Interaction	2
22	Beekeepers' Knowledge and participation in pollinator conservation policy	47
23	Doubling food production to feed the 9 billion: A critical perspective on a key discourse of food security in the UK	251
24	Revisiting the politics of expertise in light of the Kyoto negotiations on land use change and forestry	38
25	Receptivity to scientific and technological advice	3
26	COVID-19 and science advice on the 'Grand Stage': the metadata and linguistic choices in a scientific advisory groups' meeting Minutes	0
27	Bringing Policymakers to Science Through Communication: A Perspective From Latin America	1
28	The Art of science advice to Government	187
29	Are issue cycles culturally constructed? A comparison of French and American coverage of global climate change	556
30	Science communication in multiple languages is critical to its effectiveness	69
31	Understanding citizen perceptions of science controversy: bridging the ethnographic–survey research divide	230
32	What's next for science communication? promising directions and lingering distractions	1118
33	Brokerage at the science-policy interface: from conceptual framework to practical guidance	51
34	Religious beliefs and public attitudes toward nanotechnology in Europe and the United States	278
35	Knowledge and science advice during and after COVID-19: Reimagining notions of 'expertise' for post-normal times	6
36	Epistemic injustice: Power and the ethics of knowing	8308
37	A cautionary tale: On limiting epistemic oppression	560
38	Conceptualising joint knowledge production in regional climate change adaptation projects: success conditions and levers for action	403
39	Salience, credibility, legitimacy and boundaries: linking research, assessment and decision making	748
40	What developing countries can teach rich countries about how to respond to a pandemic	19
41	Whose evidence counts: exploring evidence pathways during the Covid-19 crisis in Panama's Housing Ministry	0
42	The Emergence of Post-Normal Science	499
43	Network determinants of knowledge utilization: preliminary lessons from a boundary organization	130
44	Understanding COVID-19 in Africa	45
45	Alma-Ata 1978 Primary Health Care Report	5

Discussion

Contextualizing Language and Culture

The influence of culture and language on science advice has not been extensively studied. However, the scarce academic literature available provides some useful background information. the review shows that culture is conceptualized around four main themes:

1. Ethnic or local belief systems, (20,29–31)
2. Political (national), (1,32)
3. Organizational and (9,30) and
4. Disciplinary or professional (scientific) culture (23,33)

Language is described using two main categories:

1. Indigenous or native language (16), and
2. Technical or professional language which includes scientific jargon (23).

Another class of language which could be regarded as a subcategory are those characterized by linguistic markers which are pretty much used by science advisors in communicating certainty and uncertainty. The United Kingdom Scientific Advisory Group for Emergencies (24) often use this type of language during the COVID-19 pandemic. Details of this will be discussed later.

There is very limited peer-reviewed literature on the influence of native languages on science advice apart from the English Language. Most of the publications emphasize the linguistic choice of professional language in science advice and communication (21–23,30,34). The available case studies are largely drawn from the environment and public health domains. Nonetheless, the review shows that culture and language could significantly influence the mechanisms of scientific advice, including the source and legitimate expertise of scientific knowledge.

Renn (17) succinctly captures the different categories of cultural styles under which national cultures towards science advice and policymaking could be categorized. Renn describes cultural styles as the different approaches adopted by policymakers in the use of sciences in different countries. The author described culture in the context of a national outlook on how the policymaking arena is constructed such as who is included or excluded in the policymaking process The work discusses how insensitivity to the different national cultural styles, values, and norms could weaken the effectiveness of a policymaking

making process and the policy outcome. It faulted the sole reliance on systematic knowledge in a policymaking process. An example of this is seen in the implementation of the Primary Health Care (PHC) policy in Indo-Nepalese groups of Nepal in South Asia (20). Though the PHC policy as promoted by WHO contains declarations that consider culture (35), however, it appears that the cultural needs and criteria for who is included among the community health workers and committee are already conceptualized and defined by WHO thereby leading to poor implementation (20). The Indo-Nepalese group is a region with strong socio-cultural norms and diverse ethnicities with their beliefs. Designing a healthcare policy in such a region is expected to assume one or a mix of the policy-making styles described by Renn (17) such as the adversarial and mediative styles of policymaking that encourage legitimate inputs from diverse stakeholders, including indigenous expertise. However, it appears that the PHC policy held some misconceptions and negativity with limited knowledge about Nepalese culture and indigenous traditional medicine which resulted in the poor performance of the policy. The author (20) concludes that the policy has a narrow framing of cultural norms and the local stakeholders for the policy implementation. Similarly, the assessment of Howarth *et.al* (30) on the role of the Intergovernmental Panel on Climate Change (IPCC) in informing local decision-making in the UK, is another critical piece of evidence that reflects the impacts of disciplinary language and culture in science advice. The work acknowledges that local decision-makers have a useful local understanding of managing the impact of climate change with solutions for low-carbon transformations based on their values and needs, however, there is a disconnect between the IPCC's decision-making processes and these values. Therefore, the local decision-makers tend to seek alternative resources that best align with their values compared to IPCC's advice. This poor involvement of local stakeholders' culture and expertise has generated concerns over the limitation of the political and scientific approach to climate change. The authors described this as an information deficit model and very authoritative in advising climate change policies. Although the IPCC assessment report is generally regarded to be of very high quality, another obstacle in accessing its usefulness is the linguistic choice used in the report. The language is described as "technical", "heavy", "dense", and "inaccessible". The local decision-makers often find themselves in need of interpretation and understanding of this technical jargon, or in some instances, they provide the interpretations or paraphrases to internal staff in layman's language, or by also distilling the reports in locally relevant summaries.

A study on how communication of scientific knowledge to stakeholders, such as diplomats and policymakers in Latin America was undertaken by Pulido-Salgado *et.al.* (25). The investigation also revealed that technical or disciplinary language used by researchers makes it difficult for the policymakers

to easily access and utilize science in addressing policy questions and social concerns. The research supports the use of easily understandable language in communicating science in the science policy ecosystem as one of the most cited solutions for bridging the cultural gap between researchers and policymakers. The scientific evidence producers (researchers) in Latin America and the policymakers consider simple language as a key to helping science inform policy. Although there was no framework or definition to what simple language means without diluting the scientific information. Therefore, the authors argue that a communication bridge could effectively connect policymakers with science. They concluded that it is possible to find a common language which will build that bridge between the researchers and the policymakers if research evidence is to be optimally utilized. Perhaps to put a perspective on defining simple language, Márquez *et. al.* (16) examines multiple language applications in communicating science, whether for informed policymaking or enhancing inclusivity and legitimacy. The authors consider the use of a single language such as English in communicating scientific knowledge and evidence as a bias. They support the argument that this leads to polarized cultural views and ignores the perspectives of non-English speakers in global science. A given example is the high rate of rejection of research papers written by non-English speakers based on grammar and not the quality of the science they project. They argue that this could lead to unreported useful scientific knowledge. The authors attempt to forward a few recommendations such as developing a multilingual framework for producing and accessing scientific knowledge. They hold the view that such a framework will support inclusivity and could improve legitimacy in terms of acceptability due to cultural alignment. Some other authors have similarly expressed concerns for legitimacy due to the cultural divide (20,30). The contribution from Bar-On H (21) adds to some authors' views in this review by suggesting a common and simple language that will facilitate interaction among scientists, politicians, science advisers, lawyers, social scientists, and the humanities. However, it appears that no clear framework exists yet.

The work of the Scientific Advisory Group for Emergencies (SAGE) in the United Kingdom during the COVID-19 pandemic was studied by analyzing the minutes of their meetings for the period 22 January 2020 to 13 May 2021, comprising 89 minutes (24). This study describes the language used by SAGE scientific advisers during the period when communicating certainty and uncertainty. Linguistic choices when providing advice could influence the public acceptance or rejection of the advice. The language they used cannot be categorized as scientific disciplinary language. The authors described it using linguistic markers. Two types of such markers were identified: boosters and hedges. Boosters are used to emphatically make assertions that rely on evidence. It defines the certainty of the advice. Examples are

phrases or words like “evidence shows” “clear” particularly”, “will” “highly likely” and “particularly important”. Conversely, hedges are usually deployed to signal uncertainties in the assessment that have been done for government or public consumption. Such advice is characterized by words like “probably” “may” “indicates” and “highly uncertain”. However, there are instances where they use both markers to draw attention.

Epistemic injustice, expertise legitimacy and knowledge sources

The literature review has shown that culture and language can exclude certain sociocultural classes from contributing to the scientific knowledge pool from which advisers draw knowledge for policy advice. Such bias monopolizes knowledge expertise and promotes epistemic injustice described by Fricker (8) and Dotson (36). Fricker defined epistemic injustice as when ‘someone is wronged specifically in her capacity as a knower’. For Fricker, this is observed in two ways, firstly when a knowledge source or ‘knower’ is discredited due to prejudice and secondly through hermeneutic injustice, created by a lack of conceptual resources required to understand or express the knowledge. Dotson’s position refers to the marginalization and exclusion of certain groups from the process of knowledge production. Both cases limit the robustness of advice and promote assumptions and wrong predictions. Within the framework for knowledge sources in climate change adaptation and disciplinary boundary, Hegger *et.al*. (37) and Cash *et.al* (38) summarize legitimacy as the accommodation of different perspectives in the knowledge production process, the reconciliation of opposition views and the explication of assumptions. They submit that legitimacy, salience (the relevance of information for an actor’s decision choices, or for the choices that affect a given stakeholder), and credibility (whether an actor perceives information as meeting standards of scientific plausibility and technical adequacy) are not mutually exclusive. The authors faulted how IPCC prioritizes credibility and undervalues the other two attributes. The research by Howarth *et.al* (30) and Stone (20) discussed earlier is an example of the conflict that could arise when such priority is made.

Ingram *et.al*. (22), who report on the understanding of the communication of soil carbon science to farmers across Europe, exemplifies the importance of incorporating the Hegger *et.al*. (37) and Cash *et.al* (38) framework for legitimacy, even though certain challenges were acknowledged such as the fair management of diverse views or sometimes, contradictory views. Overall, the research shows that there are opportunities in overcoming these challenges and having a robust understanding of knowledge production and framing of scientific evidence. A reflection on the Pangnirtung-Canada case study on

climate change and community fisheries in the arctic shows that the world could be losing some critical scientific knowledge from indigenous knowledge that could inform sound policy advice for the public good (27). A focus group discussion in the research attested to the fact that there is a weakening in traditional knowledge and expertise, which in some way affects the response to climate change. Legitimacy could in a sense guarantee the sustainability of useful indigenous knowledge. The global management of the COVID-19 pandemic portrayed another example of an epistemic injustice where the Global North showed some unwillingness in acknowledging and learning from the knowledge and perspectives of the Global South (12). For example, Africa which was less impacted by the virus compared to Europe and the United States of America, has had to deal with other kinds of outbreaks such as Ebola and the Zika virus among others. The continent has developed some hard lessons, knowledge, and experiences in managing outbreaks, or may be developed some forms of immunity over time, yet because of the narrow contextualization and conceptualization of knowledge sources and legitimacy, many countries in the Global North failed to benefit from shared knowledge and local expertise in the Global South (10,39–41). Even within the Global North, there were instances such as in Sweden where certain classes of knowledge sources were excluded or disregarded in the management of the COVID-19 pandemic (11). The Public Health Agency (PHA) was criticized for not considering expertise outside the agency, also claiming that other countries' knowledge about the pandemic was wrong. It is a clear example of a narrow framing of expertise and knowledge sources even though Sweden has a strong national competence and resources. This failure was attributed to the reorganization of the PHA between 2010 and 2012 which saw six professors leaving the agency. The poor management of scientific evidence eventually led to the lowering of the ethical rating of Sweden by the British independent sustainability rating agency "Standard Ethics". The conclusion drawn by de Paredes (42) in exploring evidence pathways during the Covid-19 Crisis in Panama's Housing Ministry gives a perspective on the Sweden case and the powers that could influence scientific advice. The author shows that evidence pathways can be swayed by internal and external political influence, social class identities and the government's role. de Paredes (42) conclusion aligns well with the views of some other author's referenced in this review.

Post-Normal Science and science advice delivery in pressured times and uncertainties

Under low uncertainties and decision stakes, science advisers have the luxury of time to iterate a policymaking process with a selective approach to knowledge production and sourcing to determine

which strategy best solves a problematic situation (43). They often find the application of routine methods sufficient in addressing the problem. When the uncertainties and stakes can be assessed to be at a medium level, professional consultancies are deemed appropriate to provide solutions. However, there are instances above these two situations where the conditions are described as “irreducible complexities”, “deep uncertainties”, “plurality of legitimate perspectives”,” value dissent”, and “decision urgency” (43,44). Funtowicz *et.al*. (44) describes this as Post-Normal Science (PNS) conditions. It involves the delivery of scientific advice under high uncertainties that is equally time bound in its delivery. The authors argue that the contemporary scientific culture has reached a turning point for reframing and contextualization, seeking new methods and modes of engagement, if the wicked environmental problems are to be properly managed. The PNS theory acknowledges diversity in proving solutions to wicked problems such as public health, climate change, water, and food security without relying only on scientific evidence but taking cognizance of negotiations around cultural norms, political frameworks, and values (18,44). Normal and PNS seem to address the same goal except that PNS emphasizes robustness and trust in the knowledge that is suitable for sustainable decision-making. It points to a discussion on epistemic injustice in knowledge sources. Guimarães *et.al.* (45) suggest the adoption of the PNS concept in the practice of scientific advice. The authors also premised their arguments on the wicked problems we face and the marginalization of certain knowledge sources in policymaking.

Boundary organizations

The work of Guimarães *et.al.* (45) indicates that the complexities involved in the Post-Normal Science (PNS) framework will require some mediating mechanisms such as the use of boundary organizations. They advocate for the urgency in adopting the PNS style by examining the post-normal institutional identity of the European Commission’s Directorate General Joint Research Centre (JRC) (45,46). The authors discussed JRC as a boundary organization. Even though there has been some criticism about the original meaning of boundary organization, it is still potently used in understanding the relationship between the transfer of knowledge and science policy. The analysis done by Gustafsson *et.al.* (47) claims that boundary organization does not refer to a specific organization nor does it provide any guide to organizing the interplay between science and policy. However, the authors acknowledge that labelling an organization as such works performatively and it could shape the identity of the organization and provide legitimacy, giving it some stabilization in engaging with other organizations.

Boundary organization facilitates the uptake of scientific evidence for informed policymaking by acting as a bridge between scientific knowledge sources and policymakers (48). Such organizations tend to be critical in addressing the challenges associated with epistemic injustice. The IPCC is another organization that fairly exhibits the features used to define boundary organization. Guimarães *et.al.* (45) suggest that JRC as a boundary organization can improve the quality of scientific evidence used in the policymaking process in the European Union, (EU). The JRC shows some evidence of accommodating a plurality of scientific culture in the EU by engaging in open workshops that challenge longstanding narratives (48). A similar concept was discussed by Gluckman *et.al.* (49) which they referred to as "brokerage" at the science-policy interaction. It involves the use of knowledge brokers with an understanding of the ontologies, cultures, and languages that exist in the scientific and policy communities to aid mutual interaction between the two communities. The authors suggest that if such intervention is to be effective in addressing diverse issues, it should be institutionalized and formalized. They presented ten recommendations for effective brokerage This tends to agree with the concept of having boundary organizations and their functions defined as such.

Conclusion

This review analyzed the influence of language and culture on science advice. It also attempts to understand what could be regarded as legitimate expertise and knowledge sources for scientific advice. Culture is generally framed under four themes: national, ethnic, organizational, and disciplinary such as scientific culture. Language is grouped under two main themes: native and disciplinary language. However, a subcategory used by science advisors in times of certainty and uncertainties is also identified using linguistic markers. The limited literature showed that language and culture influence the receptivity of scientific advice. This includes the linguistic choice in delivering advice and the contextualization of culture. The impact of this was revealed in the work of some of the authors, especially in the domains of climate change and public health.

Many of the challenges requiring scientific advice in recent times are theorized within the framework of post-normal science (PNS). The complexities of the problems that PNS seeks to address are "wicked" problems that are characterized by high levels of uncertainties yet require urgent scientific advice. Climate change and public health are described to have these attributes. Therefore, it has put pressured demand on scientific advice and a test on the robustness of the current science advisory mechanisms in

accommodating different knowledge sources and inputs for policymaking. There is an existence of epistemic injustices due to the narrow framing of culture and differences in linguistic choice, leading to the marginalization of certain knowledge.

A dichotomy exists in the cultures of science and policy. The language used by scientists in communicating scientific information makes a significant difference in the acceptance or rejection of scientific information. The use of simple and plain language is suggested to manage the interaction between science and policy. No definite framework was provided on how this could be achieved without a dilution effect in the scientific information. Some suggested approaches to manage science-policy interactions include the use of boundary organizations or brokers. Therefore, science advisors must consider these factors when crafting science advice. They need to understand and navigate these contexts when conveying scientific information to different audiences. Addressing these influences can help facilitate a better-informed society.

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