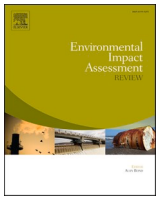
Environmental Impact Assessment Review 105 (2024) 107453

Contents lists available at ScienceDirect

Environmental Impact Assessment Review

journal homepage: www.elsevier.com/locate/eiar



Investigating communication of findings in Environmental Impact Assessment and developing a research agenda for improvement

Alan Bond [a,b,*], Francois Retief [b], Angus Morrison-Saunders [b,c], Jenny Pope [b,d,e], Reece C. Alberts [b], Claudine Roos [b], Dirk Cilliers [b]

[a] School of Environmental Sciences, University of East Anglia, United Kingdom
[b] Research Unit for Environmental Sciences and Management, North-West University, South Africa
[c] Centre for People, Place & Planet, Edith Cowan University, Australia
[d] Integral Sustainability, South Fremantle, WA, Australia
[e] Harry Butler Institute, Murdoch University, Western Australia, Australia

ARTICLE INFO

Keywords:
Environmental impact assessment
Environmental impact statement
Communication
Meaning
Semiotics
Social psychology
Verbatim
Gist

ABSTRACT

Environmental Impact Assessment (EIA) aims to embed consideration of the significance of predicted environmental consequences (the findings) of proposed developments into approval decision making. Achieving this aim relies on adequate communication of the findings of the EIA to the stakeholders, especially the decision makers responsible for the approval decision. However, the naïve assumption that this communication of findings can be effectively achieved through the publication of a written report pervades legislation worldwide, despite decades of evidence to the contrary. As a first step towards improving such communication, this research identifies the contingent conditions associated with effectively transferring EIA findings from an Environmental Impact Statement (EIS) to decision makers and other stakeholders based upon literature review. The transmission of meaning is found to be the major theme underpinning good communication, subdivided into discourse, readability, and legitimacy. Based on a clearer understanding of the limitations associated with an EIS as a communication medium, and acknowledging there are likely to be better mechanisms for transferring the meaning of the findings of an EIA to decision makers and other stakeholders, a pragmatic research agenda is outlined. This includes some initial suggestions of other research fields (like semiotics and social psychology), or technologies (like AI) that may provide learning and improvement opportunities.

1. Introduction

Communication is fundamental to Environmental Impact Assessment (EIA). Especially important in the process is communication with the decision-makers responsible for approving new development and establishing the conditions for implementation. In this section we briefly introduce the problem statement underpinning our research, before setting out the objectives and structure of the paper. For brevity (and to allow a clearer explanation of the problem to be investigated), we provide evidence for some of the claims in this initial section in more detail in the sections coming after.

Caldwell (1988) indicates that the basis of the world's first EIA legislation, the US National Environmental Policy Act (US Congress, 1969), was that better evidence leads to better (and more rational) decisions. This reflects an assumption that an EIA communicates this evidence to decision makers and other stakeholders. This was articulated by Wood (2008, p.22) who stated that: "*a universal and defining purpose of Environmental Impact Assessment (EIA) is to provide an analysis of the potential significant environmental effects associated with major development proposals and to communicate this information to decision makers and the broader public*". Thus, communication of EIA findings to all stakeholders, including decision makers, is an essential component of EIA, as the public and stakeholder response to the evidence, combined with the decision makers' interpretation of the response and the evidence, underpins the final decision on whether the project should be authorised or not. Echoing Fairfax (1978), we acknowledge that there is far more to effective EIA than communication through written documents such as the environmental impact statement (EIS) and other

* Corresponding author at: School of Environmental Sciences, University of East Anglia, United Kingdom.
E-mail addresses: alan.bond@uea.ac.uk (A. Bond), francois.retief@nwu.ac.za (F. Retief), a.morrison-saunders@ecu.edu.au (A. Morrison-Saunders), jenny@integral-sustainability.net (J. Pope), reece.alberts@nwu.ac.za (R.C. Alberts), claudine.roos@nwu.ac.za (C. Roos), dirk.cilliers@nwu.ac.za (D. Cilliers).

https://doi.org/10.1016/j.eiar.2024.107453
Received 26 September 2023; Received in revised form 15 January 2024; Accepted 7 February 2024
Available online 10 February 2024

reports presented to decision-makers. However, it is beyond our research remit to address public participation in general, or other decisions in the EIA process associated with screening, scoping, prediction, etc. (after the decision stages outlined by Weston, 2000).

In different EIA systems, the environmental information used in the final decision is communicated to stakeholders and the decision makers in different ways. These different approaches can be grouped into two broad categories:

1. The stakeholders and decision maker reads the proponent-prepared EIS. This happens in, for example, the European Union where an EIS is produced and becomes the document read by stakeholders, including members of the public and decision makers (Glasson and Therivel, 2019); in the USA where a draft EIS is subjected to consultations before a final EIS is produced, accommodating public comments made on the draft EIS, and informing the decision makers (Canter, 1996); and in South Africa where an independent environmental assessment practitioner is appointed to compile a draft EIA report and, after public participation, a final EIA report is submitted to the competent authority (Kidd et al., 2018).
2. The decision maker reads a report prepared by a third party, with that report itself being based on the EIS. Both documents are available to the public and other stakeholders. This happens, for example, in Western Australia where, following public review of the proponent's EIS, the Environmental Protection Authority (EPA) undertakes an assessment based on this material together with information from its own sources (Government of Western Australia Environmental Protection Authority, 2021), and in Canada where, the federal system requires an impact assessment report be prepared by a Government Agency based on a proponent's EIS and following public engagement, and it is the impact assessment report that informs the relevant Minister in making a decision (Impact Assessment Agency of Canada, 2020). There are likely to be many other examples, including very different degrees of synthesis which make generalisation inappropriate.

The main focus in the literature is the EIS typically produced by the proponent. Therefore, our research principally investigates the communication of EIA findings based on the first of the two approaches above. Common to all EIA systems, however, is a final document that provides the basis for communicating information on environmental impacts to the approval decision maker along with suggested strategies for managing these which decision makers will typically embody in conditions of approval. We return to this point in the conclusions to comment on the wider relevance of the findings to the second approach also.

A key point is that it is not sufficient for an EIS to simply contain information and knowledge, it must transmit it to another person; as Miller (1984, p.289) argued, a key challenge for EIA was "*to communicate that information [gathered in the EIA] in such a way that it becomes a part of the knowledge base of those who are to make decisions concerning the innovation*". This is consistent with a dictionary definition of 'communication' notwithstanding such entries reveal many different contexts and therefore understandings of this term. Thus a definition in the Oxford English Dictionary (2023) close to the context for an EIS is "*The transmission or exchange of information, knowledge, or ideas, by means of speech, writing, mechanical or electronic media*". In other words, the information must be transmitted rather than simply reside on a page. Communication must be active, not passive. But transmission of information alone is still not enough: there must also be a process through which the receiver of the information generates meaning from the information received so that they can act on that information.

Following the work of Cashmore et al. (2008) on the causal operation of EIA, which provides a useful model for explaining how EIA delivers certain outcomes, Fig. 1 presents a simplified diagram outlining how evidence-based decision-making is assumed to come about through the practice of EIA, assuming the knowledge of the findings have to be transmitted to the reader. Depending on the EIA system, Step 1 may or may not contain additional steps involving draft documents, and synthesis by agencies. The underpinning assumption in the causal map of EIA decision making (Fig. 1) is that an EIS (or its synthesis) conveys an understanding of the findings of an EIA to the stakeholders and decision makers, i.e., that the EIA transmits meaning.

Our focus is on Step 2 in Fig. 1, which encompasses the causal mechanism and contingent conditions that facilitate the desired outcome of an evidence-based decision. This operates on the assumption that, given the right contingent conditions, detailing in writing the potential significance of the predicted consequences of the proposed development in an EIS will deliver the desired evidence-based decision-making (competence and objectivity of decision makers will be assumed for the purposes of this analysis).

In legal processes for EIA globally, the causal mechanism in Step 2 is restricted to the production of an EIS (or its synthesis). Legal mandates are therefore based on the assumption that full understanding of the

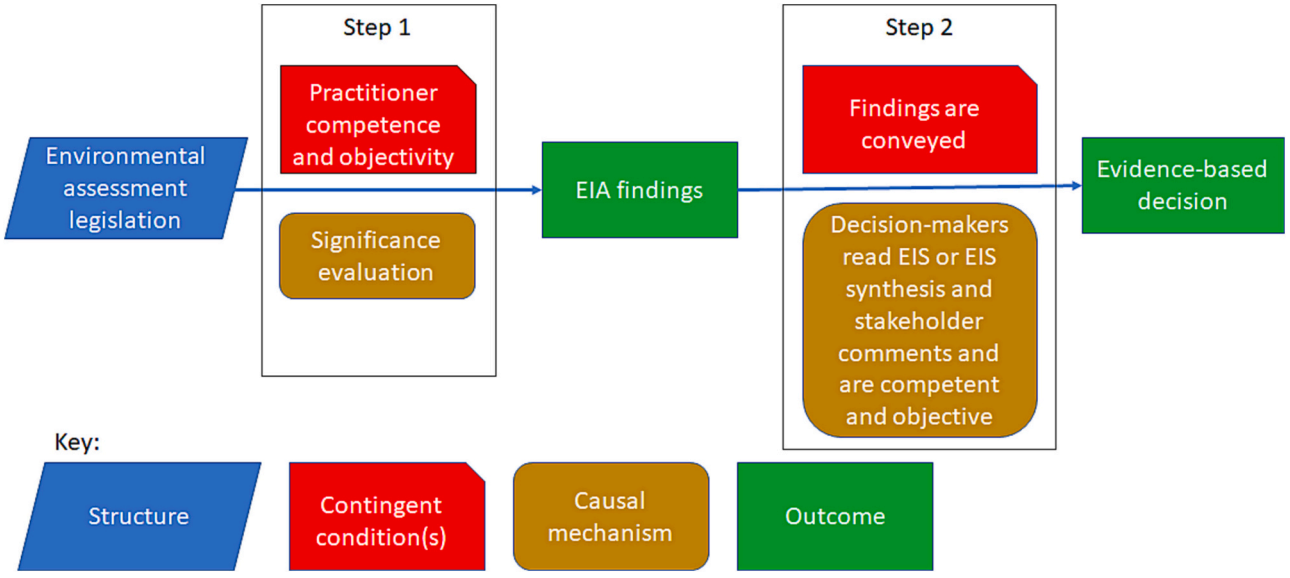


Fig. 1. Assumed causal model for delivering science-based decision-making.

consequences of a proposed development can be conveyed through the existence of a written document. This immediately raises concerns over the ability of the readers to understand technical language, the likelihood that anyone will read an EIS (or its synthesis) in full, the reality that the EIS is likely to be one of many sources consulted about a proposal, and so on (these are contingent conditions associated with the transfer of knowledge to the reader of an EIS, or its synthesis). Given that legal procedures dictate that the causal mechanism relies on production of, and engagement of decision makers and stakeholders with, an EIS, a literature review can only explore the research that has taken place on contingent conditions in Step 2 of Fig. 1,as the production of an EIS is mandated.

In order to work out how best to communicate the findings of an EIA to stakeholders and decision makers, the two specific objectives of this paper are to:

1) Identify the contingent conditions associated with effective communication of the findings of EIA to stakeholders and decision makers through an EIS.
2) Develop a research agenda focussed on improving the communication of the EIA findings to stakeholders and decision makers.

In the next section we review the literature on communication related to the EIS and identify the contingent conditions based on thematic mapping of the review results. This section concludes with an updated causal model that unpacks the contingent conditions for an EIS (or its synthesis) to communicate effectively to decision makers and other stakeholders. It also highlights how dependent the assumption that an EIA can lead to evidence-based decision-making is on the causal mechanism of producing an EIS, and subsequently engaging with it. In Section 3 we start the task of developing a research agenda aimed at improving communication of EIA findings to stakeholders and decision makers, addressing both contingent conditions associated with continued focus on an EIS, but also on a move away from the current written document as the key causal mechanism. This recognises that considerable learning from other fields of study will need to be transferred into EIA practice, which will take time and further development. Finally, we present our conclusions in Section 4 and set out a future research agenda to identify how best to communicate the findings of an EIA to stakeholders and decision makers.

2. Identify the contingent conditions associated with effective communication of the findings of EIA to stakeholders and decision makers through an EIS

The approach taken for our literature review on communication in EIA commenced with a search of the Scopus database, being one of the largest index databases of peer-reviewed works ever built (the newer Dimensions database has far more source documents, but much of the database lies behind a paywall) (Singh et al., 2021). Our search focused on titles, keywords and abstracts using the search terms 'environmental W/2 assessment' OR 'environmental W/2 statement' OR 'environmental W/2 report' AND 'communication' (the W/2 operator in Scopus looks for any instances of either of the terms occurring within 2 words of each other, so 'environmental assessment' and 'environmental impact assessment' and 'assessment of environmental impacts' would all be found using the 'environmental W/2 assessment' search string). Our search, conducted on January 9th 2023, identified 1660 documents which we filtered based on relevance of title, then keywords, then abstract. In all cases, the communication needed to be at the end of the EIA process when the aim is to communicate the findings to stakeholders and decision makers for identified sources to be included in the thematic mapping.

Our approach for identifying the contingent conditions associated with effective communication of the findings of EIA to stakeholders and decision makers through an EIS involved an inductive process to develop themes relevant to communication (i.e. our process being similar to that for conceptualising a research field based on the identification of themes). We followed approaches recommended in Braun and Clarke (2014) and Fereday and Muir-Cochrane (2006) involving coding of the literature for the identification of themes. Categorising the themes then followed the approach set out by Jabareen (2009) of:

1. identifying and naming themes of communication of EIA findings;
2. deconstructing and categorising the themes;
3. integrating themes; and
4. synthesis, re-synthesis, and making it all make sense.

This process was undertaken based on our own analysis across the sourced literature; specific software packages (like NVivo or ATLAS.ti) were not used given the large number of articles involved, meaning that a systematically documented coding task was not practical.

In this literature review process, we identified the transmission of meaning as the key overarching theme for communication of scientific evidence. In turn, we determined that transmission of meaning can be broken down into several sub-themes: discourse, readability, and legitimacy. While these sub themes are not wholly independent of each other, they are identified in the literature as key components, and so we present each in turn here, drawing on specific text that validates their inclusion and delineation.

2.1. Discourse

The importance of discourse in EIA has been the topic of many studies (see, for example, Bina et al., 2011; Hilding-Rydevik and Åkerskog, 2011; Rozema and Bond, 2015; Runhaar, 2009; Runhaar et al., 2010; Wilkins, 2003), where discourse can be defined as "*a specific ensemble of ideas, concepts, and categorisations that are produced, reproduced, and transformed in a particular set of practices and through which meaning is given to physical and social realities*" (Hajer, 1995, p44). Svarstad et al. (2008) highlighted a range of environmental governance discourses: preservationist (priority is to protect biodiversity); win-win (equivalent to sustainable development, as interpreted by Bond and Morrison-Saunders (2009)); traditionalist (local actors are best placed to manage the environment); and promethean (human ingenuity can solve all problems created through the use of natural resources). Depending on the discourse prominent in an EIS, the interpretation of the significance of impacts can vary, and Rozema and Bond (2015) found in a case study analysis that EIA could only accommodate a single discourse.

Whilst adopting a discourse can be a tacit act, it is important in the decision-making context to understand the discourse underpinning the presentation of information and knowledge (and therefore meaning) in the EIS. What might be an unacceptable impact using a preservationist discourse (whereby nature is protected for its own sake (Svarstad et al., 2008)), might be acceptable using a sustainable development or promethean discourse (which assumes all environmental problems can be solved by human ingenuity (Svarstad et al., 2008)). Evidence that EISs are written to support the agenda of the developers does exist as indicated in Box 1.

Discourse is therefore important because the EIS will almost certainly reflect a particular discourse, which may or may not align with the views of the decision makers (or other readers). Discourse in language affects the way reality is constructed by the reader (Darics and Koller, 2019). That is, the meaning communicated by an EIS will depend on the discourse embedded in its text. Along the same lines, Miller (1984) argues that the authors of EISs overlook the most important error of assuming the audience has the same perspective as the authors which, is invalid and dooms the EIS to failure as a communication device. Miller draws on work by Linstone (1981) to identify three common perspectives: technical; organisational/societal; individual/personal, and argues that any person operating from one of these three perspectives can communicate only to someone with the same perspective. For EIA, this

Box 1
Evidence that EISs are written to support the agenda of developers.

Card (2020) refers to the existence of technical communication scholars as having a potential role in engaging publics in policy making and focuses on the website 'regulations.gov' launched in the US to allow broad participation in US policy making. Card conducts an analysis of the public engagement emerging from the publication of multiple drafts of EISs for a contentious development in the US. Whilst the research focuses primarily on evidence that public participation has changed subsequent drafts of the EIS, it also identifies that an issue with the EIS as a means of communicating the EIA is that it represents an 'instrumental forum'. If EIA represents an instrumental forum, it means that even if a reader can comprehend the messages, it only exists as a legitimising tool for the authors as it allows the developers to "*better defend predetermined outcomes*" (Card, 2020, p.97).

Evans (2011) states that "*the environmental impact statement (EIS) is probably one of the most reviled yet one of the most misunderstood technical documents in use today*" (Evans, 2011, p.1), going on to use Burke's pentad, which is a device for analysing rhetoric, in order to investigate motives in discourse. The approach examines text (in this case in eight EISs produced by the US military) and through coding apportions the text into five different categories (the pentad: act, scene, agent, agency, purpose). Evans concludes that the EISs examined were examples of instrumental writing, indicating that the proponents valued their own views above all others, and pursued a discourse that supported their views as a result.

Hilding-Rydevik and Åkerskog (2011) undertook a discourse analysis in relation to Strategic Environmental Assessment (SEA) of plans in Sweden and found two major metaphors emerged: efficiency and continuity. These metaphors provide further evidence that the authors of environmental assessments construct arguments and follow discourses that support their own agendas which are focused on saving time and money and making fewer changes to plans.

Glasson and Therivel (2019) comment on communication in EIA at some length, especially in regards the proponent's EIS, noting that "*an EIS can be seen as a publicity document for the developer*" (p.160).

effectively means that the consultant (technical–T, dealing with data, and using formal and analytical models) will not be able to communicate to the perspective shared by the decision-makers (organisational–O, dealing with group-defined realities and using dialectical models, i.e., discourse to establish 'truths') or the public (individual–P, dealing with intuition, and using personal views).

Whilst we recognise that the perspectives introduced are actually very diverse (for example, there are many publics according to Noble, 2010), and we further acknowledge that EISs might have different sections dealing with different readers (e.g., non-technical summaries; technical appendices) the general principle that communication needs to align with the discourse of the reader if meaning is to be transferred, holds. However, Froomkin (2015) points out that an EIS is a complex and unwieldy document that is unlikely to be read by any other than a small fraction of those who have a stake or are impacted by a project proposal. Froomkin is clear that "*the direct consumers will be intermediaries such as public interest groups and the press*" (p.1785). This starts to suggest not only that the audience for an EIS might be somewhat different than that it is written for, but also that the intermediaries may start to construct their own realities; that is, change the discourse in their communications to reflect their own agendas. This may equally apply to the third parties interpreting and summarising EISs for decision makers (and potentially other stakeholders also) in a formal capacity (approach 2 in the introduction).

2.2. Readability

In 1978, the US Council on Environmental Quality (CEQ), the body tasked with implementing the National Environmental Policy Act, developed regulations that included sections on communicating information clearly (Council on Environmental Quality, 2022). In particular, section 1500.4 of the CEQ Regulations focuses on 'reducing paperwork' and section 1502.8 stipulates:

> "Writing. Agencies shall write environmental impact statements in plain language and may use appropriate graphics so that decision makers and the public can readily understand such statements. Agencies should employ writers of clear prose or editors to write, review, or edit statements, which shall be based upon the analysis and supporting data from the natural and social sciences and the environmental design arts".

Essentially, this is about improving readability, which is a measure of how easy it is to read and follow the meaning of a written text. However, from the EIA literature, there is evidence of issues associated with the use of appropriate visual design; page length; overly technical content; and compartmentalisation. Each of these will be introduced in this section.

2.2.1. Visual design

Evans (2012) examines two US EISs from the viewpoint of visual design, encompassing supra-textual design, metadiscourse, page layout and typography. In this small sample of two EISs, Evans finds that the CEQ's expectations with respect to visual design are not being met.

Sullivan et al. (1996) conducted research on the understanding gleaned from an EIS in the community of Joliet, Illinois, in which 70% of 113 citizens answered correctly at a level equivalent to blind guessing when asked about their understanding of the information presented in an EIS. They followed this research with attempts to present information based on a single EIS in two different ways: photosimulations and simple editing (Sullivan et al., 1997). They found that adding photosimulations to the original EIS improved understanding between 17 and 39% (range reflects potential error), and further adding photosimulations to an original EIS already modified through simple editing increased the understanding between a further 5 and 22%.

Similar sentiments are expressed by Fischer and Kirkwood (2022) who identify "*an unfulfilled public need for visual communication in the environmental impact statement process*" (p.62). As a landscape architect and planner respectively, they worked to provide visual communication to members of the public in relation to oil field development in North Dakota, USA. They argue that such visualisation techniques they employed "*suggest possibilities for improving environmental impact statements, particularly the affected environment and potential consequences section*" (p.75); however, it is notable that they used their visualisations separately to the EIS and as the basis for discussions at public meetings. Other research of visual communication in EIA (e.g., de Oliveira et al., 2023) report deficiencies in the visual literacy of creators and recipients alike of visual design, which impedes effectiveness of communication.

2.2.2. Page length

The length of EIS documents has long been identified as an issue for the communication of EIA information, particularly in relation to public participation (Fairfax, 1978; Fernández et al., 2018; Miller, 1981). For example, Lyles (2017) reports that the average EIS in the United States is 700 pages in length, despite CEQ regulations limiting this to 150 pages, or 300 pages for EISs of "*unusual scope or complexity*" (Council on Environmental Quality, 2022, s.1502.7). In the UK, a sample of EISs for offshore windfarms (which are complex projects) have been reported as increasing in size from fewer than 2000 pages in 2007 to almost 10,000 pages in 2013 (Glasson and Therivel, 2019). Perhaps inevitably, given this herculean task, few individuals will ever read an EIS in its entirety. This is borne out by Ross (2018) in an analysis of news media in relation to an EIS in the United States: "*there is little evidence that opponents or proponents, politicians, or reporters had read the entirety of the EIS[s]; at best a few were aware of the Executive Summary*" (Ross, 2018, p.241). Cashmore, Bond, and Cobb (2008, p.1236-1237) found more direct evidence through interviews where "*case officers and decision-makers acknowledged that they did not have time to read, or, in some instances, the expertise to understand, all of the environmental assessment documentation … instead they relied extensively upon comments made by statutory consultees and advisory bodies*". Kørnøv and Thissen (2000, p.193) concur in terms of the likelihood of decision makers reading EISs, albeit they provide a specific explanation: "*attention is seen as a scarce resource. Decision-makers — like all other people — have a natural limited mental capacity and are therefore only able to cope within these limits and with a limited volume of information*".

It is important to note that the sources cited above relate to the first approach set out in the introduction where the EIS is provided directly to decision makers. In jurisdictions such as Western Australia and Canada, where the EIS is taken by a third party responsible for synthesising and assessing the information provided in the proponent's EIS, the documents provided to decision makers are considerably shorter. They are also more focussed, written to provide the necessary information for decision-making in accordance with relevant legislation. Whilst no research could be found on the length of the synthesis documents provided to decision makers, one example illustrates a difference of a proponent's EIS provided to the Western Australian EPA being 543 pages in length (with 21 additional appendices providing over a thousand additional pages), with the synthesis provided to the Minister by the EPA being 151 pages in length (see stages 3 and 4 of the assessment provided at: https://www.epa.wa.gov.au/proposals/alkimos-seawater-desalination-plant).

2.2.3. Overly technical content

Early research had already recognised the problems of communicating to a diverse audience through a largely technical document; the technicality issue. Bendix (1984, p.271) wrote that "*the greater your expertise in your field, the more important it is for you to break out of your own mental framework and don the hat of your reader*", albeit this assumes that better presenting the information will solve the problems of communicating technical information to a diverse audience. Recognising the issue in US EISs, Plung (1980) suggested the use of motivated sequence as a strategy to improve technical communication in an EIS; this involves organising ideas in patterns that align with natural thought processes, which is a "*structure that allows the writer to 'motivate' the reader*" (Plung, 1980, p.66). The motivation sequence follows five steps:

1. Attention – 'hooking' the reader by identifying the problem and coaxing the reader into reading further.
2. Need – Breaking down the need for reading into four components: statement (identifying the specifics of the problem); illustration (explaining the scope of the problem); ramification (providing evidence to demonstrate the problem is serious and immediate); and pointing (demonstrating the problem is the reader's problem).
3. Satisfaction – leads to the establishment of goals based on five components: statement (what needs to be done); explanation (why it needs to be done); theoretical demonstration (explain how a solution resolves the problem); practical experience (evidence that the solutions have worked before); meet objections and alternatives (demonstrate how alternatives do not provide solutions to the problem).
4. Visualisation – make readers 'see' what needs to be done and how it will affect them, undertaken in two parts: project a negative image (show the consequences of alternative solutions examined in the 'solutions' step); project a positive image (vivid descriptions to show readers the benefits of the proposed solution – recognising readers remember what they read last).
5. Action – some kind of explicit expression of what the reader must do, for example, attending meetings, writing letters to officials.

Thus. whilst overly technical content is an issue identified in the literature – there are strategies available to improve the situation.

2.2.4. Compartmentalisation

Antonson (2011) focuses on a Swedish EIS where the difficulties in communicating landscape comprehensively are highlighted – particularly because landscape is intrinsically linked both to cultural heritage and nature – which are elements appearing elsewhere in the EIS. This points to a more functional communication issue created through the compartmentalisation of environmental aspects in separate chapters. That is, it is difficult to convey a full understanding of the interrelated nature of simple impacts when they are separated into different chapters. In a similar vein, Ehrlich (2022) notes that such a siloed approach to EIA is "*myopic*" and "*does not properly capture the interrelated collective and systemic impacts of individual developments*" (p.129).

The readability sub theme clearly reflects the written form of an EIS. That is, unlike the other sub themes, it is dependent on the continuing central role of a written document. This point does need to be considered in relation to a research agenda aimed at improving communication of findings of an EIA. Whilst it has emerged from the literature as an important sub theme related to communication, it should not be considered as a criterion of good communication in its own right.

2.3. Legitimacy

Legitimacy is an issue associated with an EIS in that it needs to have credibility if a reader is to respect its content. As a key component of any Social License to Operate (SLO) (Jijelava and Vanclay, 2017; Saenz, 2018) whereby communities decide on their level of acceptance of a proposed project, the legitimacy of the EIA process that has been undertaken for a particular development proposal needs to be communicated through the EIS. Yet legitimacy can be jeopardised where there is clear evidence of attempts to manipulate communication, with the possibilities categorised by Enríquez-de-Salamanca (2018) as including: false information; false alternatives; exaggerated information; hidden information; under- or over-evaluation of impacts; complex information; self-censorship; EIA process manipulation; bribes and kickbacks; and extortion. Evidence of bias, in particular, is well known in EISs (Hollick, 1984, 1986), and encompasses fake news, although such an approach is generally associated with the agendas pursued in relation to proposed development through social media (Bond et al., 2018). A particular issue has been noted with considerations of uncertainty in EISs with Lees et al. (2016) identifying the issue of the use of vague terminology to describe uncertainty (including the terms 'might', 'probably', 'assumed', 'relatively', 'approximately', amongst many others). We would anticipate that such problems with legitimacy of EISs will be greatest where the proponent's EIS is the basis, acknowledging the other approach provided in the introduction in which a separate entity produces a synthesis of the proponent's EIS after it has been subject to public review.

The review presented in this section leads to a revised causal model for step 2 of Fig. 1, which is in the focus of Fig. 2 in an expanded form. This highlights a large number of contingent conditions (all sub-themes associated with transmitting the meaning of an EIA to decision makers) that need to be met before evidence-based decisions can be made. From the analysis in this paper, it seems inconceivable that the publication of an EIS can satisfy all the contingent conditions without supplementary communication approaches, and the challenge is to develop the most efficient and effective communication approaches to supplement the EIS (recognising that an EIS has a legal role as the repository for the scientific evidence gathered).

Noting that the literature has focused largely on research examining the first of the two approaches outlined in the introduction for providing evidence to decision makers (that is – a proponent's EIS), there is a gap in knowledge in terms of the extent to which the same issues are resolved through the use of third parties to interpret and synthesise EISs (approach 2 as set out in the introduction), or whether this simply complicates some of the sub-themes and, in particular, discourse, whereby the third parties have the privileged position of being able to present their own discourse in their own synthesis (if they chose to do so).

Fig. 2 provides a more detailed understanding of the contingent conditions that can promote more evidence-based decision-making. However, we caution that the literature reviewed takes the production of an EIS as a given, based on its legal position as the means to present evidence stemming from the EIA. The literature does not address other potential causal mechanisms as a result, despite other mechanisms potentially providing better means of communicating findings. On this point, Gerrard and Herz (2003) highlight the fact that EISs were conceived before there was an Internet, or even a word processor. And whilst the advent of online versions of EISs has removed barriers like expense, availability, and the simple delay inherent in printing hard copy, key issues remain, like their lack of user friendliness given their enormous length. This is at odds with Dayton (2002) who examined some EISs against criteria derived to assess the extent to which Habermas' norms of communicative action were achieved: comprehensibility, truth, sincerity, and legitimacy. Dayton found that the norms of communicative action could be met, albeit in disaggregating communication in this way, the analysis seems to lose sight of the realities of reading such long documents. That is, Dayton (2002) concludes that an EIS *can* theoretically serve as the discursive focus for democratic decision-making rather than demonstrating that it ever *does* so.

The realities of the use of EISs is clearly illustrated by Ross (2018) who analysed a single EIS in the United States and concluded that it met all the statutory requirements in terms of technical and professional communication. Yet Ross also concludes that the public response to the project by opponents and proponents was not informed by the EIS, but was instead based on "*media reports, web sites, and press releases*" (Ross, 2018, p.222). This communication of elements of the EIS through intermediaries has consequences for EIA decision-making. Fenton (2012), albeit clearly having an agenda to support fossil fuel extraction, laments the use of the Internet and social media in stating "*there are many examples where the industry and the government have provided robust scientific fact to support the industry, only to have the anti-CSG [Coal Seam Gas mining] lobby claim that the information is somehow incorrect, falsified or that the government is part of some nefarious conspiracy to hide the facts from the community*" (p.2). The argument being made is that the EIS is selectively used to underpin confirmation bias amongst individuals with a particular view – and that the selected evidence is then quickly and efficiently spread through social media and traditional media (newspapers) networks. Fenton (2012) recommends the simplification of science, increased transparency over the existence of risks associated with developments, and a recognition that members of the public will not take the time to fully read the science reported in an EIS.

Moore (2016) evaluates the approaches taken by professional communicators when engaged to assist with public participation within EIA. Whilst this is not the focus of this paper as it is part of the evidence gathering rather than communication of findings, Moore cites Rude's (Rude, 2004) criticism of the use of a one-time delivery of a single document (like an EIS) from the perspective of the limits of "*connecting documents (and rhetoric) to social action and change*" (Moore, 2016, p.257).

Therefore, there is an inference that other forms of knowledge transfer are needed to supplement (or replace) the written document. That is, other causal mechanisms are potentially required based on different outcomes of Step 1 in Figs. 1 and 2.

3. Developing a research agenda focussed on improving the communication of EIA findings to stakeholders and decision makers

The previous section has identified contingent conditions for effective communication of findings from an EIS based on the literature, assuming an EIS is the principal method for doing this. This section starts the task of developing a research agenda aimed at improving this communication element. This is useful because the primacy of EIS is

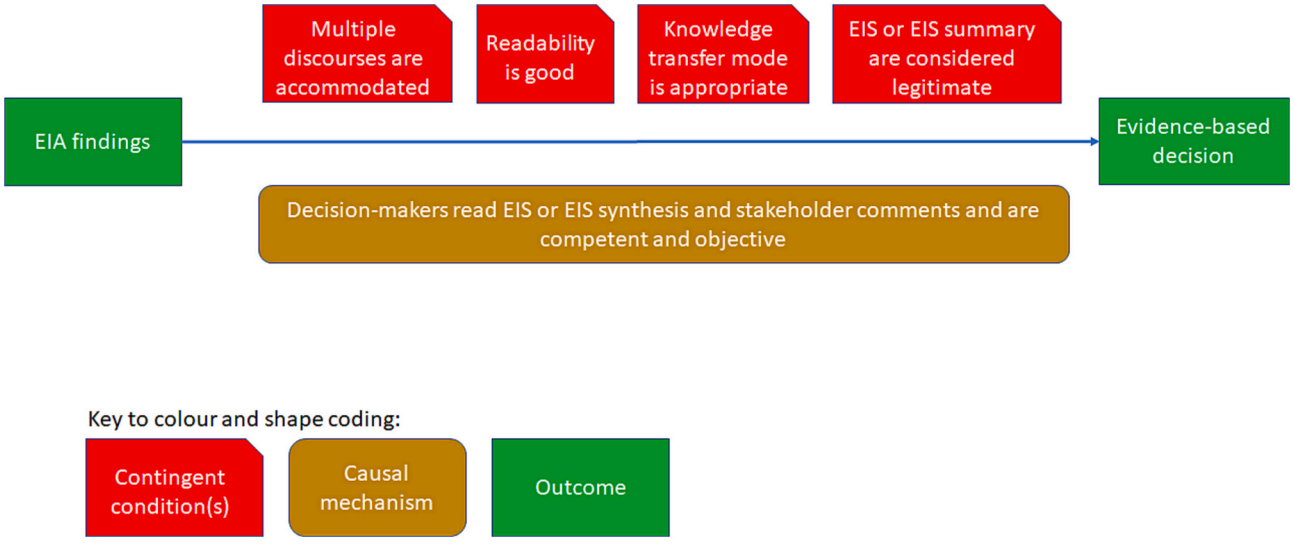


Fig. 2. Amended causal model for delivering evidence-based decision-making.

locked into legislation, so it is important to investigate how communication can be improved where it remains the key document for transmission of meaning. However, improved communication can also stem from changing the causal mechanism based on a different outcome from Step 1 of Figs. 1 and 2, and so we also examine research fields that may help to identify better causal mechanisms.

3.1. Research questions related to improving communication of EIA findings

Fig. 2 develops Fig. 1 by setting out a more detailed understanding of the contingent conditions that affect how an EIS communicates to decision-makers. As the EIS is embedded as a legal requirement, our literature reviewed has not explored alternative causal mechanisms. However, other causal mechanisms would potentially be the most effective means of improving communication of EIA findings. In developing research questions, we have taken two approaches to casual mechanisms: 1) continue with EIS and focus on contingent conditions; and 2) a different (as yet unknown) causal mechanism to communicate the findings of an EIA to decision makers and other stakeholders. These are considered in turn below.

1) Continue with EIS as causal mechanism. The publication of an EIS (or its interpreted synthesis where third parties interpret the proponent's EIS) is legally embedded as the accepted method of presenting evidence to stakeholders and decision makers. This is reflected in enforcement processes through the Courts which maintain the status of the written document as the immutable legal requirement. As an example, in the UK the House of Lords considered a case where it was argued that the necessary information to identify environmental impacts were spread across planning application documents making it unnecessary to produce an EIS, the presiding judge, Lord Hoffman, disagreed: "*I do not think it* [The European Union EIA Directive] *allows member states to treat a disparate collection of documents produced by parties other than the developer and traceable only by a person with a good deal of energy and persistence as satisfying the requirements to make available to the public the Annex III information which should have been provided by the developer*" (Tromans and Fuller, 2003, p.103). This relates to the concern raised by McHenry et al. (2015), that simply disclosing information through making multiple documents available to the public does not uphold best practice expectations for transparency. Learning from the need to communicate meaning accurately in the intelligence community – the approach of a written technical document can be categorised as delivering precise details 'verbatim' (Broniatowski, 2019).
2) Develop a new causal mechanism. Considering that communication technologies, and consequently styles or modes of communication, have hugely evolved over the past 50 years, the production of a single written document is now out-of-step with current communication expectations. This is starkly evident in the need to better communicate climate change which has led to a far greater understanding of the importance of the media in communicating more widely, and also underpins calls for more dialogic forms of communication that can "*open minds, deepen understanding, foster empathy, change attitudes, and increase receptivity to policy alternatives*" (Moser, 2016, p.352). Again drawing from the need to communicate meaning accurately in the intelligence community, this can be categorised as delivering the 'gist' of the assessment (Broniatowski, 2019).

If we connect these different causal mechanisms to the sub themes identified in the literature, it helps to point the direction to a research agenda embedded in the practical realities of a mandatory assessment process that demands the production of an EIS (Table 1). This Table asks research questions related to the current legal requirement to produce an EIS (verbatim), the need to communicate the meaning of the findings (the gist), and a likely combination of the two which meets legal expectations whilst communicating meaning. We would caution that Table 1 represents a snapshot in time, and will change as new understanding comes to light.

Table 1
Research questions associated with different approaches to communicating meeting from 'verbatim' to 'gist'.

	Single written document remains a legal requirement (verbatim)	Somewhere along the spectrum of opposing views (verbatim and gist)	Single written document approach rejected as being out-of-step with modern communication expectations (gist)
Discourse	How can different discourses be represented in an EIS? How can conflicts between different discourses be effectively addressed in an EIS?	How can the variety of discourses about the environmental consequences of a development most efficiently be communicated to decision makers?	Which approaches can best communicate the variety of discourses at play?
Readability	How can an EIS better transmit meaning? How can new technologies, such as artificial intelligence and natural language processing, be used to enhance the readability and meaning transmission of an EIS?	How can an EIS better connect with other communication approaches for transmitting meaning? How can decision makers be made to engage with these other communication approaches?	What are the barriers to, and enablers of, legal mandate change away from a single written document?
Legitimacy	How can decision makers be confident that an EIS is perceived as legitimate by the public? What are the key factors that affect the perceived legitimacy of an EIS?	How can the legitimacy of an EIA be optimised through communication to decision makers?	How can decision makers be confident that an EIA is perceived as legitimate by the public? How can transparency and accountability be ensured in the EIA process and communicated in a way to enhance public confidence?

Reference to Fig. 1 makes it abundantly clear that a single document has a function in law in providing a record of the evidence gathered and made available to decision makers. Efforts to move fully away from this approach could be difficult to justify given the way court systems currently function. On the other hand, our research has confirmed the severe limitations of the ability of an EIS (or even a synthesis of this) to transmit an understanding of the predicted consequences of a proposed development (the 'gist' of the analysis). A pragmatic way to improve communication is likely, therefore, to involve supplementing an EIS (or its synthesis) with additional communication approaches

3.2. Some other fields that may help to improve communication in EIA

Our desire in this research is to identify how best to communicate the findings of an EIA to stakeholders and decision makers. This stops short of identifying solutions to any problems we have identified with the current approaches to communication through the format of written documents. However, here we identify some examples of research from other fields that researchers can draw on when addressing the research agenda set out in the conclusions. We acknowledge that there will be

many other fields that can also offer valuable learning.

Perdicoúlis and Glasson (2012) make an attempt to analyse the ability of EISs to communicate, focussing on the extent to which they communicate causality, to convey the causes that lead to the potential effects. One of the methods they pursue is semantics analysis, whereby specific words that conveyed meaning were identified in EISs; thus Perdicoúlis and Glasson (2012) demonstrate a different way of considering the extent to which meaning is conveyed in written documents.

Smagorinsky (2001, p.135) wrote: "*When considering the meaning that any individual attributes to a text, it is important to note that the text is not interpreted alone, but in terms of the context in which it appears*". The argument here is that the meaning taken from text is not simply the embedded meaning that an objective consultant endeavours to impart, but is instead a meaning developed in the mind of the reader that is contingent on prior narratives from personal experience (Smagorinsky, 2001). That is, the text serves as a sign from which further sense is drawn. The word 'semiotics' refers to the study of signs (Scholes, 1982), or meaning-making and meaningful communication and therefore is potentially an appropriate focus of future research for evaluating the extent to which meaning is imparted by different communication approaches within an EIS.

The role of tools such as Artificial Intelligence (AI) for improving EIA are also being investigated (see, for example, Bice and Fischer, 2020; Bond and Dusík, 2020; Curmally et al., 2022; Sandfort et al., 2023). There are opportunities to explore, specifically, how AI might improve communication associated with each of the research agenda questions highlighted here (noting that potentially AI might be also used by decision-makers to interpret an EIS when determining approval conditions; i.e., thereby reducing or even removing human-to-human communication in EIA).

The literature on communication lacks a focus on research that deals with the psychology of the recipient of information. Retief et al. (2023) highlighted the importance of psychology underpinning the significance judgements that are made in EIA (and provide the key evidence to be communicated to decision makers). Further, Moreira et al. (2022) stress the importance of social psychology in understanding, amongst other issues, the risk perceptions of stakeholders associated with projects subject to EIA. They draw on Slovic et al. (2004) in distinguishing between the human brain's systematic (high effort, conscious, analytical processing) versus heuristic (intuitive, automatic, non-conscious) dual processing. In relation to the EIS, the argument is that the information is targeted at systematic processing, whereas a communication approach targeting heuristic processing may transfer meaning much more readily.

4. Conclusions

In this research we set out to identify how best to communicate the findings of an EIA to stakeholders and decision makers. This work was undertaken given concerns about how well an EIS (or its synthesis) can communicate the findings of an EIA to stakeholders and decision makers. This step is clearly critical for EIA to embed scientific evidence into decision making. In the absence of any clear explanation or understanding of what communication should entail, this research has developed from the literature a clearer understanding of the contingent conditions associated with effective communication from an EIS, alongside an understanding that the focus on an EIS as the communication device in legal processes is potentially flawed. In doing so, themes have been extracted from a variety of literature, albeit other researchers are urged to further develop the understanding of contingent conditions, using different search strategies, different coding approaches, and benefiting from emerging research not available at the time of writing.

Identifying the contingent conditions associated with the communication of the findings of an EIS to stakeholders and decision makers is an important benchmark, and our literature review points to the transmission of meaning as being the critical element. But understanding the importance of communicating meaning does little to improve practice on its own. In this paper we have identified some other fields of study (and emerging technologies, i.e., AI) which have the potential to provide solutions to known problems, and to increase the communication performance of EIAs where proponent EISs are submitted directly to decision makers. Fields such as semiotics may be able to help to provide more meaningful measures of the extent to which meaning is transferred to end users, and is perhaps better placed to act as an evaluation framework for additional communication approaches. The field of social psychology may help to point the way to better communication approaches that avoid failures in community relations associated with EIAs (as highlighted by Moreira et al., 2022).

We end by posing some research questions that might prompt future research in this field which have been extracted from the middle column of Table 1. While these remain very broad in nature, we believe they are nevertheless critical to overcoming the communication deficit currently evident in EIA practice.

- How can the variety of discourses about the environmental consequences of a development most efficiently be communicated to decision makers?
- How can the gist of the EIA findings be communicated as well as the verbatim facts?
- How can the level of legitimacy of the EIA be communicated to the decision makers?
- Can the field of social psychology help us to understand how best to improve communication of the findings of an EIA to decision makers and other stakeholders.
- What communication approaches can provide credible alternative causal mechanisms for communicating EIA findings to decision makers and other stakeholders?
- How can decision makers be made to engage with these other communication approaches?

This research agenda is contingent on the validity of the thematic analysis presented to identify contingent conditions, and therefore we invite other perspectives, both to criticise and to supplement it. In addition, we encourage researchers to begin the task of responding to our call for future research with a view to improving communication in EIA.

CRediT authorship contribution statement

Alan Bond: Conceptualization, Methodology, Writing – original draft, Formal analysis, Investigation. **Francois Retief:** Writing – review & editing, Validation. **Angus Morrison-Saunders:** Writing – review & editing, Validation. **Jenny Pope:** Conceptualization, Writing – review & editing, Validation. **Reece C. Alberts:** Writing – review & editing, Validation. **Claudine Roos:** Writing – review & editing, Validation. **Dirk Cilliers:** Writing – review & editing, Validation.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

No data was used for the research described in the article.

References

Antonson, H., 2011. The treatment of landscape in a Swedish EIA process. Environ. Impact Assess. Rev. 31, 195–205.

Bendix, Selina, 1984. How to write a socially useful EIS. In: Hart, Stuart L., Enk, Gordon A., Hornick, William F., Jordan, James J., Perreault, Paul (Eds.), Improving Impact

Assessment: Increasing the Relevance and Utilization of Scientific and Technical Information. Westview Press, Inc, Boulder, Colorado.
Bice, S., Fischer, T.B., 2020. Impact assessment for the 21st century–what future? Imp. Assessm. Project Apprais. 38, 89–93.
Bina, Olivia, Wallington, Tabatha, Thissen, Will, 2011. SEA theory and research: An analysis of the early discourse. In: Sadler, B., Aschemann, R., Dusik, Jiri, Fischer, Thomas B., Partidário, Maria R., Verheem, Rob (Eds.), Handbook of Strategic Environmental Assessment. Earthscan, London.
Bond, A., Dusík, Jiří, 2020. Impact assessment for the 21st century – rising to the challenge. Imp. Assessm. Project Apprais. 38, 94–99.
Bond, A.J., Morrison-Saunders, A., 2009. Sustainability appraisal: jack of all trades, master of none? Imp. Assessm. Project Apprais. 27, 321–329.
Bond, Alan, Pope, Jenny, Retief, Francois, Morrison-Saunders, Angus, 2018. On legitimacy in impact assessment: an epistemologically-based conceptualisation. Environ. Impact Assess. Rev. 69, 16–23.
Braun, Virginia, Clarke, Victoria, 2014. What can "thematic analysis" offer health and wellbeing researchers?, 9, pp. 1–2.
Broniatowski, D.A., 2019. Communicating meaning in the intelligence Enterprise. Policy Insights Behav. Brain Sci. 6, 38–46.
Caldwell, L.K., 1988. Environmental impact analysis (EIA): origins, evolution, and future directions. Policy Stud. Rev. 8, 75–83.
Canter, Larry W., 1996. Environmental Impact Assessment. McGraw-Hill, New York.
Card, Daniel J., 2020. Off-target impacts: tracing public participation in policy making for agricultural biotechnology. J. Bus. Tech. Commun. 34, 77–103.
Cashmore, M., Bond, A., Cobb, D., 2008. The role and functioning of environmental assessment: theoretical reflections upon an empirical investigation of causation. J. Environ. Manag. 88, 1233–1248.
Council on Environmental Quality, 2022. National Environmental Policy Act Implementing Regulations, 40 CFR Parts 1500–1508 (May 20, 2022). Council on Environmental Quality. Accessed 30 January 2023. https://ceq.doe.gov/docs/laws-regulations/NEPA-Implementing-Regulations-Desk-Reference-2022.pdf.
Curmally, Atiyah, Sandwidi, Blaise W., Jagtiani, Aditi, 2022. Artificial intelligence solutions for environmental and social impact assessments. In: Handbook of Environmental Impact Assessment, 163.
Darics, Erika, Koller, Veronika, 2019. Social actors "to go": an analytical toolkit to explore agency in business discourse and communication. Bus. Prof. Commun. Q. 82, 214–238.
Dayton, David, 2002. Evaluating environmental impact statements as communicative action. J. Bus. Tech. Commun. 16, 355–405.
de Oliveira, Ana, Roque, Sofia Bento, Partidário, Maria, Morrison-Saunders, Angus, 2023. Understanding stakeholder experiences with visual communication in environmental impact assessment. Environ. Impact Assess. Rev. 102, 107210.
Ehrlich, Alan, 2022. Collective impacts: using systems thinking in project-level assessment. Imp. Assessm. Project Apprais. 40, 129–145.
Enríquez-de-Salamanca, Á., 2018. Stakeholders' manipulation of environmental impact assessment. Environ. Impact Assess. Rev. 68, 10–18.
Evans, Rob, 2011. The pentad and the EIS: Using Burke's pentad to analyze environmental impact statements issued by the US military. In: 2011 IEEE International Professional Communication Conference. IEEE, pp. 1–7.
Evans, R., 2012. Design of the environmental impact statement. In: IEEE International Professional Comunication Conference. IEEE, Orlando, Florida, p. 14.
Fairfax, Sally K., 1978. A disaster in the environmental movement. Science 199, 743–748.
Fenton, R., 2012. Demystifying science: communication of complex science to reduce community fear of industry. Appea J. 53, 12.
Fereday, Jennifer, Muir-Cochrane, Eimear, 2006. Demonstrating rigor using thematic analysis: a hybrid approach of inductive and deductive coding and theme development. Int J Qual Methods 5, 80–92.
Fernández, G.M.R., de Brito, L.L.A., Fonseca, A., 2018. Does size matter? An evaluation of length and proportion of information in environmental impact statements. Environ. Impact Assess. Rev. 73, 114–121.
Fischer, D.L., Kirkwood, M.L.E., 2022. Seeing the petrochemical landscapes of the Bakken. Landsc. J. 41, 61–76.
Froomkin, A.M., 2015. Regulating mass surveillance as privacy pollution: learning from environmental impact statements. Univ. Ill. Law Rev. 2015, 1713–1790.
Gerrard, Michael B., Herz, Michael, 2003. Harnessing information technology to improve the environmental impact review process. NYU Envtl. LJ 12, 18.
Glasson, John, Therivel, Riki, 2019. Introduction to Environmental Impact Assessment. London, Routledge.
Government of Western Australia Environmental Protection Authority, 2021. Environmental Impact Assessment (Part IV Division 1 and 2) Administrative Procedures 2021. EPA. Accessed 9 June 2022. https://www.epa.wa.gov.au/sites/default/files/Policies_and_Guidance/Environmental%20Impact%20Assessment%20Administrative%20Procedures%202021.pdf.
Hajer, Maarten A., 1995. The Politics of Environmental Discourse: Ecological Modernization and the Policy Process. Oxford University Press, New York.
Hilding-Rydevik, T., Åkerskog, A., 2011. A clear case of 'doublespeak': the Swedish governmental SEA implementation discourse. J. Environ. Plan. Manag. 54, 495–515.
Hollick, M., 1984. Who should prepare environmental impact assessments? Environ. Manag. 8, 191–196.
Hollick, M., 1986. Environmental impact assessment: an international evaluation. Environ. Manag. 10, 157–178.
Impact Assessment Agency of Canada, 2020. Overview of the Impact Assessment Act. Impact Assessment Agency of Canada. Accessed 13 March 2023. https://elearning.iaac-aeic.gc.ca/mod00/mod00_00_01-en.html.
Jabareen, Yosef, 2009. Building a conceptual framework: philosophy, definitions, and procedure. Int J Qual Methods 8, 49–62.
Jijelava, D., Vanclay, F., 2017. Legitimacy, credibility and trust as the key components of a social licence to operate: an analysis of BP's projects in Georgia. J. Clean. Prod. 140, 1077–1086.
Kidd, M., Retief, F., Alberts, R., 2018. Integrated environmental impact assessment and management. In: Strydom, H., King, N., Retief, F. (Eds.), Environmental Management in South Africa. Juta Publishing, Cape Town.
Kørnøv, L., Thissen, W.A.H., 2000. Rationality in decision- and policy-making: implications for strategic environmental assessment. Imp. Assessm. Project Apprais. 18, 191–200.
Lees, J., Jaeger, J.A.G., Gunn, J.A.E., Noble, B.F., 2016. Analysis of uncertainty consideration in environmental assessment: an empirical study of Canadian EA practice. J. Environ. Plan. Manag. 59, 2024–2044.
Linstone, Harold A., 1981. The multiple perspective concept: with applications to technology assessment and other decision areas. Technol. Forecast. Soc. Chang. 20, 275–325.
Lyles, K.C., 2017. Expediting the NEPA process via a document management system and virtual GIS-based NEPA platform. Environ. Pract. 19, 139–147.
McHenry, M.A., Morrison-Saunders, A., Gorey, P., Sequeira, A.R., Mtegha, H., Doepel, D., 2015. Puzzled: navigating extractives policy information jigsaws for best practice and transparency. Extract. Industr. Soc. 2, 401–405.
Miller, Carolyn R., 1981. Environmental impact statements and some modern traditions of communication. In: International Technical Communication Conference Proceedings, pp. E67–E69.
Miller, Ruth-Ellen, 1984. The EIS and the decision maker: Closing the gap. In: Hart, Stuart L., Enk, Gordon A., Hornick, William F., Jordan, James J., Perreault, Paul (Eds.), Improving Impact Assessment: Increasing the Relevance and Utilization of Scientific and Technical Information. Westview Press, Inc, Boulder, Colorado.
Moore, K.R., 2016. Public engagement in environmental impact studies: a case study of professional communication in transportation planning. IEEE Trans. Prof. Commun. 59, 245–260.
Moreira, Sergio, Vanclay, Frank, Esteves, Ana Maria, 2022. Fallacies about communities that lead to failed community relations. Imp. Assessm. Project Apprais. 40, 156–167.
Moser, Susanne C., 2016. Reflections on climate change communication research and practice in the second decade of the 21st century: what more is there to say? Wiley Interdiscip. Rev. Clim. Chang. 7, 345–369.
Noble, Bram F., 2010. Introduction to Environmental Impact Assessment: A Guide to Principles and Practice. Oxford University Press, Ontario.
Oxford English Dictionary, 2023. Communication. Accessed 1 February 2023. https://www.oed.com/view/Entry/37309?redirectedFrom=communication#eid.
Perdicoúlis, A., Glasson, J., 2012. How clearly is causality communicated in EIA? JEAPM 14.
Plung, Daniel L., 1980. Motivated sequence and the environmental impact statement. J. Tech. Writ. Commun. 10, 65–72.
Retief, F.P., Bond, A., Morrison-Saunders, A., Pope, J., Alberts, Reece C., Roos, C., Cilliers, D.P., 2023. Gaining a deeper understanding of the psychology underpinning significance judgements in environmental impact assessment (EIA). Imp. Assessm. Project Apprais. 14.
Ross, D., 2018. Environmental impact communication: cape wind EIS, 2001–2015. J. Tech. Writ. Commun. 48, 222–249.
Rozema, J.G., Bond, A.J., 2015. Framing effectiveness in impact assessment: discourse accommodation in controversial infrastructure development. Environ. Impact Assess. Rev. 50, 66–73.
Rude, Carolyn D., 2004. Toward an expanded concept of rhetorical delivery: the uses of reports in public policy debates. Tech. Commun. Q. 13, 271–288.
Runhaar, Hens, 2009. Putting SEA in context: a discourse perspective on how SEA contributes to decision-making. Environ. Impact Assess. Rev. 29, 200–209.
Runhaar, Hens, Runhaar, Piety R., Oegema, Tammo, 2010. Food for thought: conditions for discourse reflection in the light of environmental assessment. Environ. Impact Assess. Rev. 30, 339–346.
Saenz, Cesar, 2018. Building legitimacy and trust between a mining company and a community to earn social license to operate: a Peruvian case study. Corp. Soc. Responsib. Environ. Manag. 26, 296–306.
Sandfort, Robin, Uhlhorn, Birthe, Geissler, Gesa, Lyhne, Ivar, Jiricka-Pürrer, Alexandra, 2023. AI will change EA practice - but are we ready for it? A call for discussion based on developments in collecting and processing biodiversity data. In. preprints.org.
Scholes, Robert, 1982. Semiotics and Interpretation. Yale University Press.
Singh, Vivek Kumar, Singh, Prashasti, Karmakar, Mousumi, Leta, Jacqueline, Mayr, Philipp, 2021. The journal coverage of web of science, Scopus and dimensions: a comparative analysis. Scientometrics 126, 5113–5142.
Slovic, Paul, Finucane, Melissa L., Peters, Ellen, MacGregor, Donald G., 2004. Risk as analysis and risk as feelings: some thoughts about affect, reason, risk, and rationality. Risk Anal. 24, 311–322.
Smagorinsky, P., 2001. If meaning is constructed, what is it made from? Toward a cultural theory of reading. Rev. Educ. Res. 71, 133–169.
Sullivan, W.C., Kuo, F.E., Prabhu, M., 1996. Assessing the impact of environmental impact statements on citizens. Environ. Impact Assess. Rev. 16, 171–182.
Sullivan, W.C., Kuo, F.E., Prabhu, M., 1997. Communicating with citizens: the power of photosimulations and simple editing. Environ. Impact Assess. Rev. 17, 295–310.
Svarstad, Hanne, Petersen, Lars Kjerulf, Rothman, Dale, Siepel, Henk, Wätzold, Frank, 2008. Discursive biases of the environmental research framework DPSIR. Land Use Policy 25, 116–125.
Tromans, S., Fuller, K., 2003. Environmental Impact Assessment - Law and Practice. LexisNexis, London.

US Congress, 1969. The National Environmental Policy Act of 1969. US Congress, Washington DC.
Weston, Joe, 2000. EIA, decision-making theory and screening and scoping in UK practice. J. Environ. Plan. Manag. 43, 185–203.
Wilkins, Hugh, 2003. The need for subjectivity in EIA: discourse as a tool for sustainable development. Environ. Impact Assess. Rev. 23, 401–414.
Wood, Graham, 2008. Thresholds and criteria for evaluating and communicating impact significance in environmental statements: 'See no evil, hear no evil, speak no evil'? Environ. Impact Assess. Rev. 28, 22–38.