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# Artificial intelligence in impact assessment: the state of the art

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## ABSTRACT

Artificial Intelligence (AI) is beginning to reshape impact assessment (IA), offering both promise and disruption. This paper reviews the current state of the art, situating recent advances within a broader historical trajectory. Although early applications of AI in environmental assessment date back to the 1990s, the advent of large language models (LLMs) has driven an exponential rise in interest and experimentation since 2023. Evidence from literature, the IAlA25 conference, and a targeted survey of practitioners demonstrates that AI is already supporting efficiency gains through automation of repetitive tasks, improved data integration, and enhanced accessibility of complex information. At the same time, concerns persist regarding reliability, bias, transparency, and unresolved issues of accountability. Opportunities lie in fostering inclusivity, innovation, and capacity building, while threats include loss of trust, over-reliance, and ethical risks. We conclude that the future of AI in IA will depend critically on safeguards, governance, and professional standards to ensure that benefits are realised while risks are managed.

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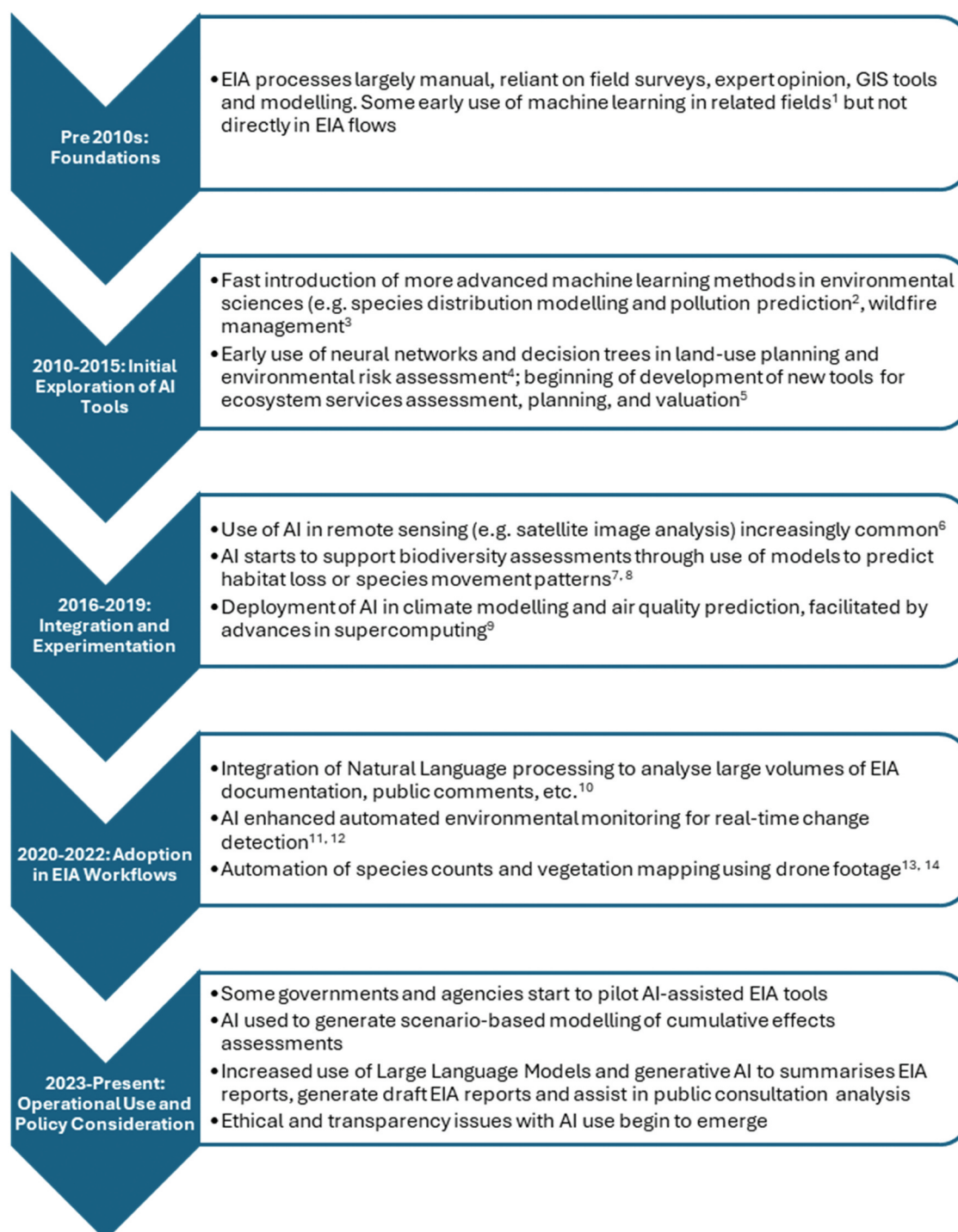
Artificial intelligence; impact assessment; LLM; AI agents; risks; impacts of AI

## 1. The increasing role of AI in impact assessment

The suite of technologies that process data, identify patterns, and generate responses to specific queries operating under the broad term Artificial Intelligence (AI) holds tremendous potential for good. These technologies begin to increasingly 'advise' various decision-making processes (including impact assessments) and open enormous potential for enhancing our individual and collective analytical capabilities but also create numerous risks. This paper aims to quickly sketch these potential benefits and risks for further debate. In considering the current level of research interest in artificial Intelligence (AI) specific to impact assessment, academic search engines have already started to embed AI into their search facilities. A search for 'environmental impact assessment' AND 'artificial intelligence' on the Scopus database (14 November 2025) identified 237 documents. However, the fact that the application of AI in IA is novel is hinted at through the first document being published on the topic in 1990, and only in the calendar years 2011 and 2023 were more than 10 articles published on this topic (13 in both cases) prior to 2024. Forty one were published in 2024, and the expectation is that this figure will rise dramatically (already 59 in 2025 by November 14th). We can hypothesise that the development and use of LLMs has underpinned this

increased interest in the role of AI given that ChatGPT was launched publicly at the end of November 2022 (Rudolph et al. 2023) (and allowing for the time it takes to conduct research either using, or focussing on the use of, an LLM, then write a paper, submit it and go through the review process – this could explain the increase in publications from 2024 onwards). Note that the term 'environmental impact assessment' is restrictive when considering the broader family of impact assessment tools; however, the term 'impact assessment' includes a considerable volume of publications on methods and techniques including Life Cycle Assessment (LCA) which begins to make analysis confusing. The term 'environmental impact assessment' is largely restricted to mandated decision-support processes and therefore provides a useful surrogate for the type of 'impact assessment' processes we are interested in (including social impact assessment, health impact assessment, etc.).

We used the ChatGPT Timeline Generator (with the prompt: 'How has AI begun to be used within environmental impact assessment?') to suggest different eras for the use of AI in EIA. These are indicated in Figure 1. Such a timeline is based on unclear data, albeit the authors consider that it fits in with their own perceptions of the development of AI in IA. In order to corroborate Figure 1, we followed the protocol for confirming AI findings set out in Bond et al. (2024)



**Figure 1.** AI in environmental impact assessment. Source references: <sup>1</sup> Hsieh (2009); <sup>2</sup> Hsieh (2022); <sup>3</sup> Jain et al. (2020); <sup>4</sup> Kussul et al. (2011); <sup>5</sup> Villa et al. (2009); <sup>6</sup> Ma et al. (2019); <sup>7</sup> Pichler et al. (2020); <sup>8</sup> Norouzzadeh et al. (2018); <sup>9</sup> Platonov and Varentsov (2018); <sup>10</sup> Curmally et al. (2022); <sup>11</sup> Zhu et al. (2020); <sup>12</sup> Essamlali et al. (2024); <sup>13</sup> Kellenberger et al. (2021); <sup>14</sup> Abdollahi and Pradhan (2021).

and this did find evidence to substantiate the content of Figure 1, although there remains the possibility that evidence could also support other configurations that were not tested.

Assuming Figure 1 to be a reasonable depiction of the development of AI in IA, in this paper we focus on the state-of-the-art in the current era, 2023 to present. This is the era where the advent of LLMs has led to a dramatic increase in the engagement of all parts of society with AI tools, including in IA

practice. It is an era in which the International Association for Impact Assessment (IAIA) has developed principles to govern the application of IA in IA (Bingham et al. 2025). IAIA's annual international conference, held in Bologna from 1–4 May 2025 (<https://2025.iaia.org/>) focused on IA in the age of AI. At the same time, the journal of IAIA, *Impact Assessment and Project Appraisal*, launched a call for a special issue on the role of AI in the future of IA, published in Volume 43, Issue 4, 2025. Thus,

there is clear interest and a direction of travel towards greater adoption of AI in IA practice.

The IAIA25 conference involved 1043 delegates from 83 countries, sharing experience through networking and 127 technical sessions. Reports from the chairs of these sessions were synthesised by IAIA using ChatGPT (IAIA, 2025) to extract the top 10 takeaways from the session chair reports (by copying all the reports listed at <https://2025.iaia.org/session-chair-reports/> and pasting them into ChatGPT). IAIA staff then designed an infographic to highlight the key themes emerging from the conference (Figure 1). These indicate specific areas of focus, but also concerns and appeals related to future practice.

In order to determine the state of the art of AI practice in IA, this paper is structured as follows: In **Determining emerging practice of the application of AI in IA** we explain how we went about determining the state of the art of practice of using AI in IA. Following this, we follow the format for this special issue by considering the strengths and weaknesses of current practice in **Current strengths and weaknesses of the application of AI in IA**, drawing on the key themes outlined in Figure 2 as well as drawing on analysis of emerging practice. **Section 4** examines opportunities and threats, before **Where to next?** points to the future, based on an analysis of emerging practice and the innovations highlighted at IAIA25.

## 2. Determining emerging practice of the application of AI in IA

In considering the state of the art, we are cautious to try and distinguish between aspiration and pilot studies, and actual use of AI in practice related to mandated IAs. For example, Hurley and Patel (2025) indicate a variety of potential uses of AI in IA but are clear that current use within the consultancy AECOM is focused on saving time and improving consistency (albeit used to flag inconsistency at present rather than auto-correcting).

We are also aware that regulators are beginning to specify how AI should be used, for example, in England the Planning Inspectorate (2024) have published guidance which focuses on transparency over use of AI, accountability for content, and legality of output.

Given this context, we chose to undertake a brief survey of IA professionals, focusing on AI experts presenting empirical examples of AI applications at the IAIA25 conference in Bologna, the authors of the principles for use of AI in IA (Bingham et al. 2025), and also the Multilateral Development Banks (MDB) working group on digital tools in IA, encompassing representatives of:

ADB – Asian Development Bank

AfDB – African Development Bank

AIIB – Asian Infrastructure Investment Bank



# KEY THEMES

FROM IAIA25 SESSION CHAIR REPORTS



**Figure 2.** Emerging themes in the application of AI in IA. Source: IAIA conference session chairs' reports (<https://2025.iaia.org/proceedings/>), reproduced with permission of IAIA.



EBRD – European Bank for Reconstruction and Development

EIB – European Investment Bank

FAO – Food and Agriculture Organization

IADB – Inter-American Development Bank

IFAD – International Fund for Agricultural Development

IFC – International Finance Corporation

KfW – KfW Development Bank

UNDP – United Nations Development Programme

WFP – World Food Programme

World Bank/World Bank Group

The survey followed University of East Anglia ethical research protocols. All respondents had to consent to responding to the survey based on information provided about how the data would be used (in this paper). Every respondent was given the opportunity to remain anonymous. The draft paper was subsequently sent to every respondent that provided their email address, and every respondent has confirmed in writing that they are happy to have their name appear in the way it is presented (at the end of the paper).

The survey ran between the 6 August and 22 September 2025, and there were 20 respondents. Of these:

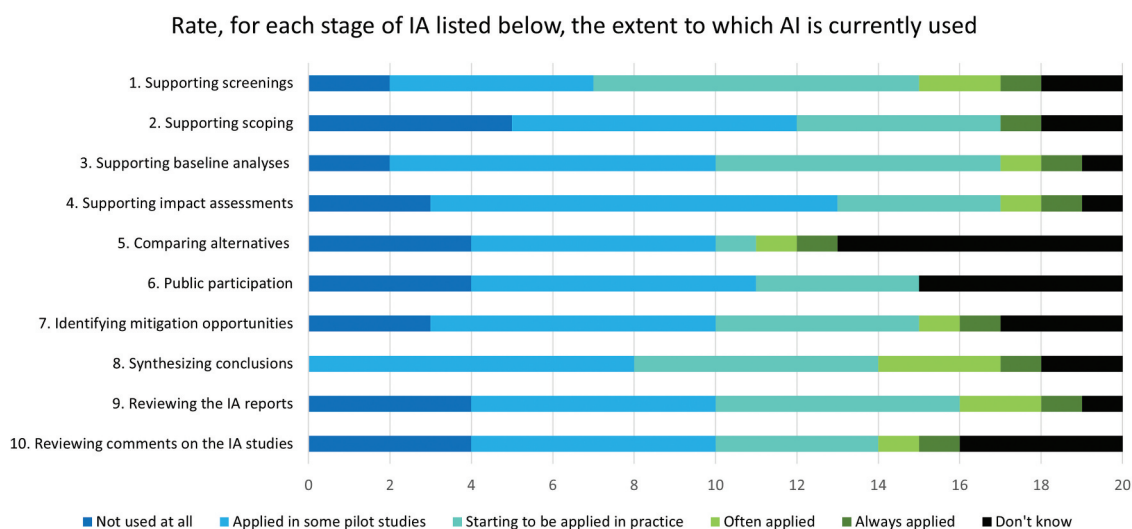
- four were authors of the principles for use of AI in IA (including three consultants and one academic);
- seven were attendees of the IAIA conference (including four consultants, two academics, and one person who is both a consultant and an academic);
- eight were from the MDB working group on digital tools in IA (three representing ADB, and one each from IFC, FAO, EBRD, UNDP, WFP); and

- one chose to remain anonymous.

One author of the principles for use of AI in IA (who is a consultant – E&S Solutions) has a specific mission to ‘to leverage modern AI technology to enable E&S performance practitioners to work more efficiently and ultimately deliver more impact’ (E&S Solutions 2025). This was the only respondent to answer ‘always applied’ to any question about the current application of AI in IA, which does influence the responses to the survey. Whilst not a large sample, it does provide sufficient information to see how IA is beginning to be used in IA and provides a useful benchmark for future studies. The Survey remains available at <https://forms.office.com/e/Cy5sbxx7CY> and can be consulted to find out the questions asked. It was structured to find out the level of existing use of AI in IA using a Likert scale, followed by nine open questions designed to find out what the strengths, weaknesses, opportunities, and threats are associated with the use of AI in IA, as well as suggestions for resources that might have been established to control the use of AI in IA, and expectations for the future use of AI in IA.

Figure 3 indicates the survey responses when asked about the level of current use of AI in the different stages of IA.

The survey responses do paint a picture of practice whereby significant application of AI in IA is starting to appear. As the note to Figure 3 indicates, cases where AI is always used in IA remains somewhat niche, but also it is clear that there is already at least one consultancy that focuses on AI. On more typical practice, pilot studies are starting to point the way to increased future practice. Screening has been highlighted as a stage where AI is finding most purchase, as can be seen by the development of screening websites in



**Figure 3.** Survey responses identifying current practice in the application of AI within separate stages of IA. Note: X-axis indicates number of people responding according to the text in the key. The respondent from E&S Solutions was the only respondent to answer “always applied” to any question, all responses for “often applied” came from members of the MDB working group on digital tools in IA except one, for ‘8. Synthesizing conclusions’, from an academic.

jurisdictions (see, for example, <https://www.eiascreening.co.uk/#/>), albeit caution is recommended (Cilliers et al. 2025). There is also evidence of greater early practice in the use of AI to synthesize IA conclusions – which is perhaps understandable given such an application is likely to be restricted to IA evidence gathered in the traditional way (and therefore less prone to some of the weaknesses and threats identified below).

Survey respondents commented on their expectations for how AI might change the work of IA practitioners. Their responses indicated that practitioners may move from ‘originators’ to ‘checkers’ of content, especially for simple or repetitive text, while still leading on complex analysis and interpretation, also AI could take over routine drafting of text. Specifically, this was felt to present a risk of fewer opportunities being available for junior specialists. There is also an expectation that there will be significant time and cost savings expected and also that practitioners will need new competencies in AI literacy, validation, transparency, and ethical use. Ultimately, it was felt that business models may change with AI-driven efficiencies potentially disrupting current fee structures (e.g. day rates), prompting new ways of charging for IA services.

Survey respondents commented on their expectations for how AI might change the work of authorities. They felt that AI has the potential to make IA reviews by authorities faster (potentially streamlining review timelines), more consistent, and better informed, while also helping them regain capacity in contexts where resources are stretched. There was also a suggestion that AI may help rebalance power between authorities and consultants, strengthening authorities’ autonomy where resources are limited. However, without safeguards, there are concerns about over-reliance on AI outputs, weakening quality assurance, potentially exacerbated by increased pressure for faster reviews because of the potential of AI. Some respondents worried about the extreme scenario of authorities outsourcing review entirely to AI, undermining democratic legitimacy. The potential for AI to reduce expert involvement was felt to threaten

democratic legitimacy and risks sidelining nuanced stakeholder input.

Survey respondents also commented on their expectations for how AI might change the work of other stakeholders in the IA process. They felt that AI could enable broader, more transparent, and informed stakeholder participation as it can make complex information more understandable, helping stakeholders provide better-informed responses. Specifically, there is potential to enhance public consultations, widen participation through social media, and summarise large volumes of information for broader audiences, thereby strengthening the legitimacy of IA processes. However, without open access, training, and safeguards, it risks deepening inequalities, lowering trust, and encouraging superficial or even obstructive engagement (for example, by using AI strategically to generate statements that slow down agencies rather than improve dialogue).

The remainder of this paper presents results and conclusions based on interpretations of the survey results combined with evidence from the literature search undertaken (see section 1 above), combined with the special issue on the emerging role of AI in the future of IA (IAPA 43 (4), 2025) and the themes identified in the IAIA25 conference (see Figure 2). From these, themes were extracted using a process of coding, with the results summarized in Table 1. Section 3 provides more detail on the strengths and weaknesses, followed by Section 4 explaining the perceived threats and opportunities.

### 3. Current strengths and weaknesses of the application of AI in IA

At the IAIA25 conference taking place in Bologna, Italy, in May 2025 ‘AI was presented and perceived as both, a promising tool and a disruptive force’ (Aung and Fischer 2025, 166). This is certainly reflected in the strengths and weaknesses identified through this research. These will be considered in turn below.

**Table 1.** SWOT analysis of the state of the art of the practice of AI in IA.

Strengths	Weaknesses
<ul style="list-style-type: none"> <li>• Significant time and cost savings through automation of repetitive/manual tasks.</li> <li>• Improved data integration, analysis, and consistency</li> <li>• Enhances expert workflows without replacing human judgment.</li> <li>• Enhanced knowledge support</li> </ul>	<ul style="list-style-type: none"> <li>• Risk of hallucinations.</li> <li>• Bias in training data; limited transparency and explainability.</li> <li>• Capacity issues with understanding AI.</li> <li>• High costs of deployment.</li> <li>• Significant time and cost savings through automation of repetitive/manual tasks.</li> </ul>
<b>Opportunities</b> <ul style="list-style-type: none"> <li>• Efficiency and productivity gains</li> <li>• Improved quality and innovation in assessments</li> <li>• Improved capacity building and human collaboration.</li> <li>• Enhanced inclusivity and engagement.</li> </ul>	<b>Threats</b> <ul style="list-style-type: none"> <li>• Loss of public trust and ownership.</li> <li>• Unclear governance, standards; increased legal risk.</li> <li>• Human and institutional risks.</li> <li>• Environmental footprint of AI systems.</li> <li>• Ethical concerns.</li> </ul>

### 3.1. Strengths

Efficiency and cost savings are highlighted by survey respondents as a key strength, through significant time and resource savings, automation of repetitive/manual tasks and improved speed, completeness, and structure in analysis and reporting. Specifically, it is expected that data handling will become quicker, with improved quality, for example, through advances in our ability to integrate and analyse large sets of structured and unstructured data (Sandfort et al. 2024). There could be advances in pattern recognition and cumulative/complex analyses that are otherwise difficult for humans to interpret (Blakley and Noble 2025). It is also expected that consistency and objectivity in outputs can be enhanced.

It is anticipated that AI will provide much needed support to humans by reducing the repetitive load experienced by specialists, providing that final judgements of text in IA reports stays with the human authors. It is expected that AI will support experts in screening (e.g. Cilliers et al. 2025), drafting, or verifying content (Figure 3 indicates that these are the areas of practice where AI is gaining most purchase at present). AI can also be applied to process real-time monitoring data, delivering 24/7 analytical support (Mobo et al. 2025), thereby potentially removing temporal constraints that often delay assessment processes.

Finally, it is also anticipated that knowledge support will be enhanced, both in terms of helping newcomers to the field gain understanding and also through supporting legal compliance through domain-specific data being used. Taking another viewpoint, AI can also prompt enhanced engineering design to improve predicted outcomes.

### 3.2. Weaknesses

A significant weakness (or perhaps fear in some cases) relates to accuracy and reliability risks, in particular, the propensity for AI to produce hallucinations, errors, and misleading outputs (Bond et al. 2024; Aung and Fischer 2025). AI can struggle to distinguish credible from non-credible data (Wang et al. 2006; Nadeem and Hameed 2008), and can also deliver outputs that are too generic without domain-specific training. Furthermore, *'a study of newer, bigger versions of three major artificial intelligence (AI) chatbots shows that they are more inclined to generate wrong answers than to admit ignorance'* (Jones 2024, first page).

Bias and transparency issues are also a concern, especially given that any bias in training data can distort results (McGovern et al. 2022). As a result, transparency is key, but there is growing concern that AI applications are not fully disclosed, leading to a risk of over-trusting results without proper validation. The IAIA principles for the use of AI in IA (Bingham et al.

2025) specifically address this concern with expectations for full disclosure.

Capacity issues are highlighted by survey respondents, highlighting that many users lack skills in prompt engineering (i.e. asking the right questions of Large Language Models, LLMs) or critical understanding. This presents a risk of misuse or over-reliance, particularly by non-experts. It was also felt that it could hinder skills development in junior staff if over-used. Expert oversight and competence in the use of AI are both required in the principles for use of AI in IA (Bingham et al. 2025) to address these weaknesses.

Another weakness highlighted counters the cost saving anticipated in Strengths. Specifically, costs and practical constraints were raised given the high costs of deploying and maintaining systems, alongside the fact that the benefits anticipated in Strengths are only realised with quality data and well-designed architecture (neither of which are a given).

The lack of contextual knowledge leads the AI systems to frequently miss crucial local factors, including cultural sensitivities, historical grievances, informal governance structures, and seasonal or temporal factors specific to affected communities (Kibuacha 2024). This issue is particularly prevalent where western-centric AI models are applied to indigenous cultures (Ray 2024).

Finally, the legal responsibility and accountability issues remain unresolved. The issue here focuses on legal accountability, which goes beyond the accountability principle in the principles for use of AI in IA (Bingham et al. 2025).

## 4. Current opportunities and threats in relation to the future application of AI in IA

Given the current level of use of AI in IA practice to date, *'discussions among impact assessment professionals and specialists seem to focus on the opportunities and challenges that AI presents for the practice of environmental impact assessment'* (Fitzgerald and Taylor 2025, 298). This section synthesizes these, based on evidence from the survey, the literature review undertaken, and the themes identified by IAIA25 session Chairs (Figure 2).

### 4.1. Opportunities

In the same way that efficiency is highlighted as a strength for the application of AI in IA, given that actual practice is still limited, it is also highlighted as an opportunity. Survey respondents specifically highlighted efficiency and productivity gains; time and cost savings, faster and more complete reviews; automation of repetitive tasks and data gathering; the expectation that AI can free up experts to focus on higher-value work; and the potential to reduce health and safety risks by gathering baseline data in hazardous

environments (albeit this relies on emerging technologies, like drones, also).

There is an expectation that quality may improve in assessments based on improved modelling, monitoring, and verification of mitigation measures and support for cumulative and long-term impact assessments by better aggregation of data. Communication may improve because of development of more reader-friendly, accessible, and multilingual outputs.

Capacity Building is expected to increase as a result of growing expertise as practitioners and graduates learn to use AI tools. There is also an expectation for advanced knowledge management and learning across projects. And, as AI is expected to complement, not replace, human judgment – safeguard specialists will have more time to focus on complex analysis.

Opportunities are also anticipated for inclusivity and engagement, through simplification and translation of technical material for public participation, with AI providing the potential to make consultation more meaningful and inclusive (Aung and Fischer 2025).

#### 4.2. Threats

The effect of AI on trust, transparency, and reliability is highlighted as a major threat for the future use of AI in IA. For example, increasing the risk of inaccurate, incomplete, or biased outputs ('garbage in, garbage out') (see Enríquez-de-Salamanca 2025, for threats associated with botanical data); further concerns have been raised by Sandfort et al. (2025) about existing deficiencies in data availability and quality, especially spatially, which undermines the evidence base for IA processes placing an over-reliance on AI. AI can also lead to reinforcement of systemic biases, including marginalization of affected populations (Aung and Fischer 2025). Ultimately, it is felt that over-reliance on AI without fact-checking will erode trust and ownership, and may lead to dilution of verified sources with unverified information. As Fitzgerald and Taylor (2025, 300) put it, *'there is an ongoing (and embarrassing) paucity of impact monitoring and ex-post assessments in the digital public arena which can be drawn on for impact prediction (the source material for AI)'*.

The absence of clear frameworks, regulations, and quality assurance was highlighted as a key governance issue, whilst at the same time there was recognition that over-standardisation may discourage critical human analysis. There are also concerns about the potential for legal and data privacy risks, especially when handling sensitive information. And further concerns that clients (or regulators) may start to impose restrictive requirements or demand faster outputs, reducing quality.

Whilst improving the capacity of IA practitioner has been seen as a significant opportunity, paradoxically, it

is also seen as a threat as it could potentially lead to de-skilling of experts and reduced learning opportunities for junior staff. Furthermore, jobs and capacities of IA practitioners could be placed at risk if AI replaces rather than supports experts.

Finally, survey respondents highlighted environmental and ethical concerns, for example, the high resource use and environmental footprint of AI systems, the risks of disinformation, manipulation, or misuse, and also ethical concerns around power dynamics and surveillance (Jiricka-Pürer and Stöglehner 2025; Nooteboom 2025).

#### 5. Where to next?

A common feature of current practice is that AI can be seen as both a strength and a weakness, or an opportunity and a threat, for the same topic. As such, there is frequent mention of the need for safeguards to ensure that strengths materialise and weaknesses do not, and that opportunities are realised and not threats. In order to deliver robust safeguards, all sources of evidence point to the need for some kind of regulation to ensure appropriate application of IA in IA practice.

One perspective that may be useful is to consider where specific reference was made through the survey responses to young professionals. These people represent the future of the IA profession and are most likely to work with AI throughout their careers. For them, strengths were identified as delivering knowledge support and learning, given that AI can assist newcomers in gaining understanding of complex domains and methodologies. This can support onboarding and skills development for young professionals entering the field. AI can also enhance guidance and consistency in situations where it can help junior consultants learn from clear, consistent examples of professional reporting and data handling. Weaknesses included the potential for AI to hinder the development of critical analytical, writing, and interpretive skills of junior staff, potentially limiting the capacity and expertise to conduct the much needed critical evaluations of AI outputs. Furthermore, extended use of AI could lead to dependence on non-contextual outputs that overlook local, cultural, or historical nuances. Opportunities for young professionals include the potential to accelerate capacity building as practitioners and graduates learn to use AI effectively. There are also opportunities to enhance knowledge sharing and learning across projects, supporting skills development and early-career progression. And, by automating repetitive tasks, AI can free up young professionals to engage in more complex analysis and critical thinking. Threats for young professionals include de-skilling and reduced learning opportunities as the same



automation that saves time can also limit hands-on experience and learning-by-doing for junior staff. There is also a perceived risk that AI could replace rather than support experts, potentially threatening early-career opportunities. Finally, overreliance on AI without critical oversight may undermine professional credibility – particularly affecting younger consultants who are still establishing trust and reputation.

To an extent, the issues raised for IA practitioners in general are already included in the IAIA Principles for use of AI in IA (Bingham et al. 2025), encompassing the need to be transparent, to ensure AI support rather than replace human expertise, to guarantee data protection and privacy in general, and for responsibility to reside with human operators. However, these principles are entirely discretionary for practitioners. Given this lack of regulation, survey respondents called for Government standards and frameworks for both public and private sectors use of AI in IA, recognising that failure to regulate in this way risks abuse.

Further calls were made by the survey respondents for the development of standardised IA repositories to ensure integrity of data sources (e.g. Kørnøv et al. 2025).

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