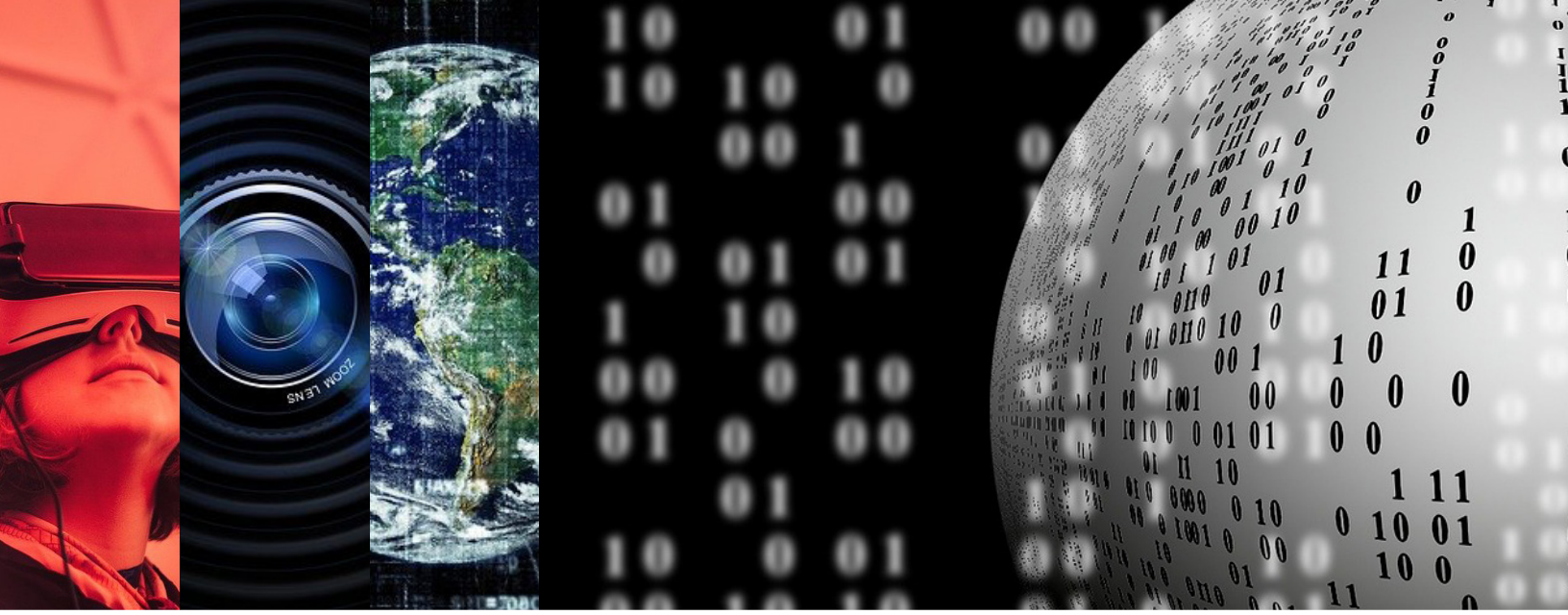

The State of Digital Impact Assessment Practice

A global review of the uptake of digital technologies and approaches within impact assessment practice

IAIA International Association for Impact Assessment

FOTHERGILL Training & Consulting

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And finally, to all 182 of the IA professionals—IAIA or otherwise—who completed the research survey and shared both their knowledge and perspectives on the use of digital approaches and technology in IA practice.

Purpose

This report explores progress in the application of advances in digital technology and approaches across impact assessment (IA) practice in mid-2021. It provides a global snapshot of the innovation, leadership and the application of digital solutions across the profession. The scope of this growing arena of "digital IA" is significant and inevitably overlaps with the much broader digital transformation going on across the global economy. While developments related to Big Data, Smart Cities and other areas of digital progress are clearly relevant to digital IA, the focus here is on how our profession and practice is both adopting and being influenced by advances across technology, online data and computing, artificial intelligence, and a myriad of other areas.

The report's purpose is to help ensure IA professionals are aware of the pace, scope, and scale of change that digital advancements are generating across practice, and to highlight the benefits and challenges such approaches can generate. The project team has engaged with digital projects related to IA practice across the globe and considered approaches being applied by governments, the private sector, academia, and the financial institution (FI) community.

The report, and the research behind it, were kindly supported by an Innovation Grant from the International Association for Impact Assessment (IAIA), the aim of the grant being to enhance knowledge and understanding among IA professionals of the different components of digital technology and approaches that are being applied around the world with the intent of enhancing IA's effectiveness.

The report includes over 20 case studies, and a far greater number of brief outline examples, of digital IA practices; this can only demonstrate the "tip of the iceberg"of activity to apply recent advances in digital technology and approaches within practice. The case studies presented across the ten areas of digital IA practice that the report reflects upon (in Section 4) are intended to demonstrate progress across global practice. They are intended to inspire members of the professional community to both seek and share more knowledge on specific aspects and example of digital IA.

Disclaimer

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1. Digital Impact Assessment (IA) in Context

It was April 2015, in the nice weather of Florence, that the potential of advances being made in digital approaches and technology was brought front and center to the global impact assessment (IA) community. Nearly 1000 delegates from across the globe navigated the conference via smartphone app, interacted with posters of IA case study on person-size iPad-like touchscreens, enjoyed the free high speed Wi-Fi available across the venue's open park land, and engaged with over 100 papers on the opportunities around IA's digital future.

The International Association for Impact Assessment's (IAIA) 2015 conference was in many ways the starting gun for this report's investigation into the state of digital IA practice. It galvanized the interest of many IA professionals to either begin or further their exploration of the potential of digitizing one or more aspects of the IA process. What was missing in among the excitement and opportunity generated in 2015 was the hard evidence to turn the potential into reality: the broad-scale demonstration that the IA process could be made more effective in the real world through the adoption of advances in digital technology apparent in wider society.

In the six years since that landmark conference, it is fair to say that such evidence has now emerged and is constantly growing. From consultancy-led initiatives, through academic related research studies and regional/national scale projects, to the work of those involved in IA across development bodies and financial institutions (FIs), the development of advances in the real-world application of digital approaches in IA have been rapid. For example, we have moved from a handful of pilot examples of fully digital Environmental Impact Statements (EISs) at IAIA's Nagoya conference in 2016 to now having multiple examples of live online EISs from countries across the world, generated from a competing range of digital IA workspace platforms. All this in less than five years.

The world of digital IA is therefore fast moving, and this makes it difficult for the IA community to keep pace. We have not had the chance to take a step back and recognize the depth and breadth of these advances across different areas of global practice. As such, there was a need for a study to look at:

- Where is progress being made?
- How can digital technology aid screening, assessment, or monitoring?
- And even more simply: What do we mean by digital IA?

This *State of Digital IA Practice* report addresses these issues and more, by combining the proven research capabilities of Fothergill Training and Consulting Ltd with IAIA's unique position at the heart of the global IA community. The report provides a snapshot of advances across the landscape of digital approaches and technologies being applied within global IA practice in the first half of 2021.

The project team—Josh Fothergill and Jo Murphy of Fothergill Training & Consulting Ltd—have significant experience in providing IA leadership in the UK and engaging with the wider global profession through IAIA and other capacity building initiatives. They have been interested in the growth of digital IA and recognize the potential that innovation and digital technology could have in improving the effectiveness of IA, the latter being a key theme Josh brought out in authoring the UK's Proportionate Environmental Impact Assessment (EIA) Strategy for IEMA in 2017 (Fothergill, 2017)—a strategy outlining themes and approaches to improving EIA's effectiveness in the UK.

They are, however, cognizant of the potential risks and challenges that can emerge if such digital approaches are applied without due consideration. As such, the authors have been tracking progress and initiatives around digital IA practice for some years and used this to create the spark behind this *State of Digital IA Practice* project.

Based on this interest, the project team submitted a grant proposal to IAIA in 2020. The bid was reviewed by the relevant committee and the project was successful in winning one of the Association's two Innovation Grants for delivery in 2021. IAIA's grant provided $4875 in financial support to the project team, with additional work and inputs provided on a pro-bono basis with the key output of the grant being the creation of this IAIA-FothergillTC report for publication by the end of 2021.

It must be remembered that no such report can be fully comprehensive and undoubtedly there will be digital IA examples and unique developments that are not covered below. The report does not seek to be an encyclopedia, but to instead make the best use of the opportunity afforded via the IAIA Innovation Grant funding to help enable IA professionals and those with an interest in the IA to discuss, be energized by, and seek to advance the application of digital approaches and technology in global practice to enable sustainable development.

The remainder of this introductory chapter sets out to provide a conceptualization of what digital IA means and demonstrate how interest and application are growing around the world. The report then goes on to provide:

- An overview of the project's approach and the views of the IA profession on different aspects of digital IA, including highlighting a number of individual and institutional innovators and leaders (Section 2).
- The benefits and challenges that IA professionals believe are arising as a result of IA's transition toward more integrated use of digital technologies (Section 3).
- A review of the state of digital IA across 10 different areas of practice, from screening through drones and artificial intelligence to virtual reality, digital EIS, follow-up, and capacity building (Section 4).
- Key themes and trends that have emerged from the project's review of the state of digital IA practice and a series of questions to ask the IA community what this may mean for the medium- to long-term future of IA practice (Section 5).
- A series of links to further reading for those who want to explore the subject of digital IA for themselves are presented to round off the report (Section 6).

Throughout the report, examples and case studies of digital IA practices from across the world are included. Section 4 provides in-depth examples of advances in digital IA practice across 14 nations, and a range of development agencies, international financial institutions (IFIs) and export credit agencies, providing the most comprehensive review of global digital IA practice yet compiled.

1.1 What do we mean by Digital IA?

While much interest over the last five years has been focused on digitizing IA reports and online platforms that enable virtual stakeholder engagement, the reality is that digital IA is far more than this.

This *State of Digital IA Practice* report defines digital IA as:

> "The use of advances in digital technologies and their applications in the pursuit of enabling more effective IA practice."

This report contests that digital IA is about the application of a broad spectrum of advances in digital technologies. This ranges from physical hardware—such as drones—through software applications, the growth of computer algorithm based Artificial Intelligence (AI), and the use of virtual, augmented, and mixed reality to the interconnected nature of such approaches manifest by the Internet, mobile phone networks, cloud computing, and the near-ubiquitous availability of smartphones across the planet.

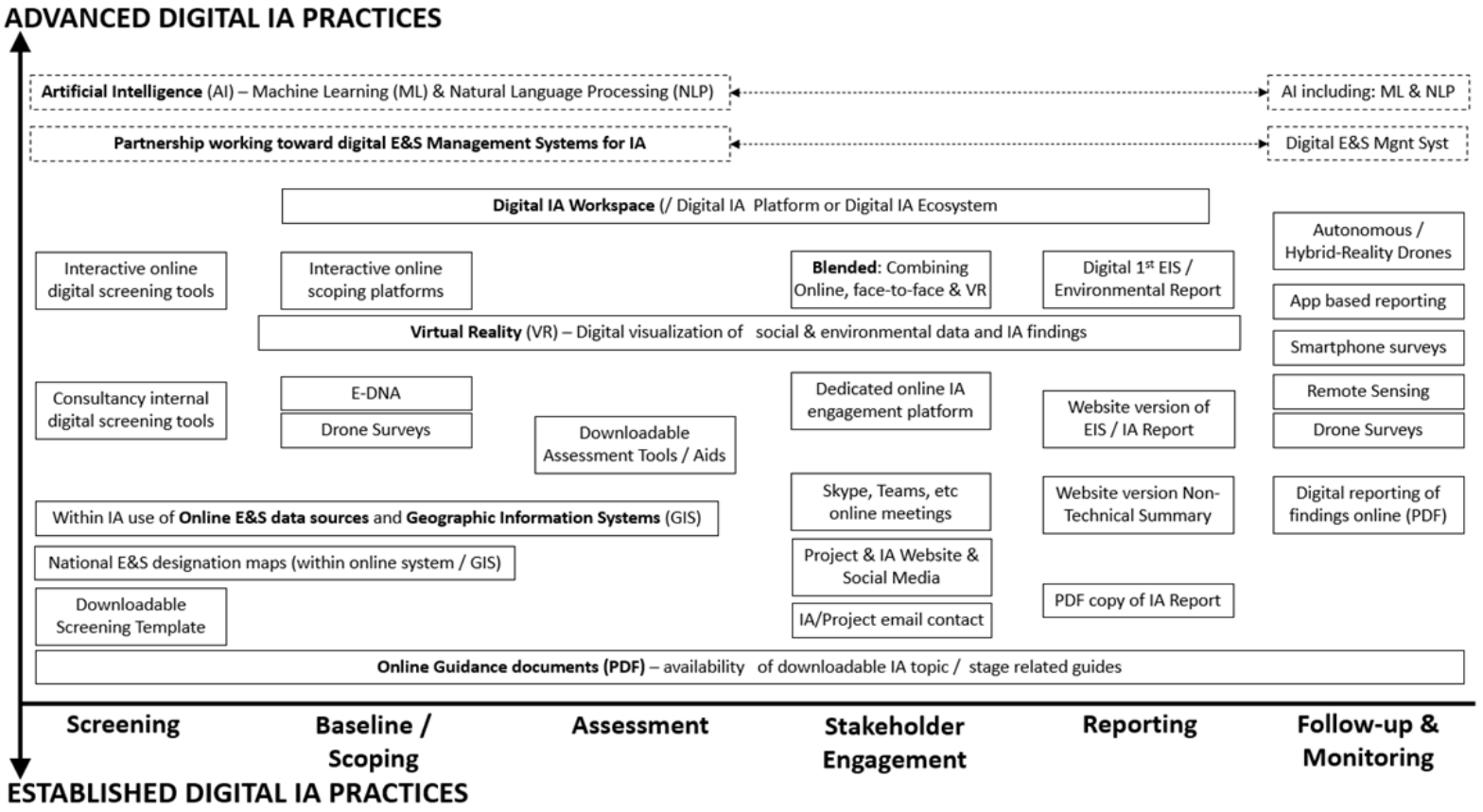
The report recognizes that IA professionals are also interested in the growing need to conduct IA of emerging technologies, including some of the digital technologies used in conducting IAs. The subject of IA of Emerging Technology is beyond the scope of this report. Those interested in this field are referred to IAIA's special-interest Section dedicated to this subject: www.iaia.org/contact-iaias-emerging-technologies-section.php.

The report identifies ten areas within IA practice, where it explores the application of advances in digital approaches and technology. These areas were initially conceptualized by considering the digital technologies being applied within the common stages of the IA process (see Figure 1.1), before being developed into the ten specific areas set out in Figure 1.2 and discussed in Sections 4.1-4.10

Figure 1.1 illustrates the application and advancement of IA's digital transformation, moving from the bottom to the top of the diagram. It should be noted that many of the approaches set out in boxes within the diagram can also be applied within other stages of the IA process, most notably in the use of data gathering approaches between scoping and follow-up stages.

While Figure 1.1 is not intended to provide a maturity matrix, further research and analysis could be undertaken to produce such a diagram as a component within a digital IA maturity tool. The current figure simply presents different digital practices, approaches, and technologies on an approximate scale based on the authors' judgment of how commonly such technologies were indicated as being applied and how advanced their application in IA appeared to be considered by interviewees. It is therefore most appropriate to read up the diagram for a single IA stage for advancement of digital practices, with horizontal comparison, between EIA stages, being somewhat compromised by the limitations of fitting such information on a single diagram. The authors consider that the potential for the future development of such

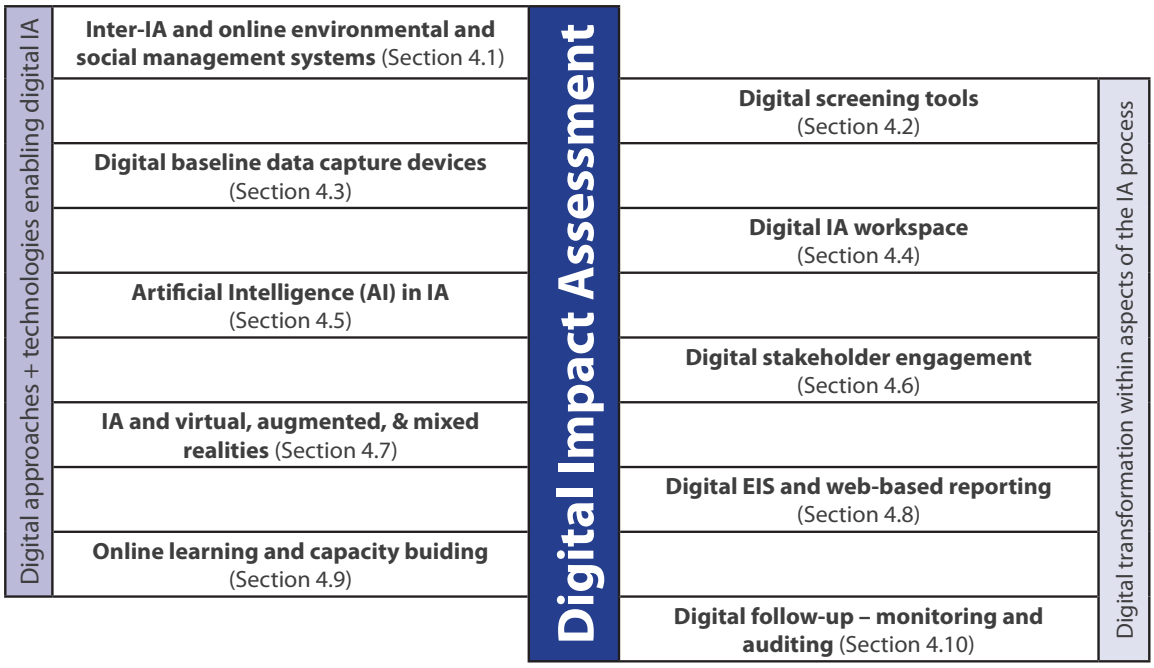
Figure 1.1: The growth of digital approaches in



The concept for Figure 1.1 was inspired by the project's interview with Lone Kornov and Ulf Kjellerup, 18 May 2021

Figure 1.1's conceptualization and discussions during the project's interviews, led the report to focus on the state of practice related to ten specific elements of digital IA. These ten elements are presented in Figure 1.2, below.

Figure 1.2: The 10 elements of digital IA practice reviewed within the project



As can be seen in Figure 1.2, the ten elements of digital IA presented are separated into two groups of five. Five of the elements—the left-hand side of the figure — relate to advances in digital technologies, such as virtual reality, that are being adopted and applied within IA practice to help enable and support the delivery of digital IA. The remaining five—on the right of the figure—are oriented to how specific parts of the IA process, such as screening, stakeholder engagement and the EIS, are adopting and integrating digital approaches to deliver these steps in a new way. Each of the ten elements presented in Figure 1.2 are discussed in detail, with multiple case examples, within Section 4.

While each of the elements in Figure 1.2 should be considered part of the broad transformation toward digital IA, the elements cannot be considered wholly distinct from each other when discussing digital IA. This is because multiple elements of digital IA practice are now commonly combined to deliver the digital IA approaches we see in today's practice. This multi-element approach to digital IA projects is a hallmark of many of the examples identified during the project, as can be seen in many of the case examples discussed in Section 4.

The ten elements are considered to provide a useful way of recognizing of the broad subject area that is digital IA. Beyond the ten digital IA elements, there are many further trends in wider digital transformation occurring across the world, which can have relevance to IA practice. Two such trends identified by the project but considered to sit outside of the main scope of digital IA are the increasing use of Building Information Modeling (BIM) in managing development project related data and the increased use of online consenting approaches/online public inquiry. While not a focus for this report, the authors recognize that both these areas are important trends that influence the work of IA teams across the globe. However, as this report seeks to determine a definition and scope for digital IA, both the above trends, and many other areas of the wider global digital transformation, were considered to be external factors that IA practitioners find themselves having to adapt to, as opposed to activity around the ten elements in Figure 1.2, where the IA community can be seen to be actively making use of advances in digital approaches and technology for its own benefit.

1.2 Interest in Digital IA across the IA community

The subjects brought to IAIA's annual global conference provide an indication of the interests and challenges facing IA practitioners across the globe. The conference regularly attracts 750+ IA professionals from all over the world. While the theme of each conference undoubtedly influences the topics brought forward by the 100s of speakers each year, broader themes of interest to IA professionals can also be seen within the program. Considered over time, these annual conference programs can provide a bounty of information about the issues that were of increasing/decreasing interest amongst those engaged in the conference's unique global conversation.

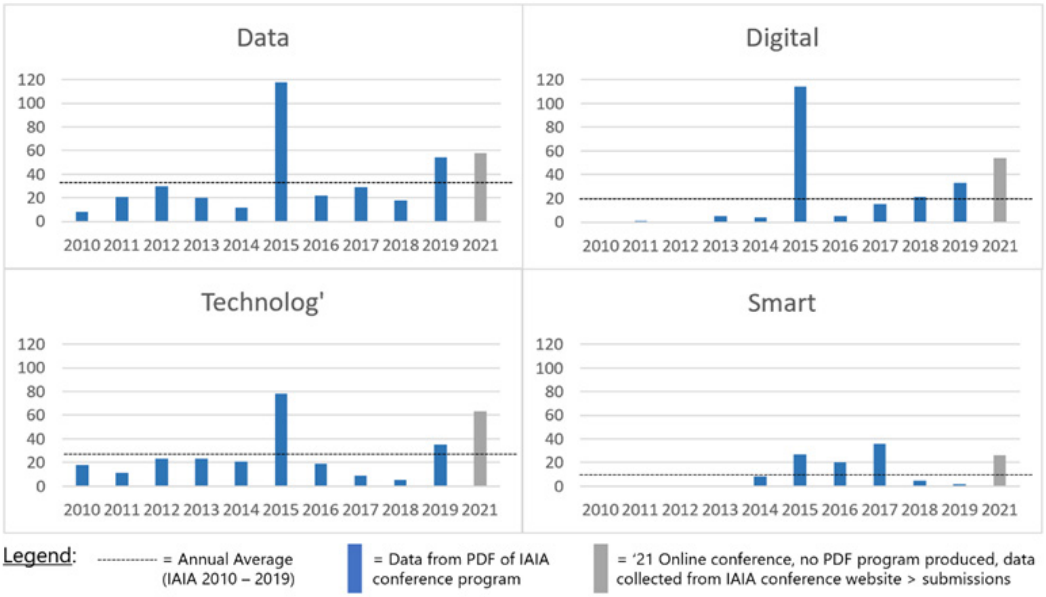
As a starting point for this project in late 2020, the authors reviewed the final programs for the IAIA annual conferences between 2010 (Geneva) and 2019 (Brisbane). The 2020 conference—intended to be hosted in Seville—was delayed until 2021 and delivered in an online format (discussed as part of the digital IA online learning review in Section 4.9); as such, a separate review of the sessions, abstracts, and posters was also conducted for IAIA21 based on the information available at that time.

The findings from the review of the 2010-19 conference programs and 2021 conference website are presented in Figure 1.3. The 2021 findings are not considered fully comparable with the 2010-19 data as they were not in the previous PDF program format; as such, they are presented in a separate color on the figure.

The review of the conference sessions, papers and posters searched for the presence of the following terms:

- Data
- Technolog* (covering both technology and technologies)
- Digital
- Smart

Figure 1.3: Appearance of selected digital IA related search terms within the final IAIA conference program - 2010 to 2019



Vertical Axis = Total number of appearances of the search term in the Final Conference Program
Horizontal Axis = Year of the IAIA Final Conference Program
Annual average statistics per search term (IAIA'10 - '19):
Data = 33.2 Technolog' = 24.2 Digital = 19.8 Smart = 9.8

The review identified all references to each search term, but not all use of the terms was in the context of digital / technological advances in IA practice. This was found to be more likely to be the case of the terms data and technology/ies, both of which are commonly used terms in IA practice (e.g., baseline data, renewable technologies). As such, the insights presented in Figure

The most obvious finding in Figure 1.3 is that the terms data, digital and technology/ies show an exceptional peak in 2015. This is not surprising, as the conference theme for IAIA 2015 was **IA in the Digital Era** and over half of the conference streams were focused on the theme, including Big data, Digital media in IA, and new technology's role in visualizing societal changes associated with major projects. A similar peak can be seen in the review of the 2021 conference, which again is likely to have been driven by the conference theme ("Smartening IA in Challenging Times") and thematic links to the uptake of smart/digital technologies in IA.

The graphs in Figure 1.3 also indicate that the common association between the terms smart/digital and the application of IA practice did not begin to gain traction within IAIA's conferencing until 2013/14. This infers that the current surge in interest in exploring the delivery of IA through the broad adoption of digital approaches and technologies is less than a decade old. This is perhaps unsurprising given Apple's i-phone—the forerunner of today's ubiquitous smart phones—was only launched in mid-2007 and time is inevitably needed for professional practice to become aware of, see the potential for, and find practical applications for such step changes in digital technologies in practice.

The final aspect of note in Figure 1.3 is that only usage of the term digital demonstrates a clear growth trend through the 10-year period, with growth in usage within the conference's final program since 2016 (and by proxy growing IA community interest since then); a trend that continued with more than 50 references to digital within IAIA21's online session, abstract and poster submissions.

1.3 Digital IA – a global phenomenon?

It is notable that the during the two peak years for digital IA content—2015 and 2021—the conference was held in Europe. This might infer there is a particular drive toward the application of digital approaches within IA across Europe, which may not be shared by other parts of the world.

The findings of this project, however, do not find this to be the case, with clear interest and evidence of progress found in the application of digital approaches and technology across the globe. The project's online survey was responded to by IA practitioners in 49 countries. Only one of the top five countries in terms of the location of the IA professional responding to the survey was within Europe—the UK (16 responses)—the other countries in the top five being Canada (23), South Africa (22), Kenya (15), and the Philippines (7).

Further to this, the research (discussed in Section 2.1) demonstrated progress in the application of digital IA across the world. Figure 1.4 provides a map highlighting just a small fraction of the real-world digital IA examples noted by the project. However, while the study recognizes it focused on English language publications, thus discussions of digital IA in other languages were not explored, it is fair to recognize an apparent concentration of activity within three European countries. These countries, listed below, provided multiple examples of digital related IA projects alongside work in Australia and the work of the IFC:

- **Denmark** (DREAMS project & EKF follow-up tool, see Sections 2.2, 4.1, 4.5 & 4.10)
- **Netherlands** (Digital ES Pilot and the iReport see Sections 2.2 and 4.4 & 4.8)
- **United Kingdom** (Digital EIA Project and IEMA Digital IA Working Group – see Box 2.1 and Sections 2.2, 4.1, 4.5 & 4.8)

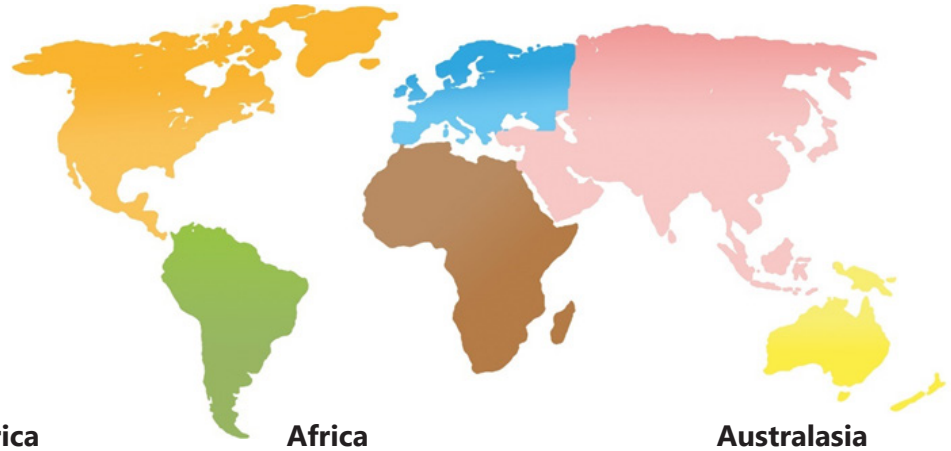
Studies in these countries have led to several prominent publications related to thought leadership in digital IA practice. However, progress in the application of digital approaches is being made in both general practice and by specific projects and initiatives across the world. Notable examples are in Western Australia and Chile and in the International Finance Corporation's (IFC) development and application of artificial intelligence to aid their environmental and social impact assessment and wider environmental, social, and governance (ESG) work.

Figure 1.4: Examples of aspects of Digital IA being applied around the globe[1]

North America:
- Canada, Environmental database management system
- IFC, Artificial Intelligence, and data innovation for social license

Europe
- Iceland, Early example of the potential of digital EIS
- Netherlands, Digital EIS, diagnostic tool country ESIA systems
- Serbia, Envigo digital IA platform

Asia
- China (Hong Kong), Virtual and hybrid reality systems
- Singapore, Autonomous vehicles + automated decision support systems
- Nepal, drones + digital air quality devices



South America
- Chile, Remote sensing and live database EIA follow-up
- Guyana, Imagery + GIS to map coastal ecosystem services, with in-field verification.

Africa
- Kenya, Drones surveys
- Nigeria, Developing digital EIA project + drone surveys
- South Africa, digital screening platform

Australasia
- Australia, digital EIA studies, reports and monitoring system.

[1] World map image, Barun Patro via https://www.freeimages.com/photo/continents-world-map-1578021

2. Origins, Innovators, and Views from the Profession

2.1 The project and approach

The research was undertaken through a combination of desk-based review, online interviews, a digital survey, and the review of digital IA-related content presented at relevant conferences and webinars during 2019-21. The latter including the review of over 25 presentations related to digital IA from IAIA21's program.

A key aspect of the project was the series of interviews with IA experts with interest in the application of digital approaches and technology in practice. Thirteen interviews were conducted, between the 5th February and 25th May 2021, with the following IA/related professionals from around the world:

- *Digital IA activity in a global consultancy* with **Paul Morgalla** and **Fiona Wilson** (Atkins – a member of the SNC-Lavalin Group)
- *Digital IA Action and Ambitions in Nigeria* with **Etia Ndarake** and **John Lahu** (Willend Associates Ltd), **Dr Andy Aboje** (Independent Consultant), **Felix Olawore** (RHDHV)
- *Developing the iReport from Netherlands pilot to global application* with **Paul Eijssen** (Royal Hakoning DHV)
- *Digital IA and Public Participation Progress in Hong Kong* with **Timothy Peirson-Smith** (Executive Counsel)
- *ENVIGO a comprehensive platform for Digital IA* with **Nikola Nikacevic** (Eon+) and **Andrew Jamieson** (Eon+ and LR Consultants)
- *Using Environmental Permitting to Digitally Follow-up EIA in Chile* with **Sebastian Elgueta** (División de Seguimiento e Información Ambiental en Superintendencia del Medio Ambiente)
- *Developing a comprehensive and trusted digital environmental baseline for the siting of long-term nuclear waste repository in Canada* with **Joanne Jacyk** and **Vera Yin** (Nuclear Waste Management Organization, Canada)
- *Developing a comprehensive digital approach to IA in a global consultancy* with **Ross Stewart** (AECOM)
- *Western Australia's Shared Analytical Framework for the Environment and Digital Transformation of Environmental Assessment* with **Chris Gentle** (Western Australian Biodiversity Science Institute and Western Australian Marine Science Institution)
- *Using Artificial Intelligence to Enhance ESG Risk Management within the IFC* with **Atiyah Curmally** (IFC – International Finance Corporation)
- *Digital impact data capture, modeling and monitoring in IA Singapore, Malaysia and beyond* with **Matt Jury** (DHI)
- *Danish DREAMS, Digitally supported Environmental Assessment for Sustainable Development Goals* with **Lone Kørnøv** (University of Aalborg) and **Ulf Kjellerup** (COWI)
- *Hong Kong Environmental Protection Department's use of Hybrid Reality in EIA follow-up* with **Clara U** (HK EPD)

2.2 Digital IA Influencers and Innovators

Many individuals, organizations, and initiatives are exploring advances in digital approaches and technology. Within this community, there are some who can be considered to have helped shape the conversation and demonstrated the art of the possible. This section highlights a range of individuals and innovations or initiatives that have particularly influenced the direction digital IA practice is currently taking.

Enabling the discussion of digital approaches in IA

The project identified several individuals within IAIA's membership who can be seen to have influenced the development of the recent surge in interest around digital IA. While it is not possible to identify all such influencers, those listed below were named by multiple individuals as having helped inspire their own progress and understanding of digital IA.

- **Guiseppe Magro.** The chair of IAIA15 ("IA in the Digital Era") and the driving force behind the focus of the conference's technical program on the application of technology and digital approaches. Guiseppe is an IA consultant who specializes in predictive modeling and decision support systems. Notably he created the worldwide data platform for sustainability and governance in smart cities (Q-cumber), which contains the data and findings of multiple IA around the world and has the potential to house all such data.
- **Paul Eijssen.** While not being the first to demonstrate a digital environmental impact statement (EIS), Paul has been and remains a major force in advancing discussion and thinking on the role of digital EIS and the process adaptations required to deliver this. Through his consultancy role at Royal Haskoning DHV, Paul and his colleagues worked with the Netherlands Government in 2016 to develop a retrospective example of the capabilities of a digital approach to EIS compared to the traditional "paper/PDF copy" oriented approach that has dominated global practice up to now. Since then he has led multiple popular sessions at both IAIA's annual conferences and a range of conferences in Europe. On the digital IA side, he has continued to lead progress on the digital ES concept expanding into an interactive IA workspace and engagement tool: the iReport (see Section 4.4 for further details).
- **Marla Orenstein.** Marla's work exploring the future of IA in 2017-18 has been influential on leading new thinking in the potential for digital approaches in IA. Beginning with a series of LinkedIn posts in January and February 2017[2], Marla reviewed a range of emerging technologies related and speculated on what this may mean for the future of IA, with the latter posts focusing on the role of artificial intelligence. These posts became the core material of both a paper and impromptu panel discussion appearance in May 2018's IAIA conference and were followed up by a well-attended IAIA webinar in September of that year. This pushed thinking not just on what may be possible in future IA, but also identified risks that may be associated with adoption of more digital approaches into our IA practice.
- **Sebastian Elgueta.** Sebastian's work over the last five years in the environmental permitting branch of the Chilean Government has helped demonstrate the art of the possible in terms of a developing and beginning the implementation of a well-structured digital transformation strategy. His work and that of his team is helping redefine environmental follow-up via digital transformation and is beginning to have influence back into IA practice in the country. Sebastian shared his experiences in a June 2020 IAIA webinar on Compliance and Enforcement of Environmental and Social Impact Assessment (ESIA).[3]
- **Alan Bond, Jiri Dusik and Miltos Ladikas.** While this project has not focused on the application of IA to emerging—and often disruptive—technologies, awareness of such

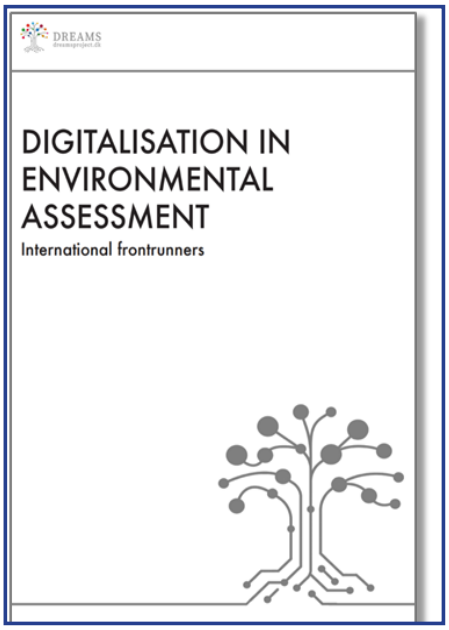
[2] Section 6, Further Reading, provides links to Marla's 2017 LinkedIn thought pieces and 2018 IAIA webinar.

[3] Access the IAIA webinar recording here: https://www.iaia.org/webinar-details.php?ID=29.

issues and potential challenges is important as IA applies more digital approaches. As such, the founding coordinators of IAIA's relatively newly formed Emerging Technologies Section should be recognized as playing an important part in the IA profession recognizing that risks and challenges can be associated with the application of digital approaches in practice.

Innovators driving current progress in digital IA

The project identified a number of more recent innovative initiatives that are helping to inspire, conceptualize, and advance the art of the possible in relation to the scope of digital IA practice. During the development of this report, the team leading the Danish digital IA project—DREAMS, *Digitally Supporting Environmental Assessment for Sustainable Development Goals* —produced a very useful review of what it termed *international frontrunners* in digital IA. Our work strongly supports the Danish team's findings that the initiatives are examples of innovators rather than repeats of the analysis.



In early 2021 the Danish DREAMS initiative (see Sections 4.1 and 4.5) published a very useful report[4] summarizing a range of international innovators in the digital IA field in early 2021. The report profiles initiatives from around the world each of which is in itself advancing digital IA as well as acting to catalyze and inspire digital IA progress more widely.

- **Western Australia**, a major project using information from EIS and monitoring to develop digital tools to enhance IA analysis and reporting across the state, with leadership from Western Australian Biodiversity and Marine Science Institutes.
- **Netherlands**, work related to piloting and developing digital ES (see reference to Paul Eijssen, above) and wider developments in relation to the Environmental Planning Act.
- **United Kingdom**, several initiatives including the Scottish Strategic Environmental Assessment (SEA) Gateway, IEMA's volunteer network's case examples, thought pieces and a primer on digital EIA (see Box 2.1), and an offshore IA initiative to develop a digital evidence base and online hub.
- **Denmark**, details of the DREAMS initiative itself are also presented in the report.

As with the above influencers section, the two initiatives described below provide a small selection of the examples identified. The two examples are considered notable as they were recognized and referred to by multiple professionals during the project's expert interviews and online survey. As such, these examples provide a brief taste of the innovative digital IA-related projects that are explored and discussed across Section 4 of this report.

[4] Ravn-Bøss, E. Lyhne, I. and Kørnøv L. (2021) Digitalisation in Environmental Assessment. International frontrunners. The Danish Center for Environmental Assessment (DCEA), Aalborg University, accessed here: https://dreamsproject.dk/reports/

Box 2.1: Principles for applying Digital approaches within IA

The Institute for Environmental Management and Assessment (IEMA) in the UK established a Digital IA Working Group as part of the work undertaken by its network of volunteers in 2017. The group was formed to respond to:

- The growing interest in digital approaches to EIA among UK professionals.
- The practical challenges posed by this development in practice.
- Address one of the four key themes within The UK's Proportionate EIA Strategy (2017) – Embrace Innovation and Digital Technology.

In spring 2020 IEMA published a *Primer on Digital IA* developed by its Digital Impact Assessment Working Group — a cross-industry voluntary collaboration of environmental assessment and GIS/data professionals. A particularly useful element for aiding understanding around how to make progress in adopting digital approaches and technology within IA are the draft principles the group developed. The Primer presents seven principles. To highlight, key issues those seeking to applying digital approaches in IA should recognize:

1. Technology offers opportunities throughout the IA process.
2. Digital working can create a culture that promotes collaboration.
3. Information management underpins effective digital IA.
4. Effective communication increasingly necessitates digital communication.
5. Provide accessibility for all needs.
6. Regulation should be carefully considered when defining digital solutions, yet also provides an opportunity to facilitate innovation and digital working.
7. Innovation and collaboration across the IA sector can improve outcomes for all.

To access the Primer, see Section 6 of this report: *Further Information & Links*.

International Finance Corporation (IFC) Artificial intelligence to aid ESG risk management – MALENA

In recent years, the IFC has been undertaking a project to make a significant step forward in the practical application of AI to the delivery of their environmental and social risk management work, including ESIA.

MALENA
MACHINE LEARNING ESG ANALYST

MALENA stands for *Machine Learning Environment, Social and Governance Analyst*. It is a project that combines machine learning and natural language processing approaches, from the field of AI, to accurately analyze large volumes of publicly-available information on environmental, social, and governance (ESG) risks and benefits. As a result, the IFC team have been able to effectively "mine" key ESG information stored within its back catalogue of previous electronic IA reports and ESG databases to help determine prevalence of such risk in different sectors and geographies as well as related to specific portfolios.

The system is not intended to replace IA or ESG professionals, but rather provide them with a powerful ally of the combined and analyzed outcomes of IFC's previous ESG risk management work. The outcome is an online tool and app that will be used by IFC staff, and to varying degrees partners and consultants, to assist in identifying likely ESG risks associated with different sectors and countries, as well as highlighting existing IFC data /studies that may be relevant to current/future ESG related work. Additional coverage of AI in IA and the MALENA project can be found in Section 4.5, with links to further reading about the project provided in Section 6.

The UK's Digital EIA Catapult Project

Innovate UK, a UK Government research institute, funded the *Connected Places Catapult* to coordinate a 6-month research study running from 2019 into 2020. The study looked into how digital approaches could be used to enhance EIA practice within the UK's regulatory system. The Catapult worked with the EIA consultancies Quod and Temple, plus research company, technology, and marketing agency Liquorice and the Leeds node of the Open Data Institute (ODI).

The digital EIA project explored how the UK's EIA process could be transformed by using a human-centered design approach. The study considered what the future for EIA could look like if it involved a more designed, digital, and data-informed approach. The report identified key existing challenges within the EIA process and developed a range of digitally based concepts on how these could be overcome, including:

- Creation of a national environmental data hub of all EIA reports and data.
- Digital tools to assist in screening whether EIA is required and what should be scoped into the assessment.
- Digital spaces for coordinating the assessment and impact modeling and both writing and reporting the EIS.
- Post-application online monitoring of environmental impacts occurring on site with the ability for stakeholders to engage where they have questions/concerns.

Further details about this project and access to its reports and analysis can be found in Section 6 of this report.

2.3 Views on digital IA from the profession

This section presents findings from the expert interviews and survey conducted in the first half of 2021. It considers the perspective of IA professionals in relation to:

- What constitutes digital IA?
- The degree of interest being shown toward digital advances within practice.
- The most common applications of different digital approaches observed by those working in the field.

Digital IA has a broad scope with no agreed definition

Each of the project's expert interviews started with the same question: What is digital IA? The result was not just different views from each of the 13 interviews, but also exposed variation in definitions and perspective among the professionals within specific interviews. None of those interviewed for the project indicated that they were either aware of or sought to use a common definition of digital IA. Many, however, indicated that while a broad definition would be useful, a lack of such a definition was not necessarily a problem and that it was more important that those working on the application of specific digital approaches/technology in IA could justify and explain the value it brought and were aware of any risks associated with its use.

Many of the interviewees agreed that digital IA included a broad range of advances in the application of technology and digital approaches in relation to IA. Further, it was clear from those interviewed that they saw a distinction between recent discussion of digital IA activity and advances in the past five years, or so, and the use of common digital technology in the IA workplace—word processing, GIS mapping, PDF document submission. It was in fact more common for the interviewees to seek to sub-divide digital IA by what they felt it did not include, rather than providing a specific definition of what it was.

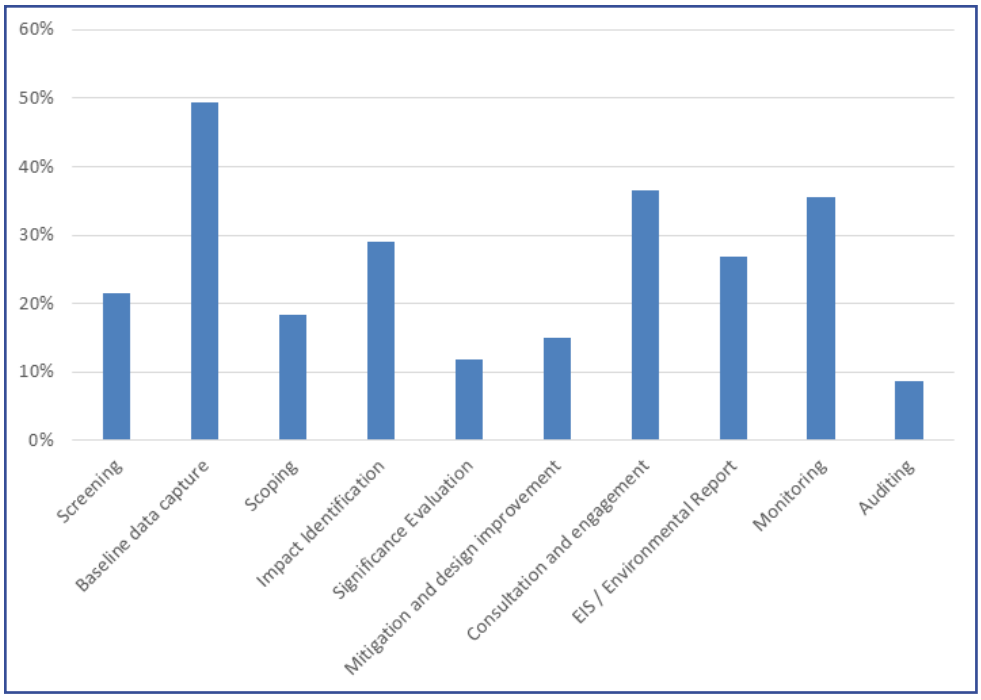
This exclusionary approach toward a definition tended to seek to separate the adoption of technology to deliver a specific task in the IA process from deeper approaches that sought to digitize multiple IA steps

or the assessment process itself. An example of this distinction was task-oriented use of drones to capture baseline/monitoring data compared with the creation of a digital workspace used to manage the consultant's IA work and engage stakeholders in scoping and/or submission through the use of interaction and reporting.

A similar split in views can be seen in where practitioners see digital IA activities fitting into the IA process in the response to the project's survey. The survey sought to identify the stages in the IA process that might benefit from digitization (Figure 2.1). Respondents were asked to identify up to three elements of the IA process they felt would most benefit from increased application of digital approaches or technologies. The results in Figure 2.1 present the views of 93 respondents and show a broad spread of views across all IA stages—from screening to monitoring—with all gaining over 10% support, and no activity gaining more than 50%.

The findings do place greater emphasis on the potential for digitization benefits in the data heavy baseline (49%) and monitoring (35%) steps, and those that can effectively apply digital overlaying/visualization of complex environmental information, such as engagement (37%), the impact identification process (29%), and the creation of a digital ES (27%). The overall message, however, is perhaps that different IA professionals are seeing different opportunities for the use of digital approaches across all stages of the IA process. This likely contributes to the variation in views when asked to provide a definition of digital IA.

Figure 2.1: IA professionals' views on the IA activities that could benefit most from an increased application of digital approaches



Legend:
Vertical Axis = Percentage of respondents to the question
Horizontal Axis = IA activity response options available

There is strong interest in digital IA approaches from across the IA community

The project survey sought to identify the importance respondents felt digital approaches had in the future effectiveness of IA and the degree of interest they saw within their contacts and different types of stakeholders.

In terms of importance to future effectiveness, respondents viewed the uptake of digital approaches as highly important. Survey respondents were presented with a sliding scale response bar pre-set at 50%, representing a neutral view of importance. 100% represented incredibly important and 0% represented not important at all. The average score of the 162 respondents was 80%.

It is notable that only two respondents moved the slider left, indicating a view that the uptake of digital approaches was not overly important in the future effectiveness of IA practice. On the opposite end, over 25% (42 respondents) gave the maximum score of 100% to indicate the use of digital approaches was in their view incredibly important to the future effectiveness of practice. This is perhaps not an overly surprising result as a survey on digital IA is more likely to be completed by those who have some prior experience/interest in this area of practice. It is a sentiment that was also shared by those interviewed as part of the research for this report and in discussions the project team took part in during the IAIA21 conference.

It should, however, be noted that in the interviews, digital tools and approaches were recognized as having risks and challenges associated with them and that such solutions are not a panacea but will need to be combined with existing good IA practices. The overall finding does, however, appear to show that there is a high degree of expectation within the profession that the application of digital approaches will lead to improvements in the effectiveness of IA practice.

The survey also sought to understand the levels of interest amongst respondents' contacts, by using a five point scale from None to Significant. Figure 2.2 highlights that not only is there expectation as to what digital approaches can deliver for IA practice, but there is a high degree of interest to discuss applying digital approaches to practice. Over a third of the project survey's respondents indicated they experienced significant interest amongst their network in digital IA, with nearly 80% finding they were having some discussions within their contacts.

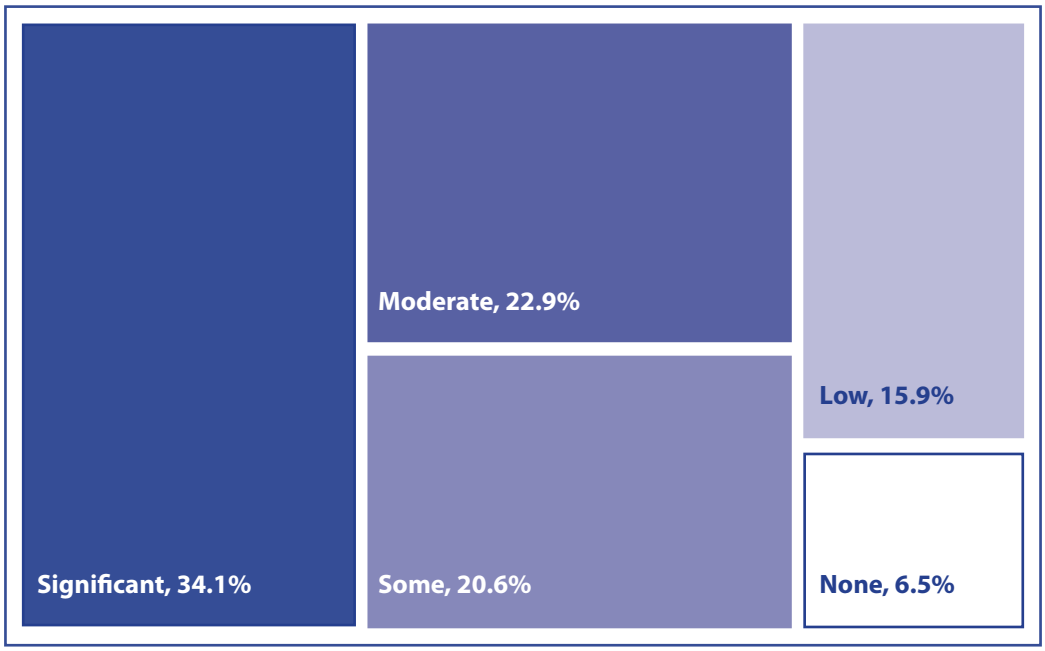
The survey findings identified that most common stakeholder groups showing interest within the IA community and engaged in such discussions were as follows:

- Consultants
- Clients, particularly for larger more complex projects in the extractives and infrastructure sectors
- Specialists, including E&S topics, GIS, engagement and data management professionals
- Government and government bodies / agencies
- Financial institutions
- Stakeholders, including Indigenous groups, communities, and NGOs
- Academics/researchers

This view is also supported by the interviews and during discussions at recent IA related conferences including IAIA21 and Scotland's EIA Conference 21[5].

[5] For example day 3 of Scotland's EIA Conference 2021 saw presentations on Digital Transformation & EIA from a renewable energy developer and a Government agency, access the slides and recording here: https://www.fothergilltc.com/eiaconference-day3

Figure 2.2: The level of interest and discussions about digital IA with the people survey respondents work with



Some elements of digital IA practices are already being widely applied

The project found that the application of various approaches to digital IA are already well underway. The survey results identified that 47% of respondents were able to provide one or more examples of digital technologies/approaches being applied in IA process they were aware of. This figure can be compared to a recent project studying the circular economy and IA[6] — another interest area for IA practice—which found only 9% of 515 respondents were able to provide some form of example of circularity being considered within IA. Additionally, these circular economy examples were more often proxies or related issues, rather than the circular economy being directly considered. In the case of this project's survey, the vast majority of digital IA were of direct relevance to the subject. The top five types of digital approaches observed by respondents were:

1. Online engagement in an IA.
2. The use of online environmental data sources for use in IA.
3. Drones for environmental data capture for an IA.
4. Online decision-making/public inquiry related to an IA development/plan.
5. Online IA learning and capacity building.

The fact that nearly half of respondents could provide one or more examples of digital approaches appears to indicate that progress in digital IA is beyond the conceptual phase, with various elements, such as those listed above, now being regularly applied in different locations across the globe. However, this also means that just over half of respondents (53%) were unaware of examples of such digital approaches being used in the IA they had been directly involved in. Further to this, few respondents indicated that they had seen approaches such as artificial intelligence (AI) or digital Environmental Statements (ES)/reports. As such, there would appear to be a spectrum of progress across the application of digital IA technologies and approaches, with some elements in the exploration phase and others being more regularly applied in various forms across global IA practice.

[6] Fothergill, J. and Murphy, J. (2021) A Primer on the Circular Economy in Impact Assessment, IAIA. https://www.iaia.org/uploads/pdf/The%20Circular%20Economy%20and%20IA_Primer.pdf

3. The Benefits and Challenges Generated by IA's Digital Transition

The aim of this section is to provide a narrative around how digital approaches are enabling improvements in IA practice, and to highlight the challenges and barriers that need to be considered when adopting such technologies and techniques. The content draws on perspectives shared in response to the state of digital IA practice project's online survey and views provided in the expert interviews conducted by the authors.

An overview of the key benefits and challenges highlighted is presented in 3.1. This is followed by key areas of debate where both benefits and risks occur in relation to the same/similar aspects of the enhanced application of digital approaches and technology in IA. These relate to:

- Data—access, integration and trust (Section 3.2)
- Engagement—equity, inclusion reach and the digital divide (Section 3.3)
- Quality and Costs—more effective practices or a loss of skilled human face to assessment? (Section 3.4)
- Safety, privacy, and security (Section 3.5)
- Barriers to IA's digital transition (Section 3.6)

3.1 Overall views on digital IA's benefits, challenges, and barriers

As with all developments in professional practice, the changes that the uptake of digital IA generates have both positive and negative outcomes as well as barriers to be overcome to enable the adoption of new approaches. In the case of digital IA, the scope of this developing area of practice is so broad that each element will have its own specific benefits and challenges that must be considered by practitioners who wish to employ such approaches/technology in their IA work.

Given the overarching nature of this study across digital IA practice, it would have been inappropriate to seek to develop concise advice on the key benefits and challenges for each of the ten elements of digital IA. It is for the wider IA community—from those working on specific elements of digital IA—to determine whether such concise advice sheets would provide a useful addition to practice. If so, they would need to work collaboratively to define the benefits and challenges related to the particular element/area of digital IA being considered. It would appear appropriate for such work to be coordinated by IAIA, perhaps using the FasTips format and the processes already established for developing such concise IA guidance. Such concise advice could draw from the broader analysis of digital IA benefits, challenges, and barriers presented in this report. To assist in this process, a conceptual example related to digital IA screening tools is presented in Box 3.1.

Box 3.1: An example of the opportunity for IAIA members to develop FasTips-style concise benefit and challenge sheets related to specific digital IA approaches

IAIA FasTips

Digital IA Screening Tools – Key Benefits and Challenges for application in practice

The benefits such approaches can deliver:

- Provides live / online access to digital systems that contain up-to-date and trusted information on environmental and social features.
- Organisations planning to undertake a project get timely – often visual - information about environmental / social issues providing greater understanding and certainty about their project's risks and opportunities to adapt / mitigate planned activities to reduce impacts and build in benefits.
- Where such digital screening tools link to regularly maintained online environmental and social data sources the information used in screening may be more comprehensive than if undertaken by an individual decision-maker.
- A fully automated system digital IA screening system – endorsed within legislation / FI policy – would save time and resources by avoiding the need for staff to make such decisions, but the trust and transparency issues would need to be comprehensively addressed to enable such an approach to be acceptable.

Risks and challenges that need to be considered:

- The key to the successful application of such tools is trust amongst users and stakeholders. Current digital screening approaches (see Section 4.2 of The State of Digital IA Practice [IAIA,2021]) combine the tool's output with other information – specialist inputs, other documentation, user perspectives to generate the formal screening decision. In contexts, where the IA screening system currently relies of a people making professional judgement related to environmental and social risk / significance a move to fully automated screening systems based on AI is likely to prove challenging.
- Reliability of information, it is critical that such tools are maintained, including links to external online data sources, otherwise they risk becoming out of date and a liability. Where digital systems are built upon the learning from the review of issues addressed in previous EIA / ESIA practice in a country the quality of that practice and the emergence of new issues, which may not have been adequately addressed in the past, needs to be considered and addressed.
- Over complication may also become an issue in some jurisdictions, while an important aspect of the IA process screening / project categorization is a relatively simple process, which can often be reviewed / revisited – if required – as more information on environmental and social risks becomes available. The use of GIS systems with digital overlays and efficient production of output reports from digital systems can generate efficiencies, but there is a risk that the application of more comprehensive digital approaches and systems may become a case of seeking to use a sledgehammer to crack a nut.

The project's online survey asked IA professionals the following Yes/No questions related to digital IA and where the respondents answered Yes, they were provided with an open text box to enable them to explain the benefits / challenges they perceived:

- Do you believe that the use of digital technology and approaches in IA will generate benefits in practice?
- Do you believe that the use of digital technology and approaches in IA will create risks/challenges in practice?

The survey results found that nearly all respondents (94%) believed that advances being made within digital IA offered benefits to IA practice. A very small proportion did raise concerns of "style over substance" within the examples they had seen, although it was not possible to determine the context these individuals were drawing from. Of the 94% who saw benefits, the majority provided additional views—in the form of a free text response—as to the type of benefits they considered were being generated. The authors reviewed this free text—which ranged from a list of individual words to paragraphs with micro-case examples to justify the perspective—and coded it into different areas of benefit to generate a summarized list as set out in left hand column of Figure 3.1.

Figure 3.1: Benefits & Challenges of adopting Digital IA

Benefits		Barriers		Risks	
… of adopting Digital IA					
Access to data	39%	Digital skills in IA	17%	Trust/reliability in technology & data	38%
Efficiency of IA	33%	Standardization	13%	Replacing traditional IA approaches	33%
Engagement	33%	Regulatory barriers	6%	Digital divide / Equity	25%
Effectiveness of IA	31%			Transparency / black box	23%
Improved impact Monitoring	8%			Privacy, safety & security	16%
Centralized data	8%			Increased costs	12%
Wider application of IA	6%			Information overload	6%
Health & safety	5%			Style over substance	6%
New data opportunities	5%				
Reduced travel	5%				

In terms of challenges, nearly three quarters of respondents (74%) felt that digital approaches also created risks or challenges to the IA practice. In this case, all respondents went on to provide further free text detail as to the basis for their concerns, which were once again reviewed and coded into groupings. Some respondents focused on challenges in the form of barriers to enabling digital IA practices to progress, whereas the majority focused on challenges that they viewed as generating risks to the quality of future IA practice. This distinction has therefore been portrayed in Figure 3.1, with the central columns highlighting the types of barriers that acted as a challenge to digital IA progress and the right-hand columns focusing on risks to IA practice.

The interviews also sought to identify views on benefits and challenges of digital IA. The approach used, however, was inevitably framed within the context of the digital IA project/experience relevant to those taking part in each interview. As such, relevant elements of the interviewees views on benefits and challenges are incorporated, as appropriate, into sections 3.2 – 3.6 below, as well as emerging within the relevant case examples presented across Section 4.1 – 4.10.

The findings in Figure 3.1 and the related descriptions from the survey and interviews highlight that many of the benefits that can be generated by applying digital approaches/technology also generate risks, not just in potentially moving away from the "status quo," but in terms of issues to do with trust, reliability, equity and privacy, alongside inevitable discussion over cost savings and real-world benefits to IA practice and environment and social outcomes.

The remainder of Section 3 explores the complexities of co-existent benefit and risks in relation to data, engagement, IA quality and costs, and issues related to safety and security, after which the three barriers to growing the application of digital approaches in IA—as highlighted in the central column of Figure 3.1—are explored (Section 3.6).

3.2 Data—access, integration and trust

Digital approaches and technologies both help to generate and bring together vast amounts of data from different sources, which have the potential to generate improvements across many aspects of the IA process from using digital mapping to aid screening, through assessment impact modeling and digital polling of stakeholders, to live online monitoring systems on site. Data is at the core of all aspects of digital IA.

It is therefore not surprising that the advantages associated with access to and usability of data was the most common benefit noted from the adoption of digital approaches in IA. Over a third of respondents (39%) to the benefits survey question highlighted access to data as a key benefit of digital IA, and a further 5% indicated that digital approaches brought about opportunities for new ways to consider data. One respondent noted that digitization can be a way to better enable indigenous knowledge to be considered alongside data from surveys conducted by IA topic specialists.

Data, however, was also identified by survey respondents as the biggest risk to IA practice from the enhanced use of digital approaches. Virtually the same proportion of survey respondents (38%) noted concerns around the trust placed in data due to risks related to reliability concerns of some digital technologies and data, poor data quality/inappropriate application of data and the shelf life of some digital data sources. The adage of "*poor quality data inputs leading to poor quality results*" is clearly a key concern for IA practitioners during a period when shifts to adopt digital approaches and technology are occurring rapidly and sporadically in different ways across the world.

"Assessment is a predictive tool and can sometimes be imprecise. Digital data can create a level of confidence that may not reflect project level science."

— SEA and EIA practitioner
with recent experience in North America

Trust and reliability issues related to digital technologies and data used/generated by digital approaches need to be considered on a context specific basis. At a spring 2021 Scottish EIA conference, Historic Environment Scotland (HES) discussed the benefits and challenges they had experienced from digital approaches across the EIAs they had responded to as a statutory consultee in recent years. In terms of this mix of benefits and concerns, their experiences reflect that as found from the project survey. HES's staff had found digital fly-throughs of landscapes in virtual reality 3D models very helpful to place a development in context; however, they did not replace the need for site visits and considering cultural heritage setting from being within the landscape. A similar issue was highlighted by those driving digital IA innovation in Nigeria. Drone surveys are used as part of seeking efficiency in the need for government scoping of remote sites; however, officials still want to put themselves in the real-world context—and engage directly with stakeholders and the environment—not rely wholly on digital replacement.

The conference presentation by HES also raised reliability concerns about how far newer digital methodologies, such as realistic 3D representations of wind farm developments, can currently seek to replace established photo montage methods. The latter established practice methodologies already uses digital technology—in terms of cameras and computer modeling—however, this is conducted within established standards that seek to produce consistent results and avoid bias. The same standards do not currently exist for 3D visualizations and different approaches/software is being used between IA projects. This issue around standards for digital IA is not surprising given the rapid adoption of approaches in the last five years, and is discussed further in Section 3.6 below.

Objectivity and the need to avoid bias is a cornerstone of good practice IA. This carries through to the uptake of digital approaches. It can be far harder to recognize and understand any biases that may exist in digital data sourced online. Outside of IA there are multiple examples of digital technologies and projects unintentionally building in bias due to the way data is gathered or the background of those feeding into machine learning processes. Social IA professionals are already well aware of how often bias can creep into stakeholder engagement and lead to challenges in accessing the views of specific groups in communities. The application of digital data capture devices in such context and the potential "status" associated with access to them risks bringing further challenge into this area of practice.

While the above risks are real and do need to be considered and managed, the reality is that the majority of data is now digital, and this is only set to increase. Further to this, practice will also continue to see increasing access to digital data, from online environmental and social data systems (Section 4.1), to remote sensed satellite data (Section 4.3) and the opportunities emerging from AI and machine learning (Section 4.5). Such advances provide opportunities for IA to rapidly integrate issues that may previously have had little/no data at the project specific level or may have been too broad for a single IA—strategic or project level—to effectively assess. These data issues and opportunities are not exclusive to digital IA and increasingly data standards are being used to improve data quality; for example, through the work of the UK's Data Standards Authority.

Digital systems are now being developed to help address such environmental and social issues, including the notoriously challenging consideration of cumulative effects. Some of these digital systems are in formats that are specifically designed for IA practice, such as Western Australia's Shared Analytic Framework for the Environment (SAFE) project (see the case example in section 4.1). Other systems are designed for different core purposes but have secondary objectives or tertiary applications within the IA process. An example of this is Canada's *Open Science and Data Platform*[7]. The system aggregates disparate sources of government data and science publications on a variety of topics and is designed to enhance general understanding of cumulative effects across the country; however, a secondary use is recognized as supporting Canadian IA practice.

The key task for IA professionals is to understand the data needs of your IA process and the capabilities of the digital data you have access to, or plan to gather

[7] Access the platform here: https://osdp-cumulative-effects.canada.ca/osdp

via digital approaches. Common practice IA questions, such as whether information is up to date, remain critical but are joined by newer aspects related to uncertainties and limitations related to the specific digital technologies/approaches being used. As with all sources and methods applied within an IA, the practitioner needs to understand the limitations and uncertainties associated with digital approaches and how this may influence the use of data and the resultant findings.

In a digital IA context, such checks on reliability may need greater consideration as there is a need to build trust in the adoption of new techniques. There is also a risk that data generated by digital approaches such as modeling is considered fact, rather than prediction, and overly relied upon against other sources of real-world evidence. As such, maintaining an open mind to the IA process and findings remains an essential element skill within digital IA as much as it does within existing good practice. Beyond this there may also be a requirement for a different knowledge and skills set than might normally be found in a traditional IA team, to be able to suitably verify data. The increasing need for access to such digital skills in IA practice is discussed in section 3.6 below.

3.3 Engagement—equity, inclusion, reach, and the digital divide

Digital approaches and technologies such as online meeting spaces, social media, and digital EIS provide new ways of engaging with decision makers, statutory bodies, communities, and other stakeholders. As with any approach to or technique for engagement, however, they come with both benefits and challenges which need to be balanced to determine when they are appropriate for use and whether additional activities are needed to avoid restricting/excluding some groups from the process. The project survey reflected this balance of benefit and concern with a third of respondents (33%) highlighting the engagement benefits of digital techniques, while a quarter (25%) flagged risks related to equity and equality issues that digital approaches can generate.

While not limited to the digital EIS and related digital engagement approaches, there was a considerable focus of responses in this area. Those discussing engagement challenges related to digital approaches in IA regularly used the concept of a "digital divide," flagging risks that some groups may not have access or not wish to access information in digital format. It should be noted, however, that this "divide" operates in two directions with some stakeholder groups, especially younger generations, being far more focused on digital engagement—via the Internet, or more commonly, social media—than real world engagement. Generation Z, the term often used in Western discourse for those born between the mid-1990s and early 2010s, are the first generation to have grown up in a world where Internet connectivity and digital devices have been the norm. Research shows they are far more likely to engage via smartphone technology, rather than a traditional computer; as such, engagement with this part of the stakeholder community may be significantly enhanced by digital IA approaches and online EIS.

What is clear is that the opportunities for varied and dynamic approaches to visualization of environmental and social information offered by digital presentation formats offer stakeholders more engaging ways to understand the issues and findings of an IA than can be offered by a traditional static report. This can also generate benefits for people who process things visually, or who have difficulties reading and interpreting text. The digital engagement examples presented in Sections 4.6-4.8 highlight how more dynamic presentation techniques combined with flexible navigation through the online report provide the potential for all those accessing them to understand the IA's findings in a less complex and more concise manner, than a reliance on word-heavy reports.

> ***[A digital EIS] "Visually demonstrates the interconnected elements of the process without requiring those engaging to navigate complex documentation."***
>
> — EIA professional active in Canadian practice

While in the developed world, reliable access to digital devices and high-quality Internet access is common, this is not the case in all contexts around the world, nor is it the case for all stakeholders within a specific context. For example, in discussion around digital IA with Prem Khanal, a leading Nepalese social IA expert, he highlighted that while the reliability of national Internet connectivity had advanced considerably for many in recent years access was not ubiquitous and

the thought of seeking to rely on such technology for stakeholder engagement—in terms of both access and trust—was not feasible. Other respondents to the project's survey and speakers at IAIA's 2021 conference highlighted that even where smartphone ownership is common, data can remain expensive and thus the costs associated with engaging with digital IA approaches need to be considered.

> ***"In global south countries, access to digital platforms is limited and this will result in some stakeholders being excluded."***
>
> — EIA and SEA professional based in South Africa

What is clear is that a key element of successful stakeholder engagement—especially community engagement—is based on showing respect, developing relationships, and building trust with those groups and individuals whose engagement is being sought. The removal of face-to-face engagement between IA professionals and such stakeholder groups makes this far more challenging to achieve. While the COVID-19 pandemic may have demonstrated that —in such extreme circumstances —community acceptance of replacement by digital approaches can be achieved, it is very unclear whether such acceptance and trust will be retained as restrictions ease in the future. There will be much to learn and share from the use of digital IA techniques in stakeholder engagement that have become established through the pandemic, but as the quote below indicates, seeking to wholly replace face-to-face engagement with digital approaches is likely to prove far more challenging than the widespread adoption of digital first approaches in other areas of the IA process.

> ***"I am extremely sceptical that functions such as community engagement, consultation and participation can be undertaken electronically/remotely… The risk, post-COVID, is that the industry (clients, financiers) will consider that these activities can be done remotely without being grounded in field work."***
>
> — Philippines-based ESIA + SIA practitioner with experience across Africa, Asia, and Europe

The reality is that good engagement practices that already exist in IA remain key to effective practice. The potential enhanced reach and understanding that can be generated by digital approaches (see Section 4.6 for examples) needs to be considered alongside existing approaches to determine what will work effectively for the stakeholders related to any specific plan/project. New approaches enabled by digital technology cannot and should not be ignored, but a blended approach that combines established good stakeholder engagement practice with this innovation will often be needed to deliver benefits without having unintended negative impacts on equitable access to the process.

3.4 Quality and costs in IA practice

Efficiency (33%) and effectiveness (31%) benefits delivered through the adoption of digital approaches within the delivery of IA practice were identified by around a third of survey respondents and highlighted across the project's interviews with IA experts. However, 25% of practitioners responding to the survey also had reservations about the transparency of digital findings, particularly that the rush to adopt digital technologies in IA risks replacing traditional IA approaches and expertise that could lead to the "dumbing down" of IA findings. As with data and digital engagement, whether the benefits outweigh the costs of applying any particular technology or approach will need to be considered on a case-by-case basis. On a wider basis, more discussion and understanding of this balance is needed across the global community of IA practitioners, especially as digital approaches to IA become more frequently integrated into practice.

In terms of delivering more effective practice at lower costs, the following quote from a survey respondent effectively summarizes the potential of many digital IA approaches, such as digital data capture and workspaces (discussed in sections 4.3 and 4.4):

> ***"The basic collection of knowledge will be streamlined, and focus will move to the pertinent/difficult issues — thereby resulting in increased focus of IA."***
>
> — SEA & SA Practitioner based in Denmark with experience across Africa, Asia, and Europe

The use of digital tools for data gathering and initial analysis can help to remove what might be described as the "churn" costs that are commonly associated with getting an IA project up and running and generating the basic framework and content of reporting. This can certainly save costs and thus deliver efficiencies for plan makers or developers who are required to

undertake IA. The aspiration is that these costs savings will be retained within the IA process to be refocused on improved effectiveness. Interviewees expressed aims to improve the IA process and more frequently to improve the environmental and social outcomes that result from the process. As such, efficiencies and savings derived from digital IA are being sought to enable more focus to be placed on improving other areas of practice. Such improvements include providing skilled IA professionals with more time: to conduct effective engagement, consider interdisciplinary issues, influence designs and, where required, develop tailored measures to deliver enhancements, as well as deliver appropriate context specific mitigation.

Cost savings from digital systems are not, however, free. For example, they can risk a loss of value from site visits and from relationship building with communities, as discussed in the engagement section above. There is clearly little value in using expensive IA/topic specialists to undertake admin related to data transcription from paper to digital format when a digital system can now deliver the same activity in seconds. There is, however, the cost of developing/deploying such systems to consider. In addition, there are risks that by "deskilling/automating," certain aspects of the IA process could influence client expectations that digital approaches can be used to replace IA professionals and topic specialists, rather than supplement and enhance their work. The latter being perhaps a little alarmist, but genuine concerns exist in the IA community around the development of digital IA workspaces and the use of AI in IA as a sign of "the thin end of the wedge" that could see low risk projects and eventually many plans and projects environmental and social impacts assessed by machine, with limited specialist review/validation.

A number of survey respondents highlighted concerns from the IA consultancy sector, especially within small to medium sized companies, that the investment needed to develop digital IA tools was prohibitive. There is real fear of smaller consultancies losing market share for their often more specialized skills to the global scale consultancies who are more commonly leading the digital IA agenda. This is not simply a matter of having the free capital to invest in digital IA solutions, but having access to appropriate digital skills, or the time to develop collaborative partnerships.

While this report highlights many examples where quality and cost benefits of digital IA applications are clear to see, there is a risk that in some areas of practice the application of digital technology goes too far and degrades the quality of practice. Such an effect, if it were to occur, might not only damage the uptake of demonstrably effective digital IA solutions, but could also impact on the reputation of the IA process as a whole, which has been under considerable scrutiny within the agenda of governments of a number of nations around the world in recent years. The risk is that those within the plan making and developer community that still see IA as a costly hurdle that needs to be overcome will seek to use digital IA approaches to reduce required specialist inputs, relationship building, and understanding in favor of cheaper "black box" models that provide a single-hit answer and don't seek to iteratively bring environmental and social issues back to the surface. The quote from a survey respondent below sums up the risk digital IA approaches could have if they act to lose the skilled human face of the assessment process:

> ***"A reminder: it is a tool, the tool is only as good as the intent behind its use and the knowledge of the tool user."***
>
> — EIA and ESIA professional practicing in South Africa

In summary, a key issue in the consideration of applying a digital solution to any aspect in IA is to understand the problem from multiple angles to understand whether a digital approach is appropriate and required. Where a digital IA approach is considered appropriate there is a need to see beyond the plethora of accessible environmental and—increasingly social—data to differentiate what is simply data, what is useful information for the IA process and what is effective knowledge to be applied within the assessments evidence and justification of key arguments and conclusions. IA quality and efficiency are by no means guaranteed by the use of increasing amounts of "digital data" as the process requires engagement, interaction, and influence in handling complex interactions.

3.5 Safety, privacy, and security

While a lower proportion of survey respondents highlighted safety, privacy, and security concerns compared to the three areas discussed above, there was a notable response in this area that is worth further consideration. A small number of IA professionals responding to the project's survey felt that digital technology offered safety (5%) and sustainability (5%) benefits—related to the use of drones to scope and monitor dangerous/difficult to reach sites and the reduced need for local and international travel using online engagement. A higher proportion, however, raised concerns about risks to safety, impacts on privacy, and security issues that can be associated with increased reliance on digital approaches.

Many of the examples of both benefits and concerns related to safety and privacy issues linked to the use of drones in data capture and monitoring. The authority to fly drones, safety procedures for their use, and any licensing requirements vary both between and within nations. The use of drones needs to be planned and considered within the likely area the drone will be used, or could enter, during its planned flight. The case examples of drone-based monitoring given in Section 4.10 from Singapore and China (Hong Kong) demonstrate the need for trusted technology and appropriate approvals to gather the project related data being targeted.

Privacy is also a key concern with drones and with the capture and storage of personal data and analytics related to those who engage with the IA process. The trust of communities and Indigenous groups can easily be damaged by the inappropriate use of digital technologies, or their deployment without discussion and understanding of their use by such stakeholders. Section 4.6 discusses examples of digital stakeholder engagement and the risk of threats and violence that can arise to those stakeholders that engage with the IA process. Online engagement—via social media, for example, can increase such risk, via so-called "trolling" due to the greater ability for anonymity on such platforms. Privacy issues also arise in the capture of aerial photos and videos, photogrammetry and increasing satellite images, with technological competition now focusing on sub-1m resolution.

The need for careful planning of technology, skilled staff, regulator and community engagement, compliance in usage, review of data intended for use in public facing IA outputs. and the safe and secure storage of data all need to be considered as part of the deployment of certain digital IA approaches. Data ethics is also an important area for consideration, in terms of understanding what is deemed right and wrong in terms of managing the collection/creation, storage, analysis, sharing, and deletion of data. This is particularly important in relation to personal data related to individuals. As IA becomes more dependent on digital data and the use of virtual engagement, recognizing when personal data has been collected, considering how it is being used, and whether it is being retained, knowingly/otherwise, are issues practitioners will need to pay closer attention to.

Security of the content of a digital IA process—in terms of both the data and digital outputs—is also an area of concern. While the project did not have any examples of hacking, malware, or ransomware being specifically targeted at an IA process, there have been such events that have impacted the ability of key environmental regulators to operate, including in delivering environmental data, monitoring, and consultation inputs to the IA process.

A recent example is the complex and serious cyber-attack that was perpetrated against the Scottish Environmental Protection Agency (SEPA) in late December 2020[8]. The attack stole around 4000 files (1.2Gb of data) and left many systems compromised and offline. SEPA was able to restore many systems in a relatively short space of time and has begun the phased return to staff using the organization's official email system. More than six months later, however, in early July 2021, the organization was still unable to provide historical data on flooding and rainfall from rivers in Scotland and documents previously on its public register remained unavailable. The risks and impacts of digital criminal activity are issues that those seeking to rely on digital systems for the delivery of IA will undoubtedly need to place an increasing emphasis on in the future. This will require knowledge and skills set that are not currently on the radar of those bringing together a team to deliver a plan/project IA.

[8] Further details of the SEPA cyberattack and the current status of the organizations response can be found here: https://www.sepa.org.uk/about-us/cyber-attack/

3.6 Barriers to IA's digital transition

The identification of barriers to the uptake of digital IA was originally not in scope for this report. However, the frequency with which a small number of barriers were raised in both the survey and interviews provided a compelling reason to provide some coverage here. Three barriers to IA's digital transition were regularly raised during the report's development with each of these explored below. The barriers relate to:

- Digital skills
- Standardization
- Regulatory context

Availability of digital skills in the IA community

Much of the professional IA community is made up of practitioners with degree-level academic qualifications and multiple years of experience in the coordination of assessments, or one or more focused social/environmental specialisms. While such qualified professionals are used to working with a plethora of digital devices, software, and interactions, these are most likely to be tertiary skills needed to enable their ability to deliver their specialism, rather than having expertise in digital approaches and technology.

In some cases, new developments in the digital IA space (notably digital IA workspaces like Envigo, E-base and the iReport; see Section 4.4), have all the digital technology "baked-in" for an intuitive user experience similar to other apps IA professionals already work with. These systems require digital skills that are not currently commonly associated with the core skills required within an IA team. Even if we consider a digital area already commonly used in IA, such as the use of GIS, such systems require specialist knowledge and experience and even have their own professional communities, good practice, and accreditations.

For those in the IA community who wish to explore and develop digital solutions for use in practice, there is a need to bring in new skills. This need was regularly reported from across the case examples discussed in Section 4 of this report, from actions to develop digital EIS in consultancies, through the development of digital database/management systems, and into the creation of digital IA follow-up. However, with limited understanding of differences in digital skills sets, it can be difficult for IA personnel to quickly identify the skills and experience they need to commission to develop digital IA solutions. In the case of drone usage, appropriate experience and qualifications for the location in question is relatively easy to determine, but for more complex digital solutions, the level of technical detail may make the field less accessible to an IA practitioner and requirements more difficult to define.

While some of the larger organizations regularly involved in IA practice may have in-house experience to draw on, or wider digitization programs that the IA process can nest within, this opportunity is not commonly available. As such, IA's exploration and expansion into digital approaches often requires a partnership approach where deep understanding of the IA process and the problem being sought to be resolved is brought together with digital and tech skills and experience, to identify the right approach and bring together the right skill set. While the aim will often be to create a user experience that is simple to interact with, most digital IA systems will have a more complex back-end that needs on-going access to those with digital skills to support it and, where appropriate, develop upgrades. The development of effective user experience of digital applications is itself a specialist professional skills area known as UX, whose time inputs may be required to help enable effective digital experiences in future stakeholder engagement and digital IA reporting, for example.

Where the ability to understand the digital skills needs of the IA process is lacking, there is likely to be a barrier to innovation and exploration of digital IA techniques. Organizations/locations that face this barrier are more likely to adopt digital IA approaches more gradually, having to wait for relatively easy to use "off the shelf" digital IA tools to be available.

Standardization of digital IA approaches, technology, and methods

Standardization of data formats, methodological approaches/outputs and specifications for technology/systems helps to ensure that a defined performance level is delivered upon. As highlighted in Figures 1.2 and 2.1, however, the broad field of digital IA is expanding in multiple directions at once in various locations across the world. It is inevitable during such a period of innovation, exploration, and experimentation

that multiple solutions and distinct digital systems or products will become available. These digital systems often deliver an outcome—part of the IA process—that already exists, but in a novel format due to the application of new technology. Existing standards—such as government advice, regulatory methodologies, or good practice guidance—may not be suitable to evaluate whether the digital IA output is acceptable as an alternative/replacement to the current accepted practice.

The HES example given in Section 3.2 also illustrates this point. HES raised concerns in relation to the use of 3D virtual reality simulations of wind farms in Scotland, and whether they were comparable to the existing standards required of traditional photomontage techniques and regulator guidance.

Digital IA systems therefore need to consider how their technology can demonstrate that it meets or surpasses existing standards/practice requirements in an accurate and unbiased way. In some cases, the way existing standards are written may be a barrier to the use of alternative digital approaches over established methods, as the existing requirements may have been written before newer digital approaches had been feasible. Solutions to update standards, where needed, are likely to be forthcoming where new digital approaches are demonstrably capable of the same or better performance. This will inevitably take time, which could impact upon the commercial viability and timely uptake of digital technologies.

Standardization is also essential to ensuring data can be gathered, integrated, and appropriately used in other digital systems. As such, there is a need to understand data maintenance and apply common data standards. In many IA projects now that use environmental and social data gathered from open source online data systems, there is a period in the project program for the cleaning of the data to enable centralized information to be trusted and of ongoing value. This is an area that does highlight where IA practice will be able to use existing approaches to overcome some barriers around digital standardization; for example, learning the lessons from BIM or other equivalent data sharing standards. The digital and technology fields already have well-established systems to develop standards and enable data integration; in many cases the application of digital data in IA will simply use these wider standards to enable integration. IA practitioners, however, may need to gain a better understanding of digital data integration issues and uncertainties to ensure they are able to understand any consequences such issues might have on the IA's predictions and findings.

> ***"There are … challenges in … standards in practice that allow data to speak to each other or portray information that is comparable—for example between jurisdictions, a species that crosses borders may be studied according to different methods that aren't easily comparable, creating difficulties in assessing data usefully or with confidence."***
>
> — Cumulative IA practitioner based in Canada

Finally, there is a need to recognize that not all data collected in an IA can be easily geographically linked and translated into a GIS layer or shapefile. This is especially the case for some of the focus areas within social impact assessment. As the need to use digital data and alongside other practices and information sources is likely to continue. As such, developing standards/practice guidance that considers how suitability digital solutions can be brought into different areas of the IA field is likely to be an area that needs greater attention in the near future.

Regulatory challenges to the use of digital approaches in IA

The growth of digital data as a basis for many aspects of modern life has led to many countries adopting new laws that relate both to the responsible management of data, especially personal data, and the use of certain digital technologies, such as the use of drones. These issues are not really barriers to progressing digital IA, but like any legislative requirements they are areas that IA practitioners will need to increasingly understand and manage as part of the IA process and align with the wider activities of the project/plan-making process.

The real regulatory hurdles to digital IA tend to come from the EIA, SEA, or other IA legislation within many countries around the world. This legislation is often relatively old (pre-2000) and even where it has been more recently developed, many of the core requirements will have drawn upon earlier legislation or the legislative basis for IA in other jurisdictions. Much of this legislation is based on the concept of the IA process running alongside a plan-making or project consenting process, usually based on the exchange of

documents over a period of time leading to an eventual decision on whether the plan or project should progress. The wording within such legislation—perhaps due to its formal legal language, or simply due to the expectations at the time of writing—often requires the need for physical hard-copies of the IA documents to be produced or assumes real world locations are required to make documents available for public participation.

While such requirements are not without merit, the research found multiple examples where "outdated legislative requirements" curtailed any benefits that might have been generated by digital approaches. Regulatory change, however, takes time, resources, and political will. The speed with which such barriers are overcome will vary across different jurisdictions. The priority for those in the IA community who wish to see such regulatory barriers removed is to ensure they are ready to engage with governments when there are opportunities for regulatory changes to be made within their IA system, either due to a wider review of the IA process, or broader digital transformation projects occurring within the relevant authority.

4. The State of Digital IA Practices

This section of the report provides a snapshot of the development and application of digital IA across the globe. This core review provides focused insight into the state of ten digital IA practices, discussing what each practice area involves and showcasing examples drawn from 14 nations, alongside globally applicable tools and advances made by international financial institutions.

The ten digital IA practices and related case examples discussed in this section are presented in Figure 1.2, relating to the digital IA categories listed below:

1. **Inter-IA and online environmental and social management systems**
2. **Digital screening tools**
3. **Digital baseline data capture devices**
4. **Digital IA workspace**
5. **Artificial intelligence (AI) in IA**
6. **Digital stakeholder engagement**
7. **IA and virtual, augmented & mixed realities**
8. **Digital EIS and web-based reporting**
9. **Online learning and capacity building**
10. **Digital follow-up - monitoring and auditing**

4.1 Inter-IA and online environmental and social data management systems

What are they?

The IA process uses data to understand the environmental and social context, to provide evidence to the assessment process. Many IA systems also require the consideration of monitoring during the implementation phase of the plan/project, which can generate significant volumes of new data or make links with existing data collection systems. It has long been recognized that efficiencies can be made by enhancing accessibility to such environmental and social data so that impact assessors, and others interested in the information, do not have to start from scratch each time a new plan/project is brought forward.

With the growth of the Internet and GIS mapping software over the past 25 years, many jurisdictions have developed and deployed online environmental databases. These systems generally allow open access to an online portal where data can be viewed, downloaded, and used in the IA process. These are commonly in the form of a GIS format so users can select a location and review the data related to that location or within a specified distance (buffer), such as designated sites, archaeological records, etc.

Such systems have now existed for nearly 20 years with the UK's Multi-Agency Geographic Information for the Countryside (www.magic.gov.uk) having launched back in 2002. The system has been updated and upgraded over the years—maintenance of such systems being a critical element in their on-going value—and now contains a wider range of environmental information for both rural and urban settings. Similar systems exist in other jurisdictions with the Danish Environmental

Portal (https://miljoeportal.dk/english/) having launched in 2017 and the South African National Environmental Screening Tool in 2018 (see Section 4.2 for further details).

In addition to such centralized tools, many public bodies also make far more of their environmental and social data available to download. For example, in the Western Cape of South Africa, data captured by both Cape Nature (SANBI) and Department of Agriculture provides data on most aspects of the area via Landmapper GIS, which is commonly used to inform EIA of projects in the region.

> ***"Although the data must be verified on a site-specific level, it gives an indication of what is to be expected and how it fits into the wider environment and planning for the area as well as what should be aimed towards when planning closure objectives."***
>
> EIA and SEA Practitioner, South Africa

Beyond national systems, there are also multiple online open source environmental and social databases available on a global basis. The Global Biodiversity Information Facility (GBIF - https://www.gbif.org/) is funded by governments around the world to provide an international network and data infrastructure open access data about all types of life across the globe. GBIF has an ever-growing record of data, which currently entails over 60,000 datasets, including over 1.7 billion occurrence records. On the social data side, the DHIS2 (District Health Information Software 2 - https://dhis2.org/) is an example of a free, open-source software platform for collecting, analyzing, visualizing, and sharing health related data. It is the world's largest health management information system (HMIS) platform and is used in 73 low- and middle-income countries.

Fundamental to all such systems is the quality and standardization of the metadata that is used to manage the various datasets. Metadata provides information about the data it is related to, such as the geolocation data of where an archaeological site is located, the date that an air quality measurement was taken, or the digital equivalent of a use by date after which point the associated data should be discarded/considered to have uncertainty associated with it. There are multiple forms of metadata, and having shared common standards is important if data is to be effectively collated and shared.

While the systems described are used in IA, very few of these types of systems are fed or informed by the information generated by the IA process. A criticism of IA has been that it gathers together information and generates a lot of its own data, but that this information is then lost, as it is not made available for future use. In fact, in many national jurisdictions it remains very difficult to access large-scale records of EIS documents as there is no online accessible digital repository. In some cases, this is because digital consent systems are still in development within a country; however, in other cases it is because such records are held within the many different systems across different government bodies and thus the records are dispersed.

An early example of an online, centralized national repository for part of the IA system is the Scottish SEA Gateway and database. This holds over 2500 records of screening, scoping, and environmental reports, providing a full searchable online record of SEA in Scotland since around 2005. Encouraged by the 2014 amendments to the European EIA Directive, several EU Member States developed centralized national EIA repositories, for example in Italy.

While such national IA repositories are good for transparency, public scrutiny, and the possibility of academic research, they often suffer from the same issue as the data collected and associated with individual IAs; that is, they are not used or analyzed to generate data that can be used to improve future IA practice.

Capturing some of the lost value from the intellectual capital generated by and stored within the IA process, or the information generated by monitoring that results from it, is a challenge that multiple digital IA projects are now aiming to address.

Examples: Inter-IA Data Management and Sharing

IRELAND: ENVIRONMENTAL SENSITIVITY MAPPING WEBTOOL (ESM)

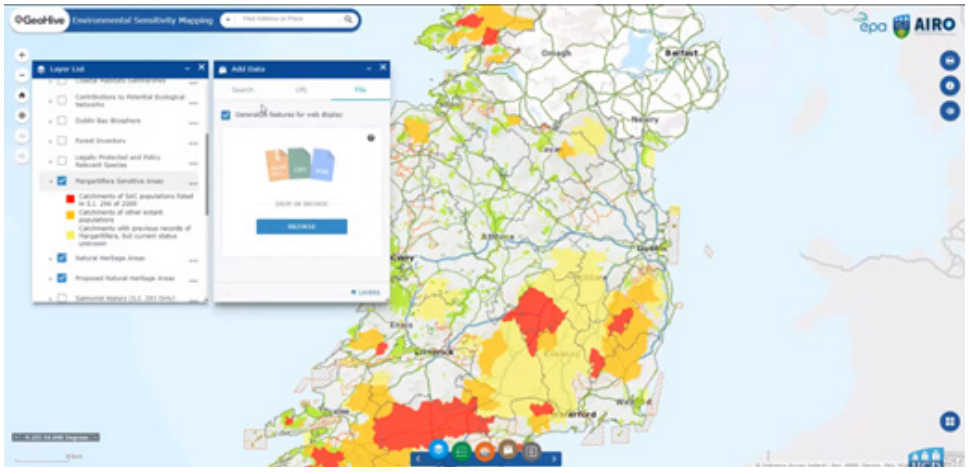
Like many digital initiatives, the ESM Webtool was developed through a collaborative, with funding from the Irish Environmental Protection Agency (EPA) and developed with input from the EPA, University College Dublin (UCD) and Maynooth University's All-Island Research Observatory (AIRO). The tool is a web-based environmental mapping decision support system (see Figure 4.1) and was launched in 2019[9]. Unlike the examples discussed above, the ESM webtool is specifically designed for use in the SEA process, in Ireland. The ESM uses an inventory of over 100 spatial datasets, many of which were already available online and accessed via a link within the tool. The tool goes far beyond simply presenting and allowing data downloads; it allows environmental data layers to be analyzed to identify how they relate to each other and interact.

The tool therefore allows those undertaking SEA in Ireland to develop plan-specific environmental sensitivity maps and data visualizations using a consistent and agreed methodology. Due to the project partners involved in its development, this approach is both academically rigorous and acceptable to environmental regulators. The tool is hosted by the Ordinance Survey Ireland (OSi) within its GeoHive Portal, meaning it is map-based. Users can analyze sensitivities between different environmental datasets at national, regional, or local level.

The tool's sensitivity calculations are derived from a multi-criteria analysis (MCA). Users can adjust the weighting related to each environmental dataset being compared. This allows for both sensitivity analysis and the ability to enable the outcome of SEA-related stakeholder engagement to feed into the outputs. Each map created by the ESM Webtool includes key associated metadata indicating date of production, who created it, what data is selected, and the weightings applied, thus assisting the transparency of findings to stakeholders of the relevant SEA process.

The tool was used in the SEA of Ireland's overarching national planning framework and is available to be applied to all future assessments with data feeds to ensure it is kept updated. The ESM does have some challenges, one being that some of the SEA topics currently have less geospatial data available within the system, meaning that there is a risk of bias towards those with larger datasets, such as biodiversity; however, this is an issue can be managed by user awareness and application of weightings. The homepage for this digital screening tool can be found here: https://enviromap.ie/.

Figure 4.1: Screenshot of the ESM Webtool



9 A short video produced for the launch of the ESM Tool can be found here: https://www.youtube.com/watch?v=pBwemNvHVkY

WESTERN AUSTRALIA: SHARED ANALYTICAL FRAMEWORK FOR THE ENVIRONMENT (SAFE)

The Environmental Protection Authority in Western Australia began an initiative in 2019 to identify how digital approaches could enhance data used in EIA. The two core recommendations from this work are both of relevance to inter-IA data systems.

The *Report of the Digital Environmental Impact Assessment Working Group*'s first recommendation seeks to streamline EIA by developing digital tools and improved information flow. The latter aspect includes supporting the WA Environment Online program, a forthcoming initiative from the Department for Water and Environmental Regulation to improve digital access to trusted data for all parties involved in EIA. The program will be similar to the national environmental data systems discussed earlier in Section 4.1, and while an important development, is less ground-breaking than the initiative that has arisen from the group's second recommendation.

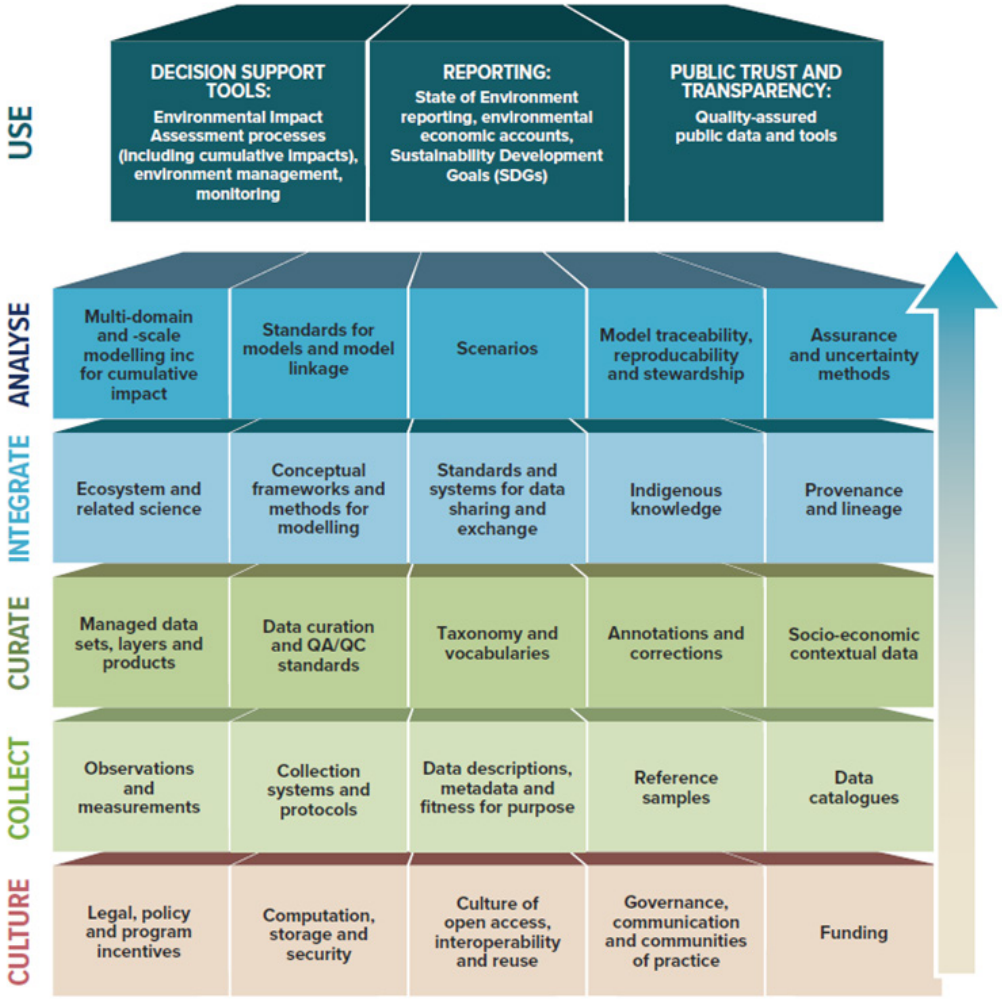
The second recommendation was to develop a Shared Analytic Framework for the Environment (SAFE). This is a "next-step" solution to use data and digital analytical tools to generate high quality and reliable predictive environmental information on the interactions and outcomes between WA's environment and multiple different types of development projects that are relevant to the region's economy. SAFE will assist the analysis stage of both EIA and strategic assessments to provide confidence in environmental trends and predict contributions to impacts from different activity, a key aim being to use the new system to enable less need for development to be stopped by the application of the precautionary principle around cumulative impacts; instead, SAFE will apply actual shared analytical prediction and integrated monitoring to actively forecast, review, and manage the complex environmental inter-relationships in the region.

The SAFE project is co-led by Western Australian Biodiversity Science Institute (WABSI) and the Western Australian Marine Science Institution (WAMSI). The Information Management Director of the Institutes, Chris Gentle, indicated that developing SAFE reaches far beyond just applying digital technology and approaches to the IA process. Figure 4.2 demonstrates the scale of activity needed within such a major digital IA initiative. The diagram helps to demonstrate how SAFE will be built to develop a high-quality system that has the trust of all parties in its approach. A key learning point from the SAFE initiative, which is still in itself developing, is that the creation of large-scale inter-IA digital systems requires significant levels of collaboration, engagement, and integration of different parties and skill sets. Importantly SAFE recognizes the need for common language to be established between all components of the supply chain of IA related information and analytics. Each component—the 25 boxes in Figure 4.2—will play its part in generating the shared framework with different organizations contributing across different building blocks depending on their roles and capabilities related to IA, digital systems and wider environmental responsibilities.

To appreciate the depth of thinking and scope of activity within the project, the reader is referred to the joint report from WABSI and WAMSI: *SAFE—A Guide to a Shared Analytic Framework for the Environment* and a link is provided here[10] and Section 6—Further Reading.

10 https://wabsi.org.au/our-work/projects/safe-shared-analytic-framework-for-the-environment/

Figure 4.2: A diagram of the tiers and capabilities of activity needed to enable the SAFE project to generate an effective end use in Western Australia



DENMARK: CENTRAL EIS REPOSITORY AND ANALYSIS VIA THE DREAMS DIGITAL IA PROJECT

The DREAMS project (see Section 2.2) is a significant 3-year collaboration, with 15 partners, using digital approaches to enhance IA in Denmark in support of the United Nations SDGs. An initial phase in this project has involved collating a substantive record of Danish EIS into a single inventory—to enable the team to apply their AI tool (CAUSA) in a later stage of the project, discussed in Section 4.5.

The team has been able to bring together almost 2000 EIA Reports (EIS), creating a central record that did not previously exist in the country. Outside this new repository, EISs are currently stored across multiple different organizational platforms in different formats, making them difficult to access and search across. Importantly, the DREAMS project has also planned for the future, offering the potential for all future EISs in the country to be brought into the system. The DREAMS team intends to enhance the new central EIS database as the project progresses to enable future users to be able to search for previous EIS by sector, geography, topic, impacts and mitigation to aid future practice.

At present, however, uploading a new EIS to the system is not a requirement; such a mandate would need to come from the Danish Government. The project team recognize that to maximize the chances of this happening, trust, and understanding of the tool and its purpose need to be developed. A collaborative approach to the tool's development across the cross-sector project partners, including government, academics, consultancies and developers, and broader engagement, therefore remains a critical part of digital IA projects.

Other digital IA approaches related to IA data management and sharing

The collation, management, analysis and use of digital environmental and social data is not limited to publicly-available repositories. Such systems are also critical within major individual projects and in IA follow-up systems, especially related to monitoring and compliance. Section 4.6 provides a Canadian example of the issues to be considered in developing trust in a digital data platform that could be used in a future IA project. Case studies related to digital IA related data management in follow-up and monitoring are presented in Section 4.10.

4.2 Digital screening tools

What are they?

Screening is the process used to determine whether an IA is required in relation to a policy, plan or program. In some cases and jurisdictions, the application of IA and the scale of that assessment is pre-determined within the legislation; however, in many cases there is a need for the consenting authority or lender to determine which category or risk class the proposal falls into and thus what level, if any, of IA is required. This determination can be simply based on meeting or exceeding specific criteria (e.g., the land area required for development, the type of plan proposed), where as in others it is an evidence based professional judgment related to the proposal's environmental and social risks, often linked to the concept of significance.

Standard practice already commonly includes the use of digital approaches and tools within the IA screening process, including:

- Digital shape files related to proposed development site/footprint.
- Online environmental databases to identify information relevant to the location.
- The use of GIS to undertake environmental constraints mapping to identify certain sensitives receptors within a given distance of the site.

In recent years, however, there have been calls for and the development of more dedicated digital tools intended to either help guide this process or even act as a core part of the formal determination process. For example, a UK collaborative study into digital EIA funded by Innovate UK reviewed opportunities to enhance EIA using digital technology and included a recommendation that a digital screening tool be developed to aid developers.

The Innovate UK project's 2020 report *The Digital EIA Project* proposes that digital technology could be used to semi-automate the screening to save resources and aid developers. The concept is that developers will enter basic details about the size, footprint, and uses of their development onto the online platform, and then answer predefined questions. The conceptual tool would then determine whether EIA was required, was not required, or was unclear and thus needed a determination by specialists, with the tool automatically generating such a request to the local planning authority. The report goes on to indicate that through the use of AI (machine learning) the need to refer to specialist for input could be gradually reduced.

The above project was unfortunately not funded to take forward this recommendation, and it should also be noted that in many jurisdictions—including the UK—the legislative framework would need to be amended to enable such a tool to make formal screening decisions as many IA laws require such decision to be made by a competent authority. However, digital screening tools designed to help aid developers, financial institutions, development bodies and government agencies understand whether a proposal is likely to require IA, based on its environmental and social risks, are being used to generate efficiency for those involved as discussed in the following examples.

Examples: Digital Screening

SOUTH AFRICA: NATIONAL WEB-BASED ENVIRONMENTAL SCREENING TOOL

The 2014 EIA Regulations in South Africa highlighted plans for the development of its national web-based environmental screening tool. Regulation 16(5)[11] indicated that applications for environmental authorization must be accompanied by the report produced by the screening tool, once it became operational. The tool was piloted in 2018 and has been a mandatory requirement within the EIA process for the past few years.

The tool is a geographically based web-enabled application that provides a single national portal that contains environmental information from key government agencies related to environment, biodiversity, heritage, and spatial planning. A developer uploads details about the project and the tool identifies plans that area relevant to the location (e.g., a bioregional plan, industrial development zoning) and identifies specific requirements, including specialist studies, applicable to the proposed site and/or development, based on national sector classification and the environmental sensitivity of the site.

The tool is a live system and thus the various government agencies feed new information into it as it becomes available, helping it to stay up-to-date and be enhanced over time.

The homepage for this digital screening tool can be found here: https://screening.environment.gov.za/screeningtool/#/pages/welcome.

GLOBAL APPLICATION: NEXUS ENVIRONMENTAL ASSESSMENT TOOL (NEAT+)

NEAT+ is project environmental screening tool used by humanitarian organizations to help quickly identify existing sensitivities in a crisis area and highlight underlying risks to the environment and communities. The tool was developed by the Coordination of Assessments for Environment in Humanitarian Action Joint Initiative, a partnership project including United Nations Environment Program (UNEP), USAID, United Nations High Commission for Refugees (UNHCR), IUCN, and WWF.

The tool uses a digital data collection platform with the user answering simple questions about their location and the humanitarian aid activities being planned and can be completed on a phone, tablet or computer. NEAT+ generates an MS Excel report to provide a rapid view on likely environmental and community risks to enable better informed decision-making and longer-term planning.

The tool was piloted in 2018 and has been applied by humanitarian organizations around the world. Importantly, it is not intended to be used as the sole means of environmental management, but rather as an on-the-ground supplement with the website providing links to a report on how it fits into the wider environmental management approach.

Further details about this digital screening tool can be found here: https://eecentre.org/resources/neat/.

11 South Africa EIA Regulations 2014, accessible here: https://cer.org.za/wp-content/uploads/2010/03/EIA-Regulations-2014.pdf

Commercial/consultancy digital IA approaches with screening functionality

A number of commercially-oriented IA screening tools are also emerging from the consultancy sector. These are either within broader digital IA platforms, with screening functionality, or are dedicated digital tools for the screening process, which can apply to one or more jurisdictions. Two examples noted during the project of digital screening tools are set out below:

- **Envigo** - The digital IA platform and workspace (see Section 4.4) provides a comprehensive tool within which to undertake the EIA/ESIA process. Envigo contains predefined checklists and questionnaires that are based on EU EIA, IFC, and other guidelines and recommendations that help in identifying potential issues and the need and scope of an EIA/ESIA study. Within the system's functionality is the ability to generate project IA-related screening reports and export them in PDF format. Such outputs could be used by developers to make a formal screening request or, due to its coverage of IFC Performance Standards, be used to assist in project categorization.
- **TESA** (Thomson Environmental Screening App) is a GIS-based app developed and applied by Thomson Environmental consultants, a UK based consultancy, to aid developers in analyzing proposed development sites. The consultants use TESA to efficiently identify relevant environmental features, provide initial recommendations for mitigation, and provide advice on whether it is likely to trigger the need for EIA. Once the analysis is completed, the system draws data from the app to generate a semi-automated report that can then be tailored to support internal project design discussions. Equally, this report can form the basis of an EIA screening report to accompany a formal screening opinion from local government.

4.3 Digital baseline data capture devices

What are they?

The data gathered, information generated from this, and the way it is used as evidence to support conclusions are key to the IA process. As such, gathering data to form an effective environmental and social baseline is central to ensuring the assessment has a firm and trusted basis. Increasingly some of these information requirements can be met through online sources, as discussed in Section 4.1. In many cases, particularly at the project IA scale, additional baseline data needs to be gathered from the field.

Traditionally this has involved boots on the ground, sending teams of environmental and social specialists to the site location to gather evidence about the current situation at the site and in the surrounding area. The need for IA professionals to direct engage with local stakeholders and gather specific information about the environment relevant to the site will not disappear. Digital technology and approaches are, however, influencing how such work is undertaken and offer the potential to generate efficiencies in planning and delivering activity.

Factors that have made digital data capture devices far more available and practical to use include developments in the quality and reliability of sensors, reductions in their size and cost, and enhancement in connectivity and digital storage. A notable development is the change in how data is captured in the field. Traditionally, IA data was manually captured, e.g., on a notepad, and then manually transferred to computer on return to the office. This approach, on occasion led to the loss of physical data sheets—the field is not a clean and tidy office—or transcription errors when undertaking the mundane task of inputting the data.

While some IA specialisms have captured data digitally for some considerable time, e.g., noise monitoring equipment, recent years have seen far more in the field digital data recording of primary information, either on a laptop or smart device. These approaches can help ensure data is captured more consistently and stored securely, plus a direct digital format—combined with

connectivity—allows data to be transferred back to the office for secure back-up and use by other members of the IA team.

Many consultancies have now adopted the use of smart devices for data capture and storage, with some, such as AECOM, having specific strategies and approaches across their organization to gather information in standardized and consistent formats. Where well considered and designed, including the assignment of appropriate metadata, such data capture systems can be designed to feed directly into a digital IA workspace (see Section 4.4) to generate efficiencies. An example of a specific tool is the English Environment Agency's PlaceMarker app, which guides a trained assessor on site to score predefined environmental criteria to establish and monitor changes in environment quality through the life of a project. The app was developed with Queen Mary's University and is used on tablets in the field that connect to a central database for analysis and better capture of environmental benefit delivery. It must be recognized, however, that data gathered in this way will often still need some form of validation and may require conversion to ensure it is accurately represented when converted into GIS/other digital workspaces.

Beyond the way data is recorded, the scope of data gathering for IA work is very broad. To deliver a reasonable snapshot of the developments in this area, the remainder of this section provides an overview of four digital approaches that are now being used in IA practice:

- Remote sensing
- Drones
- Remote cameras and sound traps
- e-DNA

Remote sensing

Remote sensing involves the use of satellites or aircraft to scan an area of the earth to gather information from it. This can be passive sensing, such as aerial photographs, or active sensing, where a signal is sent and a return recaptured, such as Lidar. Many IA now make use of the outputs of passive remote sensing through the use of Google Earth or other open-source satellite image systems to enable a recent view of a proposed site to be seen in its wider context. The information is regularly updated, provides a uniform view, is cost effective and—unlike drones, see below—does not tend to generate access/privacy issues.

The use of active remote sensing is less commonly used in baseline data gathering for IA but has been used in multiple contexts in recent years. The use of Lidar to produce detailed digital terrain models—and sonar in marine settings—as part of the design and IA of multiple projects has helped to uncover important heritage features all over the world. A more integrated example of the technology was presented at IAIA21 in relation to the digital habitat mapping for large sites for use in EIA[12]. This UK project combined sentinel-2 satellite photographs with 15cm resolution aerial images and Lidar data of both vegetation and ground

SpaceX image, sourced from www.unsplash.com

heights. The project then processed the data and sought to train a machine learning AI model (see Section 4.5) to accurately recognize habitat types in detail. The outcomes of the model were tested against an on-the-ground habitat survey, the aim being to generate sufficient accuracy that would allow large areas to be accurately mapped, with filed surveys then focused on specific areas of interest. Unfortunately, the early results of this on-going project only generated moderate accuracy findings (of between 51-56% overall habitat map accuracy), but such results are expected to be improved over time.

12 Matthew Hanson, et al. (2021) "Digital habitat mapping in EIA through remote sensing and ground truthing,"presentation on 18 May at IAIA21 within the session "Digital technologies for biodiversity assessment and monitoring."

Drones

The use of drones in the IA process is becoming a common feature, with respondents to the project survey identified it in the top 5 digital techniques they themselves had seen used on IA projects. Survey respondents and interviewees were able to provide several specific examples including from IA practice in Ghana, Kenya, Nepal, Nigeria, Saudi Arabia and Uganda. A case study of the use of drones in Nigerian EIA is presented in Box 4.1.

In many cases, drones are used for basic site survey and baseline capture work, often to help target follow-up on the ground field studies. In addition, the use of drones in IA was noted as providing benefits in hard or dangerous to access sites, such as mangroves, to enable the IA team, the consenting body and wider stakeholders to better understand the site.

There are, however, challenges related to the use of drones in IA that must be considered, including privacy, safe operation, and having appropriate licenses for their use in the country/jurisdiction. Further, several consultancy interviewees indicated that the technological capability of drones is ever increasing and thus what can be high-cost digital investments can become outdated in relatively short spaces of time. As such, while the use of drones for both environmental data capture and environmental monitoring/IA follow-up is only likely to expand, their appropriate use and the need to manage privacy and other concerns of local and stakeholder groups does need to be considered.

Ian Usher image, sourced from www.unsplash.com

Box 4.1: The use of drones for site verification activities in Nigerian IA practice

In Nigerian EIA and ESIA practice, an initial site verification visit is commonly undertaken. This has traditionally involved a site visit, including members of the Federal Ministry. In recent years, however, the use of drones in baseline data capture for IA has become more common, with efficiencies in both health and safety benefits being recognized. In this example, a site verification survey of mangrove habitat had been anticipated to take over a month to complete with a team of practitioners. Through the use of drone survey, a small team was able to provide a visual survey element in a day, with analysis undertaken in the safety of the office.

Based on this experience, consultants have sought to use drone footage to provide an alternative way to deliver the site verification process. In this process, a drone is flown over the site and surroundings, which may be in a remote area. The footage is then presented at a meeting with the Federal Ministry, where the consultant team can respond to questions and comments, as they would on the ground. Thus far the approach has had mixed results. Government officials have found such drone survey meetings beneficial to gain useful insight into the site; however, they have still had a desire to conduct a site verification visit in the real world.

This desire to visit the site appears to be driven by multiple factors. Some of these factors relate to standard practice, expectations, and interpretation of legislative requirements, whereas others relate to issues that cannot be easily captured in drone derived information alone, such as understanding local stakeholders. It is clear in this example, and in other contexts, the adoption of drone technology is relatively simple for basic data capture activities. When its role seeks to become more formal in the IA process, additional barriers can often arise that may need elements of legislative change/clarification, culture change in those involved in the IA process, and trust in the new system. In relation to the latter, it was indicated that in Nigerian IA practice communities expect to see officials visit sites, so at the current time the use of drones in site verification is likely to continue to be an aid to help focus officials on key issues before they undertake the formal site verification.

Based on discussion with Etia Ndarake (Willend Associates Ltd) and colleagues during the project's Digital IA Action and Ambitions in Nigeria interview on the 12th February 2021.

Remote cameras and sound traps

The ability to identify the presence of protected species in or around proposed development sites is difficult, as specialists can only be present in the field for a limited time and for limited periods of each day/night. As such, the use of digital equipment to capture images/audio recordings has been a feature of conservation, and some areas of IA practice, since the technology became able to be used in the field.

The development of smart phone technology, however, has seen the size and price of sensors fall dramatically. As such, the ability to use remote cameras and sound traps has become far more cost effective and their reliability has improved significantly. With longer-life batteries and improved Internet connectivity through mobile or satellite systems, such traps can also be left for longer periods and can report findings back to a central data center without the need for short-term retrieval.

Beyond this is the use of AI to seek to identify specific species, e.g., through bird song, to help map and monitor species. While no specific IA project examples using AI combined with digital photo/sound traps in this manner were identified by survey respondents or interviewees, larger scale environmental monitoring projects are using them in various parts of the world. For example, an article in *Scientific American*[13] this April highlighted a Californian soundscape study of the Sierra Nevada mountains, where 2000 sound traps will capture millions of hours of records, which will be analyzed by AI.

Such large-scale studies and trials will help develop this technology and also generate environmental baseline information that could be used to inform future IA work. It is to be expected that the approach may well see uptake in IA practice in the near future as systems that combine of these digital technologies becomes more accessible, cost effective, and reliable, as has been the case with many other areas of the digital arena.

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Environmental DNA (eDNA)

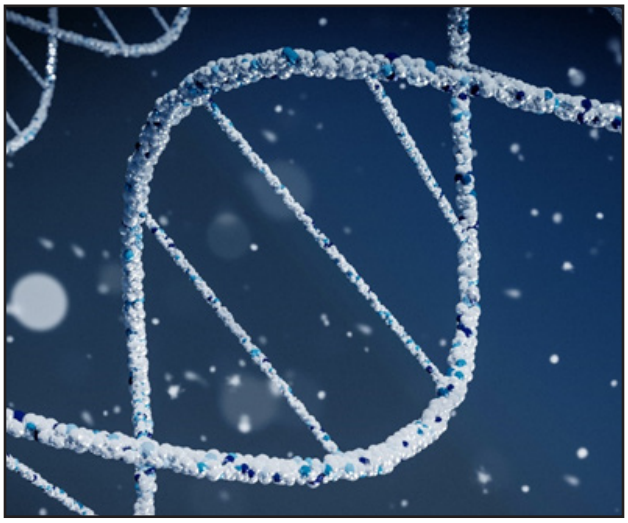
Different from the techniques discussed above, environmental DNA is an approach that allows the identification of species present in an area using indirect samples—from soil, water, snow, etc.—rather than from taking direct DNA samples from an organism. Alongside traditional field surveys, ecologists can take samples from the habitat in an area, which are then sent to a suitable lab to be processed and amplified before the findings are analyzed using advanced computing to generate the eDNA findings.

The results can be used in the same way as a digital camera trap, to determine the presence of specific species in a location without direct observation by an ecologist, but can additionally provide views on overall biodiversity of the location based on the number of different DNA signatures returned.

Application is more common in areas where existing records are poor, or where normal sampling approaches can be difficult, such as in the water and marine environment. For example, Natural England has accepted eDNA findings in relation to the detection of Great Crested Newts (a protected species) alongside the visual surveys more commonly undertaken in UK EIA studies. However, at that time the laboratory processing time for such eDNA samples—of over a month—meant that uptake of this new approach was often impractical. As the cost and processing time for eDNA sampling is reduced, the uptake in IA projects will only increase, both for baseline data gathering and in terms of wider- and longer-term monitoring programs that generate data sets used in IA.

In an IA specific context eDNA is being used in various contexts, often related to the water environment, around the world. Interviewees from the consultancy sector indicated that eDNA was more common in IA in the developed world market, but examples are increasingly being seen across global practice, especially notably in relation to hydropower and mining developments. One example is in the ESIA

13 https://www.scientificamerican.com/article/artificial-intelligence-develops-an-ear-for-birdsong1/



Brano image, sourced from www.unsplash.com

process undertaken for the Asian Development Bank in relation to the Upper Trishuli-1 Hydropower project in Nepal in 2018. The work tentatively identified 25 species of fish; however, limitations in the wider DNA database related to Himalayan fish species created challenges with this process. The eDNA approach in this context has now become a part of the IFC's Trishuli Assessment Tool—a standardized field methodology for aquatic biodiversity assessment and monitoring intended to improve fish sampling for Hydropower ESIAs. The tool has been adapted for application in other basins in Nepal—which is seeing high levels of hydropower development—with the aim of generating a higher standard of aquatic sampling and monitoring.

4.4 Digital IA Workspaces

What are they?

Undertaking any IA process requires multiple parties to engage with each other, including the developer/plan-maker, environmental/social IA specialists, and decision makers and regulators, as well as the public and other stakeholders. The more topics within the scope of the IA process, the larger the group of individuals and organizations that need to interact to deliver an effective outcome. This interaction needs to be managed and this role generally falls to an IA coordinator (or IA manager) to ensure that information is shared in a timely manner and the various parties involved in the process can access or input to the information they need at specific times, such as the production of a scoping report and consultation.

Standard practice in this area already includes the use of many digital approaches and tools, including emails, GIS files, Excel spreadsheets, JPEG images, model outputs, online file sharing and many other digital interactions occurring. The use of GIS has certainly helped to enhance alignment as multiple IA and design team members can access the information to understand changes in layout or location of social/environmental sensitivities. These approaches have, however, tended to be used more for visualizing interaction and meetings, or in reports, rather than an active space where collaborative analysis occurs. In addition, such systems do not act on other risks such as missing information on design details—beyond geospatial information—and suffer from a lack of transparency as to the reasoning behind decisions over significance of effects, for example.

Such digital IA tools remain useful and will continue to be so in the future. More recently, however, IA professionals working with IT professionals have sought to create dedicated digital systems that seeks to house all/part of the collaboration and exchange activities that occur within the scoping and assessment stages into dedicated systems. This would not be possible without the enhancements seen in the last decade in computing power, cloud storage, enhanced online interconnectivity, and widespread use of smart devices as the development of such systems has begun to emerge.

There is no agreed definition as yet for such systems, some of which have been specifically developed as digital IA assessment platforms, whereas others have grown out of work to develop effective online/digital EIS (See Section 4.8). During the project's interviews, a

number of different terms were used to describe such systems, the most common being:

- Digital IA Workspace
- Digital IA Platform
- Digital IA Ecosystem

All of the concepts and approaches developed by those interviewed were a little different, with some focusing on efficiency and connectivity across large consultancy IA service delivery (digital IA ecosystem) , while others are more focused on providing a one stop shop within which an EIA/ESIA are conducted (digital IA platform), and others that fall somewhere in between.

The concept of a *digital IA workspace* specifically emerged from the spring 2020 UK report *Digitizing the EIA Process - A user-centered approach to designing an EIA process for the future*, discussed at the end of Section 2.2. The report defines it as:

> *"A standardized collaboration space for coordinating the EIA and writing the Environmental Statement."*

This is an area of the IA market where it is clear considerable innovation, exploration and development has already begun to occur. It appears that this development trend is only likely to increase further, as more consultancies, regular IA users, technology companies and entrepreneurs/investors seek to work together on digital systems around key aspects related to the assessment (reporting and engagement) process.

An area to watch out for in terms of a potential next step initiative will be the recommendations in the forthcoming *Dynamically Transforming Environmental Assessment* from WABSI in Western Australia. This project will be the next component of the existing digital IA transformation process discussed in Section 4.1 around the Shared Analytic Facility for the Environmental (SAFE). The project will seek to make effective and efficient use of the analytics already generated in the region, to improve the project IA process, impact prediction and the combined analysis and monitoring of cumulative effects.

Examples: Digital IA Workspace

GLOBAL: ORIGINATING FROM SERBIA— ENVIGO: A COMPREHENSIVE SYSTEM FOR DIGITAL ESIA

Envigo, a cloud-based digital EIA/ESIA platform, was created by the Serbian-based company Eon+. The system allows the various stages of the project IA process to be undertaken and managed within it, from presenting data sets by topic, providing assessment methods, applying in-built yet customizable scoring on impacts and significance, visualizing effects, and reporting both via HTML and printable content in adaptable report templates. It provides a well-shaped, comprehensive digital IA platform for enhancing standardization and accessibility of the IA process. Envigo can be adapted to different project IA settings with the requirements of both the IFC's ES Performance Standards and the European Union's EIA Directive pre-built into the systems. It is currently in the early adopter stage of usage across the globe, with pilots completed in Southeast Asia and in progress in Middle East and China.

The concept behind Envigo goes back over a decade, with Eon+'s founder, Professor Nikola Nikacevic, recognizing that there was a lack of software available dedicated to the EIA process. By 2012, a small team had been formed to conceptualize how the technical aspects of the project IA process could be made accessible through a digital system that was based on delivering the requirements of the EU EIA Directive and the expectations of good practice guidance. Supported by the Serbian Innovation fund in 2013 (with contributions

from both the EU and World Bank), the initial product was developed for the Serbian EIA market, including components on baseline data sets, methods, impact significance scoring, visualization of effects, and reporting. By 2016 the Envigo system had been developed into an English language system, with an initially EU-focused range of EIA topics, that has since then been expanded to include the full range of ESIA issues within the IFC's expectations.

Envigo offers comprehensive datasets of project activities, aspects, environmental and social receptors, and mitigation measures, which are auto-filtered by the project type, then relevant issues are selected by the user in checklists and interlinked in matrices and causal networks to identify impacts and measures. Impact significance is evaluated using a number of scoring methods (predefined or user-defined) that are suitable for different effects and receptors (routine, accidental, cumulative, ecosystem services, etc.). Results are presented and visualized in auto-generated tables and charts and easily embedded in digital reports, which can be also exported to PDF format. The breadth and integration of the system's functionality can make it difficult to concisely explain, so the team often use video content[14] to demonstrate its approach and allow potential users to trial it for free online.

The platform itself is presented like a modern app in the cloud, suitable for laptop-based access but recognizing and optimizing toward tablet-based touch screen navigation. Multiple team members can be active across the Envigo system working on a single ESIA, or the whole of an IFI's E&S team and multiple consultancy teams could be working on a broad portfolio of ESIA at once in different stages of the process. Information and data is stored in the system and accessible to all who have the relevant rights to a project/stage in the process, meaning that investors can manage their ESIA in a single hub. The consultants' teams can be focused on the detail, while if desirable and appropriate, authorities and the public can be granted access rights to relevant content to engage in discussions or be consulted on impacts, mitigation and enhancement opportunities.

The platform has had a considerable degree of thought, design, and user-focused experience put into its development. What makes it all the more impressive is that it has been developed aside the current surge toward digital IA by a relatively small but highly dedicated team of IA, process system engineering, software technology, and UX design (User Experience) experts. In many ways the system is a working picture of what the Innovate UK 2020 research report on digital EIA called for in its recommendation that a digital EIA workspace be conceptualized around IA process stages and user needs. Such comprehensive systems offer a vision of how EIA and ESIA can become cloud-based platforms that feel like consistent modern applications to use, rather than the current process of jumping between software to manage and deliver an assessment and its reporting outputs.

An example of where the tool has been applied is on an Asian Development Bank supported upstream energy project (gas to power) in Vietnam, the proponents being PetroVietnam and ExxonMobil. The local office of the global ESIA consultancy ERM used Envigo to house, manage and undertake the 18-month IA study. This enabled a team of specialists from 14 offices around its global team to efficiently support the in-country consultancy team. By working together in the system's cloud-based application, they delivered an effective output while saving downtime and the risks associated with data transfer and knowledge gaps that arise when IA is undertaken through multiple systems.

14 Envigo's IAIA21 video presentation can be found here: https://www.youtube.com/watch?v=yQK5j-n6hho

UNITED KINGDOM: CROSSRAIL 2'S DIGITAL SCOPING WORKSPACE

Crossrail 2 is a proposal for a major rail infrastructure project under London to provide a new tunnel and related station connections for rail lines that come into the city from the North East across to the South West. The first Crossrail is approaching opening as the "Elizabeth Line." The project is led by Transport for London (TfL), who sought to undertake a more proportionate EIA process in light of the High Speed 2 ES, whose EIA related documentation ran to well over 50,000 pages of reports.

Crossrail 2 EIA sought to embed a proportionate approach—one that adds value to the consenting process by making the IA process and outputs more efficient and effective. It needed to embed this approach across a team of 100+ individuals working within a consortium of consultancies and TfL itself. The proportionate approach they applied included challenging normal working practices and using new skills within the team, including digital technology. The team recognized that the environmental information and data would need to be well organized and readily available and thus spent time developing suitable digital data management systems accessible across the team and a GIS based system for their visualization.

The EIA scoping process was conducted via an online web-based GIS platform, where various design options could be presented and updated alongside existing and project-specific derived environmental information. The web system was opened up to enable consultees to view the information. In the case of statutory consultees (the Environment Agency, Natural England, and Historic England), they had the ability to directly query and add feedback within the website and on to the visualized maps. This approach allowed for more direct engagement between the TfL's EIA team and the statutory consultees than would have been achieved by a traditional scoping report document submission and response letter approach.

Large consultancy action toward digital IA workspaces

A significant number of the major consultancies now offer enhanced digital approaches within their IA market offering. The study is not able to cover all such projects, but a review of progress among some of those leading in this area is provided below.

Royal Haskoning DHV

The iReport[15] began as a digital ES platform—see the example in Section 4.8—but found that to be more effective, its functionality needed to expand into a broader digital IA workspace. Royal Haskoning DHV have developed the iReport and their related internal systems so that it is no longer a back-end concept of digitizing an ES, but is instead an approach to IA that builds and considers digital approaches to information sharing for the IA team and stakeholders from the outset. This digital-first thinking helps to drive efficiency through the IA as the process is open to different digital approaches to undertake and visualize the project and environmental information, assessment and findings.

Recently, the company has added a virtual engagement tool within the iReport's functionality. This provides various online "room" formats to enable stakeholders to learn more about the project and its IA and to discuss issues in real time with environmental and social specialists. The iReport has been applied to the IA process for both plans and projects, including the Netherlands Civil Aviation Policy Memorandum SEA[16]. The digital tool has been applied to central and provincial Government IAs, as well as developer and IFI ESIA processes in a range of countries, including Botswana, Canada, Mozambique, Netherlands, South Africa, and the UK.

15 Full details of Royal Haskoning DHV's iReport system can be found here: https://www.royalhaskoningdhv.com/specials/ireport

16 Report available as a Dutch language version only, accessible here: https://planmerlvn.ireport.royalhaskoningdhv.com/

AECOM

In the last few years, the consultancy has been developing and experimenting with digital IA approaches, leveraging digital tools, and technology to improve the IA process at every stage. More recently, AECOM has put a key focus on the use of digital approaches in its work, including ESIA. Digital leads in each of its regions across the world help coordinate this transformation process. The approach brings together digital specialists, assessment leads, and topic specialists, plus engagement colleagues and others to review each aspect of the IA process and identify where digital solutions have the potential to bring improvements.

The approach is developing what AECOM's digital lead for Europe, Ross Stewart, terms a digital EIA ecosystem[17]. The foundation of this is a revamped approach to the way data is managed from its collection, analysis, and reporting. The process ensures that potential data that may be relevant to its IA work is effectively quality assured and made available in formats that mean it can be readily applied. For example, drone data and that captured by IA teams using mobile smart phone data capture fees into these systems. AECOM has also developed its own Environmental Engagement Platform, enabling data visualization, collaboration, and reporting. The platform has been regularly deployed in the UK over the past 18 months and is seeing interest for its use in the US, Australia, and across Europe. Further details on this are set out in the Digital ES example in Section 4.8.

Alongside the above, the company has developed other tools, including automated workflow between activities within the IA process between team members, is beginning to explore AI opportunities, and has seen significant use of its virtual consultation tools in its IA work and beyond, with the pandemic having increased demand for such services. On the latter, however, Ross is clear to point out that the company seeks to apply such digital/virtual consultation alongside traditional face-to-face approaches—when this is possible—to maximize the reach into different stakeholder groups.

Xodus Group

The organization's Australian arm has developed a cloud-based environmental assessment platform aligned to the steps within a project EIA. The system is known as eBase[18] and is intended to be used across the globe. The system is designed to store data regularly required in the EIA process, from baseline data associated with receptors, through impacts linked to project activities across the development cycle, to mitigation and monitoring activities used to address such impacts. By linking these data points, both the technical program of the EIA can be easily planned and defined by a developer and any design alterations or mitigation measures can be quickly assigned to relevant parties, to be implemented at the appropriate stage in the project lifecycle.

The system also provides a workflow of the IA process, using questions based on the type of project selected and the environmental receptors in its location to identify impacts. From these pre-defined issues, the user then either "scopes" the impact in, or justifies its removal. Where impacts are included, the user ranks the significance of the effect by clicking on a traditional effects matrix of likelihood and consequence. This allows the arguably "turning the handle" elements of the assessment process and core structure of an IA report to be very rapidly brought together in a structured format. The developer and the IA team are then able to focus attention and resources on generating supplementary information on the more challenging aspects of the project's interaction with environmental and social issues.

17 Learn more about AECOM's digital environmental engagement tools here: https://www.alytics.com/ee

18 Full details of Xodus Group's eBase system can be found here: http://www.ebase.com.au/

4.5 Artificial Intelligence (AI) approaches in IA

What are they?

IA practitioners are often expected to have in-depth knowledge of environmental and/or social specialisms, and potentially specific experience in one of more sectors. In some cases this expectation has been formalized in to certification schemes for individuals or organizations to demonstrate the need for what is often termed professional judgment. Some aspects of the discernment of likely trends and analysis of information to make a judgment is, however, increasingly within the capabilities of Artificial Intelligencez, and examples are beginning to emerge within the IA field that deserve consideration.

Artificial Intelligence (AI) is when a computer, program, algorithm, or robot/machine can do tasks usually undertaken by people, having traditionally required human intelligence such as problem solving and learning. Key AI terminology that is used within this sub-section is explained in Box 4.2.

Early forms of AI were ruled-based, often using If -Then statements in a program so the computer could then determine the correct outcome—a smart hoover navigating around obstacles. This can only go so far, however, as situations where we would like to apply AI often have many different possible outcomes that mean determining such rules becomes too complex. AI approaches to overcome this include machine learning, natural language processing, conversational AI, prediction analytics, and object/audio recognition.

Box 4.2: Understanding key AI terminology relevant to digital IA practice

Artificial Intelligence: AI leverages computers and machines to mimic the problem solving and decision making capabilities of the human mind.

Algorithm: A sequence of computer-implementable processing steps, including a list of steps, rules, or instructions.

Machine Learning: A branch of AI focused on building applications that learn from data and improve their accuracy over time without being programmed to do so. In machine learning, algorithms are "trained" to find patterns and features in massive amounts of data to make decisions and predictions based on new data. The better the algorithm and data (i.e., quality, quantity, and variability), the more accurate the decisions and predictions will become as it processes more data over time.

Natural Language Processing: The branch of AI concerned with giving computers the ability to understand text and spoken words in much the same way humans can. NLP combines computational linguistics—rule-based modeling of human language—with statistical, machine learning, and deep learning models. Together, these technologies enable computers to process human language in the form of text or voice data and to "understand" its meaning, including the speaker/writer's intent and sentiment.

Sourced and adapted from IBM 2020, accessible from the following starting web page: https://www.ibm.com/cloud/learn/what-is-artificial-intelligence

This project has found that AI appears to be less advanced in its application within IA compared to the use of the other digital approaches and technologies discussed in this section. It is also notable that discussion of AI in relation to IA was very limited over the last decade within IAIA's annual conferences. The project's review of the programs from IAIA's 2010-19 conferences, discussed in Section 1.2, also searched for the term "artificial intelligence" within the title and description of all sessions, papers and posters. The results found only one occurrence of "artificial intelligence" in the IAIA conference program over that decade of the 2010s. This was within the description of Jiri Dusik's workshop at IAIA19, "Social and environmental assessment of automation technologies," a session that helped form IAIA's Emerging Technologies Section.

Following the absence of a 2020 conference due to the pandemic, the proposed content for the IAIA21 conference showed a significant upturn with seven references to AI within its proposed sessions. The conference—held online in May 2021—included multiple references to AI within both paper sessions and breakout discussions, including presentations from several the case studies discussed below. Only one abstract included the term artificial intelligence in its title, delivered by the IFC on their MALENA system—see below—entitled "Discover how IFC is mining its 15 years' worth of ESG due diligence data and using artificial intelligence and data analytics to strengthen due diligence and move markets."

As indicated by the IAIA21 experience, IAIA conference program content does not provide the full story, as they do not mean that AI's potential role in the delivery of the IA process was not discussed at IAIA conferences before 2019. The authors are aware that past IAIA President Marla Orenstein discussed the potential role of AI in IA during both a presentation and panel discussion at IAIA18 in Durban, but the specific term was not used in the conference program and thus was not picked up in the review.

Marla's exploration began earlier than the May 2018 IAIA conference, with a series of LinkedIn articles on advanced technology and IA in January—February 2017, including an article dedicated to AI in IA on 17 January (Section 5 provides links to this series of papers). The review considers how AI could be used in scoping, baseline data reporting and assessment, with the following conclusions:

- *Scoping*—AI is well suited to assisting the IA scoping process, which includes considering a large range of possible issues and data to a more focused list of issues that have the highest risk/importance for further analysis. With more and more data becoming available, AI can help prioritization, but how this process is set up will need discussion, understanding, and most importantly the trust of IA professionals and stakeholders.

- *Baseline data reporting*—involving the need to combine existing, often online, data sources with onsite survey data to develop a profile of environmental and social features of relevance to the project/plan and its surroundings. Marla notes that AI is well suited to help with the "grunt work" of sifting through this information, with IA practitioners potentially freed up to spend more time explaining the meaning of the data. Machine learning techniques are well suited to this work, but data quality and considering how different forms of knowledge are used could pose challenges.

- *Analysis*—Marla notes this as the trickiest of the three areas of potential AI application as current practice relies on professional judgment, which uses the practitioner's knowledge and nuance of the information available to make a decision, often with considerable uncertainties. AI has the potential to learn from far more "experience" by looking across thousands of IA projects and each impact assessment within each. The AI, however, would only be learning from the published information and IA finding of the professional judgment that derived it, rather than the consideration of values considered behind such judgments. Those developing AI can seek to build such "values" into the algorithm, but as Marla's piece notes, this raises the uncomfortable question of who gets to decide which values are recognized/prioritized.

In the four years since this thought-piece exploration of AI's potential in IA was published, real world initiatives have already begun to test and implement these techniques in different contexts across the world. As indicated in Section 4.3, AI is being used in some environmental protection/species observation contexts to help identify species via images or sounds captured on digital monitoring devices. Beyond IA, the

British Broadcasting Corporation's (BBC) research and development team has developed a machine learning AI that is now used to assist in spotting and identifying common British birds for its Autumn and Spring Watch TV series. The same techniques and approaches to identifying species from video imagery could be expanded in future for application in IA context. The BBC's approach also provides a very useful explainer—*A Machine's Guide to Bird Watching*[19]—which provides a technical, but very accessible, explanation of how AI-related image recognition and the related machine learning process works. While not IA related, the piece is a very accessible explanation of well worth a read for seeking to explore and understand how AI works in more technical detail.

The use of AI in IA is slowly increasing; for example, AECOM's European team have recently recruited AI specialists to work on developing tools for its digital IA ecosystem, see Section 4.4. The Danish DREAMS project's 2021 report on international frontrunners, see section 2.2, outlines how the major Western Australian digital IA project's work on environmental data management systems is using AI natural language processing to extract information and seek to identify casual relationships from the review of existing ES and related environmental records. The work of the Western Australian Biodiversity Science Institute (WABSI) and its partners on AI is not described further in this section, as it is effectively summarized in the early 2021 DREAMS report and the reader is directed to the project itself to develop a greater understanding of this exciting and on-going work.

Beyond this, the consultancy DHI is working on AI to help with its quantified modeling approach to the assessment process, including within its environmental screening tool. The model currently uses detailed deterministic models to simulate predicted change, but this takes a lot of processing power and model runs can take over a week to be completed. DHI is therefore developing machine learning approaches that seek to generate thousands of much quicker, but less precise, models to train an AI to be able to generate accurate, but far quicker, environmental screening outputs in the future.

Examples of AI in IA

IFC (INTERNATIONAL FINANCE CORPORATION): MACHINE LEARNING ENVIRONMENTAL, SOCIAL AND GOVERNANCE ANALYST (MALENA)

To operate effectively, the IFC must be able to effectively recognize and govern ESG risks across the emerging markets it invests in. Alongside this is its role in enabling sustainability through shifting investment towards delivery of the Sustainable Development Goals (SDGs). The IFC applies ESIA as part of a comprehensive environmental and social risk management approach, with its E&S Performance Standards forming the backbone of not just its own, but many other financial institutes' approaches. However, it is always seeking to improve in this area and recognized that there was a huge amount of valuable data, knowledge, and information fused within the ESG information related to investments it had already made. The question was how to extract this ESG project data.

A desire to address this challenge by utilizing the potential of AI was the origins of the IFC's MALENA project.

19 The BBC R&D – *A Machine's Guide to Bird Watching* can be accessed here: https://www.bbc.co.uk/rd/blog/2021-05-a-machines-guide-to-birdwatching

The IFC project sought to build on open-source progress in natural language processing to develop an AI that could look through and extract useful information from its 15-year, publicly available record of EIS and wider ESG documentation. Using cloud computing and adapting existing algorithms, the team trained an NLP model to be able to read the unstructured text in these documents to identify specific ESG related terms, such as those used in the IFC performance standards. Initially, 600 ESG-related risk terms were included in the learning process, but this has more recently been expanded to include nearly double that.

The process would be of little value if it simply identified where terms were used in these documents. The value of MALENA's NLP model is to apply a sentiment to the contextual use of each term that is identified. That is to say, the AI not only identifies the selected ESG risk term—e.g., an issue relevant to occupational health and safety—but then categorizes its use within the document and sentence structure to indicate whether each usage is indicating a positive, negative, or neutral view of the term it has identified. Thus far MALENA has over 2000 ESG related documents, from which it has extracted such sentiment data. It has identified over 1.3 million uses of the ESG risk terms and classified over 300,000 as positive/negative sentiment. This allows commonalities in risk to be identified across sectors, geographies, and stages within the investment process.

One potential use for MALENA is to use the vast database of information generated in the AI to enable a prediction of how an investment is likely to perform on ESG grounds from the documents related to it. For example, MALENA can undertake a rapid analysis of an ESIA report and provide a demonstrably accurate prediction of that investment's likely ESG performance in the future. The aim is to eventually get to a predictive ESG analytics tool that helps IFC staff prioritize risks and identify when and where more support and resources may be needed. The IFC recognizes that far more data and validation is needed to develop full confidence in the system. Given that very significant volumes of ESG risk information is already held in digital format around the globe, the challenge is one of coordination, rather than lack of resource data.

The above rapid ESIA analysis capability is still experimental, but the benefit of machine learning is that MALENA can be optimized with more and more input and analysis to produce higher degrees of accuracy over time. A further possibility is to expand the source of ESG input information; e.g., to information in the press related to IFC's investments. Any such expansion would need to be managed in a controlled and monitored manner as with the existing steps the IFC's project has taken in its development up to now.

MALENA is still in its beta test and validation stage of development, part of which includes making it accessible to IFC staff to help provide depth and perspective on ESG risks related to projects being considered by the bank. The machine learning process is also being actively monitored and managed, the initial process having started out by training the system with over 50,000 hand-labeled sentences manually produced by IFC ESG staff. Now, via an "active learning" process, IFC's ESG experts can check sentiment statements and if they consider they have been misclassified feed this back into the system to aid the machine learning.

The IFC is also exploring how AI can assist in other aspects of the integration of ESG information in its work in emerging markets, with a recent report published on this subject in May 2021: https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/publications/publications_report_aisolutions.

DENMARK: BUILDING PRACTICAL IA TOOLS USING AI: THE DREAMS PROJECT

This major initiative to advance digital IA based in Denmark, outlined in Section 2.2, will apply AI (machine learning and natural language processing, NLP) to help improve the environmental baseline, scoping, assessment, and mitigation stages of Danish EIA and SEA.

The first planned usage of AI is within the environmental baseline tool that will be deployed within Denmark's existing Danish Environment Portal. The baseline tool will present information from existing IA Reports other environmental reports and academic articles related to previous IA of development projects, in a GIS map-based format. The information will be identified and extracted from this literature using NLP using a combination of open source and Azure cloud components. The DREAMS team's IA experts will teach the AI by initially adding data labels to a large sample of the selected words within the information gathered. This includes the 2000 ESs gathered by the project already, as discussed in Section 4.2. The aim is to generate an outcome within the environmental baseline tool that allows a user to search for specific impacts/terms across the record of reports and identify where similar issues have been dealt with before and in what context.

The second planned application of AI is to assist the assessment process itself in the CAUSA tool. Development impacts from construction and operation activities will have AI-derived summaries of cause-effect relations and common mitigation measures applied to them. The basis for machine learning is manual annotations of a significant number of reports in order to reach a critical number of relations. The intention is that CAUSA will be linked to the environmental baseline tool described above and related GIS information This part of the DREAMS project will involve development of machine learning algorithms that will search the existing ES in the project's newly developed repository. The AI will be taught to identify and recognize cause-effect relations, based on initial work by the team to outline these relations from IA expert knowledge. The resultant CAUSA tool is intended to assist future IA practice by more rapidly identifying relevant environmental risk (and opportunity) relationships based on project characteristics.

The DREAMS project was presented at IAIA21 and is taking an open approach to its learning with regular reports and progress updates posted on its website. Its progress in the development and use of AI is certainly one to watch in the next few years.

4.6 Digital stakeholder engagement

What is it?

The Internet, social media, online environmental and social databases, digital networking, and meeting platforms enable increased connectivity between stakeholders with similar interests—and with information they could use to support their view or undermine another's. The perspectives of IA professionals on the benefits and challenges that digital approaches bring to engagement is discussed in Section 3.3. Most digital IA approaches discussed across this report have elements of collaborative working and have a role in engaging those with a role in the IA process. To provide focus, this sub-section considers stakeholder engagement in terms of parties not directly involved in delivery of the IA process but who may be affected by the proposed plan/project's effects.

Visualization tools related to the use of virtual, augmented, and mixed reality in IA and the presentation of the EIA/IA Report as in a digital/online format are discussed in Sections 4.7 and 4.8, respectively. The report recognizes that the use of both of these digital approaches has increased considerably in this current surge in digital IA approaches. The use of such tools has also tended to move from being impressive back-end tools, to being applied far earlier in the design process helping enhance meaningful input from stakeholders. Their original inclusion within this section, however, unbalanced the coverage of wider trends in digital approaches being used to further stakeholder engagement related to the IA process. As such, further details on virtual reality in IA and digital IA reports are presented across the subsequent sections.

Digital approaches enable a different form of connectivity with stakeholders, and this can help the IA process to engage with those who may not normally attend more traditional face-to-face approaches, such as workshops and community events. We now have stakeholders who have grown up with digital technology and the Internet and thus may have a different perspective on digital approaches than many IA profession's leaders—this report's authors included—who remember the days when the idea of a home computer was novel and involved the use disks and cassettes to transfer information rather than the Internet, let alone Wi-Fi, smartphones, and cloud computing. Despite this change to a digital generation, the near ubiquity of smartphone access in a community cannot be taken by IA professionals as consent to digital engagement. While access to smartphones is high in many lower income countries around the world, the availability and cost of data remain a real barrier and equitable engagement will not be achieved by simply making a data-heavy digital IA report/website available online.

Not all stakeholders are comfortable or able to use digital engagement approaches, perhaps due to their beliefs, preferences, abilities, or access to suitable technology. There are significant benefits in building trust and relationships that help nurture engagement with different groups in communities that are often lost due to the presence gap of digital technology. As such, regulatory/financial institutions requirements and good practices in stakeholder engagement, such as the Core Values of the International Association for Public Participations (IAP2)[20], remain critical when planning any IA process and should be considered when seeking to apply digital approaches. Marla Orenstein's (IAIA President) 2017 thought pieces, discussed in Section 2.2, also provide a useful perspective on those who stand to gain and lose out in the adoption of digital approaches[21].

Effective IA practice requires public participation, and this is enshrined in regulations and standards, with some areas seeing expectations for increased levels of stakeholder engagement in recent years. For example, the 2018/19 changes to the Canadian EIA legislation enhanced stakeholder communications requirements. Hong Kong has a requirement for "continual public involvement" from the start to the end of projects that undergo EIA. With increasing availability, it is not surprising that digital solutions, which can be available online, accessed 24/7, and easily updated, are being used as a solution to meet such expectations.

Equally, the IA process is no longer alone as a source of environmental and social information about a plan or project. Social media and other digital tools can be used by citizens and other groups to bring attention

20 The IAP2's Core Values can be accessed here: https://www.iap2.org/page/pillars

21 https://www.linkedin.com/pulse/who-wins-loses-when-ia-adopts-new-technologies-marla-orenstein/

to their concerns related to a proposal outside of the IA process. These approaches can be unstructured or may spread inaccurate information, or they can be more structured, such as dedicated websites that seek to provide a particular perspective. While some stakeholders have always sought to raise their concerns and profile through wider means, the Internet and social media have provided connectivity and a significant amplification of such voices.

An example of such an approach can be seen in the work of Oxfam and the use of digital approaches within their community based human rights assessment (COBHRA). Within the COBHRA approach used on the East African Crude Oil Pipeline, a series of "videographies" were produced via drone flights that sought to illustrate the realities of 14 different communities along the proposed route of a pipeline project. The footage was used to produce a film, *Down the Line*, that was released on YouTube[22] and promoted through social media to help highlight the real people who would be impacted and the accompanying report[23]. The outcome was a more engaging and emotive link to the findings of their human rights IA than would be apparent in a traditional ESIA format report.

It must also be recognized that there can be risks of threats and retaliation against project and IA stakeholders. While not an issue specific to digital stakeholder engagement, it is an issue that needs to be considered by IA teams when applying such approaches and has become more pertinent in the last 18 months due to the COVID-19 pandemic. In relation to this, the IFC produced updates to its guidance on this subject[24] to the private sector in June 2020.

Examples of Digital Approaches to Stakeholder Engagement in IA

CANADA: BUILDING STAKEHOLDER TRUST IN DEVELOPING A DIGITAL ENVIRONMENTAL DATABASE MANAGEMENT SYSTEM

As with most countries that have a nuclear power sector, Canada is in the process of identifying a suitable and accepted location for the long-term storage of nuclear waste. This search effort is led by the Nuclear Waste Management Organization (NWMO) a not-for-profit organization governed and funded by the federal government. The NWMO led search process is not at the IA stage yet, as the preferred site has not been identified; however, the search has been narrowed from 22 potential locations down to 2. A key factor in the selection of any site will be the acceptance of the local community, which requires trust in the environmental data that will be used to establish the baseline, conduct any future IA, and monitor any future facility.

To develop this and identify what information needed to be monitored and in what format, the NWMO began a participatory baseline process to identify community concerns in 2018. The process identified the key environmental concerns of different stakeholders, views on environmental stressors, and consensus workshops to agree themes and the needs of a environmental baseline and monitoring system. A key message was that all parties must have trustworthy environmental monitoring and that this should be achieved via rapid sharing of the data in an accessible way—an online digital system.

22 Oxfam America (2020) Down the Line video available via YouTube: https://www.youtube.com/watch?v=oj4F98NoezQ

23 Oxfam, GRA, CRED and NCEE (2020) *Empty Promises Down the Line? A Human Rights Impact Assessment of the East African Crude Oil Pipeline*

24 *IFC (2018) Good Practice Note for the private sector: Addressing the Risks of Retaliation Against Project Stakeholders* and the IFC's June 2020 related *Tip Sheet: Preventing Reprisals During COVID-19 Pandemic* can be accessed here: https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/publications/publications_gpn_reprisalrisks.

The NWMO began to explore an environmental database management system (EDMS) as a solution in 2019, reviewing other similar systems, and began building its own system in mid-2020. The goal is to create a digital system that provides the opportunity for the environmental information to be available on a public online platform. Metadata will be available for quality checking/validation queries and real-time data will be transparently shared with all at the same time.

In terms of data inputs to the EDMS, the process is seeking to maximize digital data flows which can be rapidly processed and quality controlled. This is being designed around real-time monitoring devices in the field, lab data progressing directly into the system, and data that is collected by the community/contractors produced in agreed standardized formats. Once data enters the database, an automatic workflow process will ensure it passes through a staged quality control system. The next step in developing the EDMS system is to create a more engaging user interface that allows the data to be viewed on a map and explored in more detail. While the current system is focused on the site search process, the digital EDMS approach provides the opportunity to build this information into the digital requirements of any future IA and design process.

GLOBAL POTENTIAL: THE SOCIAL LICENCE DATA TOOLKIT, IFC, AND BHP FOUNDATION

As part of its From Disclosure to Development (D2D) program, the IFC, in partnership with the BHP Foundation, produced a report[25] in 2020 that explored how the natural resource sector is using the growth of digital approaches and an explosion in data to develop and maintain social license to operate.

The report describes how digital approaches and technology can generate data to engage with and understand communities. It presents the concept of a data value chain and provides three self-assessment tables—making up the Social Licence Data Toolkit—to help organizations to rapidly understand their readiness in relation to data use, the data value-chain and government data policies that may affect their approach.

The report also provides five case examples demonstrating where companies have begun to use digital data approaches within community engagement. The case studies provide examples of how data can help generate trust and create new partnerships and economic opportunities.

25 IFC & BHP Foundation (2020) *Unlocking Data Innovation for Social License in Natural Resources* is available here: https://www.ifc.org/wps/wcm/connect/industry_ext_content/ifc_external_corporate_site/infrastructure/resources/unlocking+data+innovation+for+social+license+in+natural+resources

GLOBAL: DIRECT WORKER REPORTING, AS PRESENTED BY &WIDER AT IAIA21

&Wider are one of a growing number of organizations that are seeking to effectively bring together digital approaches and stakeholder engagement to enable organizations to gather primary information from workers on site. Many ESIA identify risks related to labor, working conditions, and occupational health and safety, as covered under IFC Performance Standard 2. These issues then need to be managed by the developer and monitored by the financial institution during the implementation stage of the investment. Reporting data from this area, however, can be limited and is all too often generated by secondary sources, e.g., from site inspection visits when time is often divided across a reviewing progress across a range of environmental and social risks and actions.

As with some of the examples presented in the IFC *Unlocking Data Innovation* report (see above), &Wider use the availability of mobiles phones (smart/otherwise) among workers as the basis for their digital approach to direct worker reporting. The company's Engage tool[26] gathers direct information from workers on site on a regular basis, with questions designed to help identify issues such as labor practices, sexual harassment, and trafficking as relevant to the risks identified via the IA process.

Each worker's engagement with the process starts with a short call in their own language to ensure they are willing to participate and understand the process and how to respond to future survey calls. The survey—of 20 simple questions—is conducted on a regular basis.The worker does not have to speak, instead answering by pressing the 1, 2, or 3 button on their mobile phone. This avoids the need for complex apps that require the stakeholder to have a smartphone and available data credit. The additional benefit of this silent response option, alongside the short time needed to complete the survey, means stakeholders can keep their involvement in such labor reporting anonymous.

The data generated from these calls is automatically fed back into easy-to-understand digital dashboards available to the organization operating the site, financial institution, or multiple parties. Comparisons can be made between the issues asked in the survey, trends can be reviewed over time at one site or between different operations, and new issues can be added into the survey, alongside longer-term tracking of labor related issues. The dashboard is also color coded to indicate where risks are highest and thus a response/action planning is recommended.

The &Wider Engage Tool was the focus of a paper presentation delivered by Lea Esterhuizen during IAIA21's live session "Listening with technology: deepening the impact of IA," on Friday the 21st May 2021.

26 https://www.andwider.com/engage

4.7 IA in multiple realities (virtual, augmented, and mixed)

This section provides a discussion and micro-examples of the differences between virtual, augmented, hybrid and mixed realty approaches and the arrival of digital twins within IA. Many of these digital techniques are now used within the stakeholder engagement process, and therefore should be considered alongside section 4.6. As is the case with many applications of digital technologies they can, however, be used at other stages in the IA—for example in monitoring—as is the case with the application of hybrid reality in Hong Kong's IA follow-up process, with an example presented in Section 4.10.

Virtual Reality (VR)

The most familiar of the concepts, this is a computer-generated version of a real-world setting. The most common form is a 3D simulation of the terrain overlaid with satellite/aerial photographs to generate a proxy of the real-world environment. The tool is very useful in IA to generate flythroughs or walk-through environments where the assessor, statutory body, or consultee can view the context of a proposed development from multiple angles.

The pure concept of VR is to be fully immersive to trick the senses into thinking they are in the environment being simulated. As such, VR is not intended to be limited to visuals, but may include sound and other sensory input, for example in application within the gaming and healthcare industries. In IA, however, VR is often used as a visual only approach and may be viewed on a screen/web-page as well as via a headset. The former provides a more immersive experience for the user, but generally needs specialist equipment and is therefore more commonly deployed at face-to-face events, where developer/consultancy staff can assist the stakeholder with the correct use of the equipment.

In some cases, specialist facilities exist that are designed to provide an immersive experience without the need for a headset, some of which combine visuals and sound together. One such facility is the Arup Sound Lab, in London, which has been used in the IA and at public inquiry to demonstrate a combination of visual and acoustic inputs, for example existing baseline, unmitigated impact, and the influence of different forms of mitigation technology.

Stephan Sorkin image, sourced from www.unsplash.com

A further VR example can be found in Hong Kong, in the application of CAVE systems by government and in training environmental professionals. The Cave Automatic Virtual Environment (CAVE) system produces an immersive 360-degree video that can show site conditions and surrounding environment of a proposed development site. Two such systems are in the city; one is located at the Environmental Impact Assessment Ordinance (EIAO) Register Office in Wanchai and the other at the Environmental Academy @Smart Venue. The aim of such systems is to provide better understanding of projects and facilitate discussion on outcomes and recommendations of EIA studies.

A recent conference presentation by Historic Environment Scotland (HES)[27] highlighted a number of examples of such VR flythroughs and models being used to aid understanding of impacts on visual intrusion and setting. The regulatory body recognized the value of such additions to the IA process, but also raised concerns about the lack of standards and comparability between the use of different VR approaches between different IA applications. As such, at present HES see such tools as useful additions, but do not feel they replace the need for in-person site visits.

27 A, Baisden. (2021) "The use of digital technology in assisting assessment of the historic environment," Historic Environment Scotland presenting at Scotland's EIA Conference 2021, available here: https://www.fothergilltc.com/eiaconference-day3

Augmented Reality (AR)

Augmented reality adds digital information onto a user's view of reality. Useful supplementary information about the area the viewer is looking at is superimposed/overlayed onto the real world. The outcome is a composite view that provides more information that you would get from looking at the existing real-world view.

AR came to many people's attention with the release and popularity of the computer game Pokemon Go, with the game's characters overlayed on the images captured by the video camera on a user's mobile phone screen. In terms of IA, the usage of this technology has been considered in the academic literature, with a paper presented at 2019 Association for Computing Machinery (ACM) Symposium. The paper[28] was entitled "AssessAR: An Augmented Reality Based Environmental Impact Assessment Framework" and presented an immersive approach to presenting EIA findings. Beyond this, uptake and examples from IA practice remain limited and no clear examples within the last decade of IAIA conference programs were found.

Tobias image, sourced from www.unsplash.com

A June 2021 webinar for the Institute for Environmental Sciences (IES) by Ramboll, however, highlighted how augmented reality was being applied in their EIA practice, using the Ventus AR in partnership with true view visuals. The company has used AR tools for renewable energy projects in the UK with initial work involving configuring the modeling and selecting relevant parameters for the development type in question. Once the AR model has been configured to the project, it is uploaded to a mobile device, such as an iPad, so it can be taken into the field to project the AR images on the device's screen over live images of the real landscape. The AR app helps to plan site visits and enables stakeholder selected views to be readily considered in a more fluid manner. Initial photo montage images can be generated on site and considered in that context. Additionally, this allows images to be included in earlier stage reports, such as at scoping, rather waiting for such content to be developed for the submission IA report. A link to the 30-minute webinar can be found in Section 6.

There have also been applications of AR within other areas of development projects and those that seek to aid follow-up and maintenance. One example is the use of AR to record the location of buried infrastructure under roads and rail line, which can be used for future development and maintenance planning and onsite work to avoid damaging existing buried services.

Mixed Reality (MR)

Mixed Reality brings greater interaction into the user's experience by blending the physical and digital worlds, and therefore enables experiences that sit between AR and VR. In MR, the user interacts with and can manipulate aspects of both the physical and virtual world based on the use of specialized digital sensing and imaging technologies.

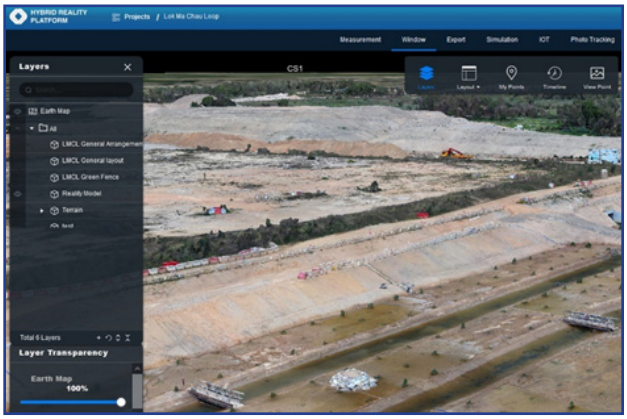
Applications of MR are found in various sectors, including gaming. In engineering, MR provides the ability to build projects in a shared 3D modeled virtual environment, enabling collaboration across teams to spot errors and manipulate the design approach in real time.

MR is also known by other terms, one or which is Hybrid-Reality (HR)—with an example of its application in the IA follow-up process in Hong Kong presented in 4.10. Another term used in this space is the concept of a "digital twin." This is where the project site, or even an entire city, is mapped in detailed and made available within a digital platform. Such tools are being used to

28 Mehra, R. (et al, 2019) AssessAR: An Augmented Reality Based Environmental Impact Assessment Framework https://dl.acm.org/doi/10.1145/3359996.3365034

aid planning and IA processes in many cities around the world. One example of such a system is that produced by Vu City, which started in the UK and has now mapped 25 major cities around the world.

Such digital twin systems can show digital models of the current city, allowing a project to understand its zone of theoretical visibility, visibility of the



Images © & provided courtesy of Hong Kong EPD

proposed site from key views, and enable more complex modeling of overshadowing, microclimate impacts from tall buildings, etc. With such models it is important they are up-to-date, and this has led to the potential to add new layers such as including final design of developments that are both in construction and those that have been consented, but are not yet being built. Such digital twins provide the potential to overlay more environmental information, which could enable geospatial environmental and social data to be added to such digital models related to the outcomes of a specific IA process. There is also the potential to use such digital twin models and information on mobile platforms to allow AR of a development to be superimposed during stakeholder engagement sessions at key viewpoints identified by the IA.

4.8 Digital EIS and web-based reporting

2015/16 saw the development of examples of web-based digital EIS which enabled easy navigation through the mass of information gathered in an IA, alongside effective integration of imagery, mapping and video. Since that time, the "wow" effect of seeing your first digital EIS has perhaps died down, with the leading edge of the field having moved on to more holistic tools that encompass a wider component of the IA process. Discussion and details of such digital IA workspaces such as Envigo, the iReport, and eBase, can be found in Section 4.4.

A key driver behind the development of effective digital IA reporting tools over the last five years has been a desire to deliver more effective and proportionate IA practice. The UK's Proportionate EIA Strategy[29] identified the need for the IA profession to embrace technology and digital approaches as one of the four key themes in addressing disproportionate EIA. Despite the progress made in the development of digital IA reports and software over this period, very few assessments around the world are currently presented as digital reports. As such, the traditional approach to IA reporting—based on the concept of a printed report with annexes, even if delivered as a PDF—currently remains dominant.

While disproportionate IA is by no means limited to the output of the process, it is often manifest in the size of traditional IA reports and the related documentation. In many jurisdictions around the world, the length of EISs themselves are making the ability to readily locate and understand key effects, findings, and relevant mitigation measures difficult. This undermines the original aim of the IA tool, to act as an effective voice for the environment and social issues in decision-making.

The development of digital IA workspaces often seek to refresh the whole IA process within an efficient and visual context, which will also hopefully address wider drivers of disproportionate assessment. There is still much to be done, however, to normalize digital IA reporting into standard practice. Very few, if any, permanent EIA legislation around the world has

29 Fothergill, J. (2017) *Delivering Proportionate EIA – A collaborative strategy for enhancing UK EIA practice*. IEMA, accessible here: https://www.iema.net/resources/reading-room/2017/07/18/delivering-proportionate-eia

been adapted to enable digital-only EIS submission. During the COVID-19 pandemic, IA legislation in some countries such as England and Scotland was rapidly revised to enable more online/digital engagement and submission of paperless documentation. However, the basis of such legislative systems still has its origins in a time before even word-processing was widespread, let alone the development of the Internet, smartphones, and cloud-based computing.

The European Union's EIA Directive and related member state legislation is a good example. Originating in 1985, the more recent 2011 consolidation of the Directive and 2014 amendments retain wording based on the original concept of a hard copy report being printed and made available. The legislation has undoubtedly adapted to recognize the growing potential and then use of digital communications, but a more root-and-branch review of reporting need, based on the fundamental changes in information availability and provision generated by the huge advances in online and digital approaches remains, as yet, unconsidered. Significant work is needed to agree standards and increase the uptake and acceptance of digital IA reporting across the globe.

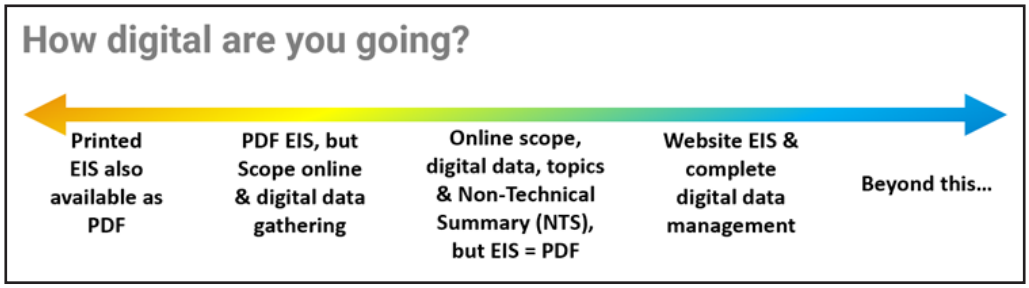
Virtually all EIS and IA reports continue to be produced in a word-processed format and while this technically means that they have (or have the potential) for a digital-only format—as a PDF, this is very much the base end of what could be considered to be a spectrum of digital IA reporting, see Figure 4.3.

The spectrum of digital EIS moves from very basic standard practice approaches such as the IA report being available/submitted in PDF digital format through to the digital 1st EIS reports generated by leading edge digital IA workspaces/platforms described in Section 4.4, and beyond to whatever innovations are yet to come. The first true step into digital reporting of IA findings for many is to present a small component of the IA findings—often the Non-Technical Summary (NTS)—as a webpage with some form of video/interactive content, an example of which can be seen in the 2019 digital NTS of Perth and Kinross Council's Cross A9 Link Road (CTLR) project [30], produced by the global consultancy Sweco.

From this step, organizations may progressively advance further along the spectrum, or seek to make a more significant step and commit to a fully digital IA process. An interim stage beyond the digital NTS pilot can be seen in the use of ESRI's ArcGIS StoreyMaps[31], which allow the effective co-presentation of GIS based mapping of environmental and social effects related to a plan/project's impacts alongside more traditional tables and text to generate a more engaging and visually accessible narrative to the IA's findings.

Beyond this we begin to merge into the more bespoke digital IA workspaces, discussed in Section 4.4. What is clear from the digital IA reporting spectrum is that activities further to the right on Figure 4.3 require a deeper integration of digital approaches, skills, and systems during the earlier stages of the IA process to ensure a digitally minded approach to the IA is taken, rather than having to retrospectively fit traditional IA process outputs into an online presentation format.

Figure 4.3: The digital IA reporting spectrum, as conceptualized by the report authors in the webinar Trends in Digital IA, Environmental Analyst (January 2020)



30 Cross Tay Link Road project Non-Technical Summary, accessible here at https://storymaps.arcgis.com/stories/fc1f0ad03487440b8a55430d91062c9b

31 https://storymaps.arcgis.com/

Examples of Digital IA Reports

ICELAND: A STEP FORWARD IN DIGITAL EIS - BURFELL WIND FARM

Mannvit produced an online digital Environmental Impact Statement (EIS) for the developer Landsvirkjun in relation to the proposed Burfell wind farm project in Iceland. While not the first attempt at making the EIS an online interactive digital report, this was a notable first at bringing together a real-world example of the potential benefits an online digital EIS can offer. Its presentation during the IAIA16 conference in Nagoya captured the imagination and inspired a number of parties to explore this now rapidly developing area of practice.

The Burfell wind farm demonstrated that an EIS could feel like a true online experience, rather than a PDF that had been repurposed to sit as text and images on a website. It made effective use of computer-generated video footage of the proposed development and links to mapping tools. It also allowed users to cut straight to key environmental issues and information of most interest to them. Notably, the developer and consultants made both an Icelandic and English language version of the EIS available, which certainly aided its ability to engage and inspire an international IA audience. Further details, of Mannvit's work on this digital EIS and a video related to the project are available at https://www.mannvit.com/projects/burfell-wind-farm/.

It should be noted, however, that the Burfell wind farm proposal did not gain development consent in the form assessed within the EIA process and that its actual digital EIS is no longer available online. The example highlights that digital IA is not a panacea to gaining consent; rather it is an advancement in the application of practice. It also exposes a challenge for digital IA, that there can be issues with the longevity of online EIS content and accessibility over time, which differ from those related to the production of hard-copy EIS.

NETHERLANDS: HOUTRIBDIJK PROJECT - PILOTING A RETROSPECTIVE DIGITAL EIS TO IDENTIFY KEY LESSONS FOR FUTURE DIGITAL EIS PRACTICE

Presented at IAIA16 (Nagoya), the digital EIS pilot conducted jointly between the Netherlands Ministry of Infrastructure and the Environment and Royal Haskoning provided many IA professionals with the next step on from the Burfell Wind Farm example. The pilot was deliberately undertaken retrospectively as an experiment to identify what effectiveness improvements and efficiencies could be bolted on to the end of an IA process and what areas would have benefited from a more embedded digital IA approach across the IA process.

The outcome of the pilot was a clear and accessible document, with interactive maps, video animation, and GIS overlays of environmental and community issues, all housed in a readily accessible website format. Paul Eijssen, the Royal Haskoning lead behind the pilot—see Section 2.2—estimated that 60-70% of the words needed in a traditional EIS report could be cut through the adoption of the various visual presentation techniques demonstrated within the pilot.

A key factor in helping shape the future of digital IA reporting was the review the pilot requested from the Netherlands Commission for Environmental Assessment (NCEA), the globally respected body in charge of IA quality in the Netherlands. The NCEA made six key recommendations on how the approach to the digital IA report pilot could be enhanced for future use in practice, which have helped to shape the development of digital IA reporting practice. The NCEA's core recommendations were:

- To see greater layering of information, to enable core information about specific topics to be easily identified by all parties, with the detail then more tailored to target groups with specialist knowledge/ interest in the subject area.
- To create the ability to produce a "frozen version" of the EIS that can be printed out, so authorities and individuals can see how the document looked at a specific time.
- Further work on the approach to different presentation options to both improve the value of the information to different users and to help to avoid the risk of bias in how information is prioritized/set out.
- To place greater emphasis on the web accessibility of the digital documentation to ensure everybody can access the information, including those with disabilities.
- To build a search functionality within the EIS to allow users to examine the online content using terms of their own choosing.
- To enhance the platform beyond the EIA's output to enable it to be used for stakeholder engagement, allowing the opportunity for knowledge exchange,

The iReport that Royal Haskoning DHV have developed over the past 5 years since this pilot has now specifically addressed these recommendations, having launched the final element—a virtual stakeholder engagement platform—in early 2021. The iReport is discussed alongside other large consultancy of digital IA workspaces in Section 4.4.

UNITED KINGDOM: BUILDING MARKET INTEREST, AWARENESS, AND UPTAKE OF DIGITAL ES

As can be seen from earlier sections of this report, the UK has shown a strong interest in exploring the adoption of digital approaches and technology in EIA (see Section 2.2). Such interest, however, must be turned into action and this requires consultants to develop systems, clients/developers—and their legal advisers—to be convinced to apply them and decision makers and key stakeholders to accept them. In the UK IA market, like many around the world, there are multiple consultancies and partnerships that have developed and deployed digital IA reporting approaches. However, it is arguable that a single digital EIS, produced by AECOM in 2018, has done the most in bring the potential for digital IA reporting to the attention of those outside of IA practice.

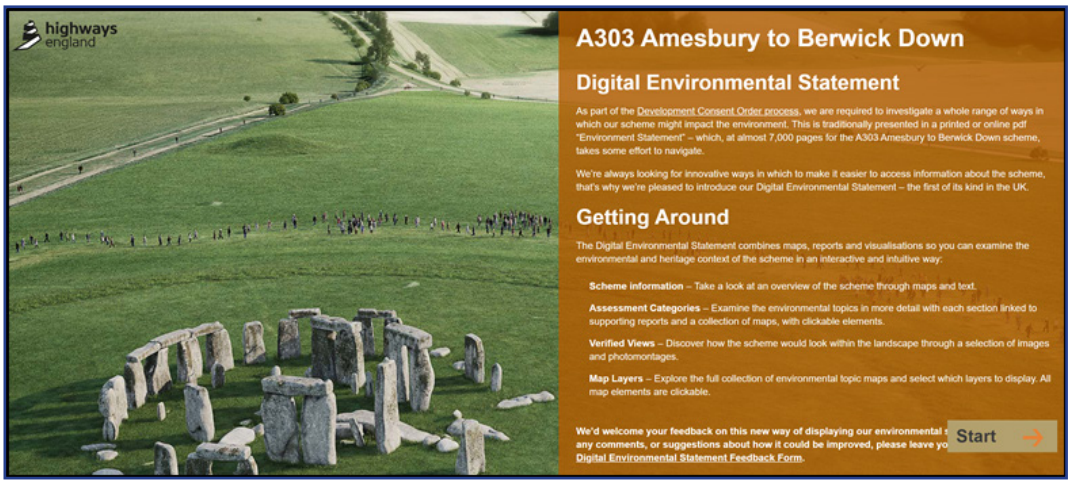
The proposed development in question was the A303 Amesbury to Berwick Down road scheme, comprising 8 miles of new road, with 2 miles in a twin bore tunnel. Due to the nature of the scheme, it was classed as a Nationally Significant Infrastructure Project, and was thus required to apply for a development consent order (DCO) through England's Planning Inspectorate, rather than planning permission from the local authority. The scheme was also Highway's England's first digital ES and one of the first examples of digital reporting seen within the UK's consenting process (see Figure 4.4). All of the above factors made the IA—produced alongside a traditional 7000-page EIS, submitted to ensure regulatory compliance—generated interest among IA professionals, but it was none of these things that led to the wider attention this digital ES garnered.

Much of the scheme was within the World Heritage Site landscape associated with Stonehenge. The new road—and its tunnel—was designed to move traffic from existing A303, major route to the Southwest of England, which currently runs within 200m of the stones themselves. As such, the nature of the project and its association with this globally recognized historic monument drove significant interest in the scheme and thus introduced many to the concept and approach of a digital EIS and provided a direct comparison to a traditional format report of the same information.

The digital EIS itself[32] presents a good example, although Ross Stewart (AECOM's Digital Lead) highlights that practice has already advanced based on embedding of digital approaches across the IA process (see Section 4.4), and based on feedback on this and other digital ES the firm and others have submitted in the UK. The project helped many of those on the edges of IA practice—clients, consenting authorities, consultancy senior executives, and other stakeholders—to visualize the art of the possible. The fact that the partnership of Highway's England and AECOM chose to innovate with a digital ES on an iconic scheme like this, which was always going to draw significant interest and focus onto its assessment, appears to have helped others in the UK marketplace have the confidence to deliver their own digital EIS in practice.

32 AECOM on behalf of Highways England (2018) A303 Amesbury to Berwick Down - Digital Environmental Statement https://eia.aecom-digital.com/A303/intro

Figure 4.4: The homepage of the A303 digital EIS



4.9 Online learning and capacity building

What is it?

The shift to online training and continuing professional development (CPD) and the growth of e-learning is a trend influencing all professions. It could be argued that this is less an area where IA practice has sought to adopt digital approaches but is rather one where our profession has been swept along by a wider transition. Over a decade ago, webinars emerged as a key knowledge sharing platform. Increasing Internet connectivity, bandwidth availability, and smartphone connectivity around the world has helped them to become preferable to the face-to-face seminars and workshops that were the mainstay of professional events at the turn of the millennium.

In the last decade, we have seen an explosion across all professions of online learning. E-learning, massive open online courses (MOOCs), webcasts, podcasts, and other media all seek to provide different formats to access knowledge, whether in a formal training sense or a wider CPD basis. Many consultancies and large organizations have developed their own in-house digital learning spaces to help actively share and retain knowledge, examples, and experiences across the organization and make the most of the intellectual capital they generate. Atkins (a member of the SNV-Lavalin Group), for example, have created their own Digital Learning Academy for the organization, within which IA is covered as part of the organization's relevant content, rather than the driver behind the initiative. The COVID-19 pandemic has also seen a major push of conferencing and other large traditionally face-to-face capacity building events to an online format, with IAIA21 and the IFC's 2021 Community of Learning on ESIA being recent examples.

Further to this, digital approaches and technology are increasingly being applied in the academic field, with online degrees and blended learning becoming increasingly available as options. In Hong Kong, the development of the Environmental Academy@ Smart Venue is designed to enhance mainstream environmental learning using digital technologies. The Academy is equipped with a TV wall, interactive projector system, a 3D TV, a video conferencing system, and an immersive Cave Automatic Virtual Environment (discussed in Section 4.7). These technologies enable the Academy to provide training in an innovative and experiential mode, with the training facility also serving as a venue for interaction with local and international environmental experts.

While it may be the case that IA practice is a follower of wider global trends around online learning, the use of such tools in capacity building remains an important area for focus both for this report and the wider profession. In particular, as a lack of high-quality professional IA capacity and limitations in opportunities

and access to ongoing IA-related learning and experience remain a major barrier for many nations in improving the effectiveness of practice.

Online project IA-related capacity building has become relatively common over the last decade, with a wide range of different opportunities available for those who have access to a decent and reliable web connection. In terms of ongoing development, IEMA in the UK has offered a regular series of project IA-related webinars for around a decade, with a monthly webinar service that ran from 2011 to 2016. Since then, regular IA webinar delivery has continued from this institution, but has become less frequent as other professional bodies and consultancies now run their own IA-related webinars. These events are often focused on a specific country's EIA system, or on a specific sector/part of the EIA process and are therefore more tailored to existing practitioners rather than those seeking more general learning.

This is where online training comes in, with courses designed for different learning needs, from the fundamentals of the IA process within a global context to more specific, often shorter, courses/masterclasses seeking to deliver focused learning on EIA in a specific context. In the case of the former, universities have been a leader in this area for some time—via distance learning courses—a number now offer full online delivery of EIA units. An example of this is the University of Derby's Online Learning, which offers a post-graduate online EIA module to be undertaken over 10 weeks as part of its wider online degree program.

IAIA has also developed a 20-30 hour Foundations of Impact Assessment online course on project IA, which is delivered via the web with online support from expert IA tutors based across the world to help support learners in any time zone. The course is designed to assist those early in their IA career who have some initial experience in project EIA and forms the first online aspect of its developing Professional Development Program (PDP).

In addition to these longer foundational courses, shorter online courses that act as refreshers or updates for working professionals are available via online delivery. Such courses were beginning to emerge online but were generally delivered face-to-face before the COVID-19 pandemic. The result of such restrictions, however, saw many courses shift to also offer online delivery options. The type of digital technology used in this shift varies considerably, with some opting for a simple replacement via a Zoom/Teams platform, whereas others have moved onto dedicated online learning software that allows a greater range of functionality, often related to enhanced interaction and networking.

There are also free digital capacity building resources available related to IA, an example of which is the International Institute for Sustainable Development's (IISD's) EIA Online Learning Platform (www.iisd.org/learning/eia). The site provides clear information on the essentials of EIA, the steps in the process, and downloadable examples including case studies, methods, and monitoring approaches as well as teaching tools. The online platform, jointly funded between the Government of Canada and the Honduras Environment Ministry (MiAmbiente+), is available in both English and Spanish, with a downloadable lesson plan designed for application in Central America.

While the speed of the shift to online short-course EIA training was certainly accelerated by the pandemic, it is now likely to remain as a permanent feature in the IA related training field and continue to grow. From the project's research and discussions with IA professionals, there would appear to be far more project EIA online training than those available in relation to social IA and strategic IA.

Finally, it is worth recognizing that digital approaches and technology are not limited to moving IA capacity building online, but can also be used within the development of training content to aid learner understanding and retention session and monitor performance. The Equator Principles Association commissioned an e-learning toolkit to enable capacity building and enhance compliance across the 90+ member banks. While the training modules were delivered as self-guided e-learning, digital content and formats were also used to deliver an interactive, engaging, informative, and resilient learning process.

The content included video dramatization using actors to demonstrate how IA decisions are taken, respecting stakeholder interests. The company behind the e-learning package, LIMETOOLS, often applies dramatized video to show typical behavior in complex decision making, so that participants can then improve their own operational effectiveness alongside taking on new or refreshing existing knowledge. The company was also part of a consortium of organizations—led

by Netherlands-based consultancy Arcadis—that developed the modules for the World Bank's global rollout training for the 2017 updated Environmental and Social Framework. In this case, dramatized video content was developed to help make the simulated IA case study come alive and engage delegates of the deeper dive training courses, who revisited the case at different stages in the IA process on different days of the face-to-face training course.

GLOBAL: COVID-19 PUSHES IA CONFERENCING ONLINE

Video presentations and online delivery has not been an uncommon way to engage specific speakers unable to attend a conference in person. Before COVID-19, most conferences were held face-to-face. The pandemic stopped that possibility in many countries, especially for conferences that sought to bring practitioners from around the globe together to share experiences, including IAIA. The need for online conferencing went from something of minor interest to a necessity in the space of a few weeks in early 2020, as face-to-face conferences, including IAIA20 in Seville, were postponed or canceled.

Many organizations have learned in the last year that delivering an IA conference is possible online, but with a few major differences. One of the first issues is selecting a viable platform to deliver their online IA conference—with questions such as could a Zoom style platform work, or was something bigger needed with more dedicated functionality? Linked to this are about different platforms' reliability and their accessibility to different users across the world with differences in Internet speed and web-browser software, etc. Ultimately, however, the key issue for online IA conferencing, as with all such events, was not one of digital capability/technology. The key issue was the same as organizing a real-world conference—what are the user needs/experience of those attending the planned online event?

IAIA had to go through this process of defining the particular features of an IAIA conference that could be viably delivered by different online platforms, in order to select an appropriate digital service provider to host the conference. In the case of IAIA21, a range of digital solutions was deployed to deliver an online conference that although very different than all previous years, retained the essential feel of what it means to attend the leading global IA conference:

- Live plenary sessions were organized with the opportunity to watch presentations, ask questions of the presenters, and exchange views with other delegates.
- Facilitated coffee breaks were organized to help simulate a proportion of the lively discussions that arise at the real-world venue following major themes of the conference.
- The poster area and sponsorship booths were available to visit and arrange to meet and discuss issues with those involved.

A key difference, however, was that the normal plethora of concurrent sessions was replaced by the release of presenter video recordings at set times through on each day. While a digital platform could have been selected to enable 10+ live sessions to occur concurrently, there was significant risk of problems arising, e.g., the normal role of a session chair to check that the speakers had arrived in the room and uploaded their presentations onto the laptop at the front risked becoming a need for them to be international tech support to a series of speakers trying to connect at once from different time zones across the globe.

This practical decision generated a novel and useful outcome. All presentations were required to be provided as recordings and, as such, were made available to delegates not just for the 90-minute session in a face-to-face room in a conference center, but for a period of 4 weeks from their release. The result was that the digital delegates at IAIA21 had the opportunity to watch every aspect of a full IAIA conference—something that is simply not possible to do in the real world.

4.10 Digital monitoring, follow-up, and auditing

What is it?

Follow-up and monitoring have always been a bit of an Achilles heel to the IA process. Regulations and responsibilities shift between the planning of an initiative, where IA is active, to its implementation, where other mechanisms, such as permitting and environmental management systems (EMS) play a more prominent role. Effective systems are necessary to enable environmental and socially-related design elements and mitigation/enhancement measures to be efficiently carried from an EIS/consent/investment agreement into the real-world actions of construction and then operation. Further to this, monitoring requires data to be gathered and rapidly reported to those who have responsibilities for environmental and community protection on the ground as well as those with oversight responsibilities.

The above speaks to the need for integrated digital systems that efficiently and transparently enable this flow of information. Such systems could enable the real-world delivery of E&S commitments to be validated, poor performance and unanticipated occurrences to be readily identified and resolved, and IA systems to efficiently learn from the realities of plan/project implementation challenges. While we already have systems that seek to do these tasks, recent developments in satellite observation, cloud computing, lower cost monitoring devices, and a plethora of other digital advances and technologies are now being used to help transform the approach in different locations across the globe.

It is, however, worth recognizing that the IA community has recognized the potential of digital innovation to improve the follow-up process for many years, an early example being the launch of an online environmental monitoring and audit portal in Hong Kong in the early 2000s (see Box 4.3).

The developments in digital approaches and technology that are being used in IA are also being widely adopted across fields and professions associated with gathering environmental and social data. As such, there is inevitably significant crossover between online digital data systems and digital data capture devices that are being used to inform the baseline of the IA process and those that are being used and fed into by IA related monitoring and follow-up. This includes large-scale environmental data management systems (see Section 4.1) and the use of drones and satellite data (see Section 4.3).

It would be reasonable to argue that the work on SAFE (Shared Analytic Framework for the Environment)—led between the Western Australian Biodiversity Science Institute (WABSI) and the Western Australian Marine Science Institution (WAMSI)—should be included in this section. The combined work in relation to digital environmental data for EIA is likely one of the largest specifically IA related "environmental monitoring" projects in the world today. The SAFE concept itself, however, goes far beyond collecting and curating IA monitoring data. It has plans to integrate Indigenous knowledge and generate models from this data to generate shared analysis tools across IA practice, as well as enabling the cultural changes needed to enable acceptance of such a system. For further details on the SAFE project, see the discussion in Section 4.1.

Box 4.3: An early example of using advances in digital technology to improve the follow-up of EIA projects - Hong Kong's early 2000s Environmental Ordinance

Hong Kong developed and launched a publicly accessible online system for environmental monitoring and auditing (EM&A) of EIA developments over 15 years ago. The EM&A webpage continues to ensure that consented projects—which required assessment in line with Hong Kong's EIA ordinance—report on their environmental issues, incidents, and implementation of mitigation and monitoring conditions via a publicly accessible website.

While the tabular web-based reporting format and listed monthly PDF reports may now seem "old fashioned," compared to the recent example of drone-based hybrid-reality follow-up Hong Kong's EPD is piloting today—see below—the approach was innovative at the time, its key influence being an early example of connecting the environmental protections and commitments identified in the IA process with a regularly updated online platform accessible to the public and wider stakeholders. Further details of this early initiatives are still available online and can be found here: https://www.epd.gov.hk/eia/english/monitor/index_web.html.

The shared use of digital approaches and technologies between monitoring efforts and the IA baseline gathering provides great opportunities for shared learning. The potential for "cross-pollination" of ideas and innovations can help to accelerate the uptake of efficient and effective digital approaches into IA across the world. IAIA already plays a significant role in this—through its conferencing, symposia, webinars, and online networking—helping disseminate innovative approaches. IAIA could, however, take a more proactive approach, specifically seeking to act as the key conduit for the exchange and learning of digital IA practice approaches, rather than acting as a host for IA professionals who choose to share examples and initiatives. This project identified several groups of IA and digital innovation specialists around the world who are seeking to engage more widely. Some of this demand is already being met by the proactive work of the Danish DREAMS project (see Section 2.2), but further global leadership, by IAIA or a proactive new IAIA Section, could act to work with, supplement, and expand this to facilitate even greater sharing of knowledge and experience around digital IA.

The digitization of IA follow-up does not have to be limited to professional efforts. The increasing availability of relatively low-cost monitoring devices, cloud computing and block-chain provides the potential for citizen science to play a role in the future of practice. In a presentation at IAIA21, Massimo Zanasso, an Italian Environmental Manager with the consultancy Wood, provided details of an EIA project where a clear role for "citizen science" had been identified. While the smart monitoring approach has not yet been implemented, it is fully designed and all the technology required exists, providing a useful glimpse at a new potential future avenue for IA-related monitoring.

The project in question involves the redevelopment of a large urban site that will require the movement of over 1 million cubic meters of soil. Unsurprisingly, air quality issues were a feature of the EIA findings and the need for monitoring in the urban area around the site was identified, beyond the city's existing network of monitoring stations. The developer plans to provide the voluntary community participants with a smart device combining a sensor, modem, processor, and solar charger. These devices will be installed and calibrated and will deliver atmospheric particulate matter data (PM 2.5 and 10) to the developer. The citizens will retain ownership of their smart devices data, potentially allowing them to provide, or even sell, this data to other interested parties in the future.

Another key area is the growth of virtual appraisal, audit, and site inspection. The need to apply virtual appraisal was significantly increased by the COVID-19 pandemic due to its impacts on the ability for environmental and social specialists to travel to sites. Without the interconnectedness provided by digital technologies—enabling online meetings, sharing

of recent/live images and video from site, etc.—the viability of a switch to virtual follow-up visits would simply not have been possible and work would have had to either stop or continue without oversight of E&S risks.

While recognizing that virtual appraisals are not the same as field visits, financial institutes had to rapidly adapt their approaches to ensure they had clarity of what types of projects, investments, and locations were suitable for virtual appraisal. Based on discussions with FI around this area, a key aspect of the approach included enhanced provision of documentation prior to the appraisal and detailed planning of the virtual appraisal's agenda. The latter could include ensuring the client/in-country advisers (depending on COVID restrictions at the site's location) had organized a range of digital technologies—cameras, reliable Internet connection, video, drones—and had people capable of using them. Undertaking a pre-recorded drone flight to get an overview of the current state of the project's progress, is a highly useful step, with the potential for real-time flyovers, where possible. Additionally, this overview digital technology allows for virtual tours—via video apps often using smartphones—to focus on specific locations with the camera's focus being directed via advice from topic specialists.

An example of a successful program of virtual follow-up was conveyed by David Burack during discussions at IAIA21[33]. David is a senior international environmental expert for World Fish and had responsibility for conducting the environmental mitigation and improvement plan of a farming improvement project in Myanmar sponsored by USAID. With COVID-19 restrictions stopping his ability to travel to Myanmar, let alone get near the multiple sites where the project was investing on the ground, David had to work with the client to develop a system to enable the monitoring of their progress on environmental risk management. A combination of smartphone exchange, MS Teams, Skype, and Google Earth-Pro formed the core digital tool kit to enable David to successfully conduct the work. While such technology and global improvements in mobile and Internet interconnectivity undoubtedly enabled this success, David was clear that the key to success on this project was having a competent national environmental expert. In this project's case this was a PhD candidate acting as David's on-the-ground arms, ears, and eyes. It is therefore useful to recognize that it is not sufficient to simply have a camera onsite: where it looks, the relationship with those on the project site/s and the interaction back to the international specialists—the professional human element—remains a key success factor in ES follow-up.

33 IAIA21 20 May 2021 – Coffee Break – Experiences on undertaking virtual impact assessments: Benefits and Challenges

Examples of Digital Monitoring and Follow-up

CHILE: THE DIGITAL TRANSFORMATION OF A NATION'S APPROACH TO POST-IA ENVIRONMENTAL PERMIT COMPLIANCE AND MONITORING

In 2015, the Chilean Government's Superintendencia del Medio Ambiente (SMA)—the environmental enforcement and compliance body - recognized the potential benefits of investing in a strategy to integrate digital approaches into their work monitoring operational permits. The requirements for such permits are often the result of commitments defined by a separate government agency responsible for Chile's environmental assessment process, as part of the consenting process.

Sebastian Elgueta leads the División de Seguimiento e Información Ambiental - Environmental Information and Follow-up Division. In the interview, Sebastian described how he has provided the leadership to catalyze the progress of this digital initiative. The SMA recognized it needed a centralized database system to bring all the records together related to all permits, to identify and manage environmental risks and community complaints more effectively. The approach—termed "Environmental Compliance 2.0"—combines the use of online automated data feeds from permitted sites, the use of open-source satellite mapping, and standardized reporting from permit holders. The SMA's digital systems also include easy to navigate user interface enabling permit breaches and potential issues to be quickly and efficiently identified and prioritized by staff.

Data quality improvements have taken place, for example working to standardize the way water quality data is captured and reported by all permit holders within their monthly reports. Alongside this, digital technologies are being harnessed, including the use of real-time monitoring from devices at permit holder sites that live-connect to the government database, and the use of open-source satellite imagery to provide a multi-faceted overview of environmental performance and risk.

The system has enhanced environmental reporting rates and the timeliness of their provision. It has also improved the ability to target the Agency's staff resources to deal with high-risk sites or specific environmental concerns based on live data. These successes have enabled the scheme to grow. Sebastian's team are now in the process of developing the Agency's next strategic plan for digital environmental compliance and monitoring —termed "Environmental Intelligence"—with the aim of adopting AI approaches to help further improve the system. The approach has also had a positive feedback on Chile's Environmental Assessment Agency. The two organizations recently worked together to align data requirements and standards on water quality and borehole data. This enabled more effective comparison between information contained in the IA process and that generated for operational environmental permit compliance.

SINGAPORE AND MALAYSIA: COMBINING DRONES AND DIGITAL SYSTEMS TO AUTOMATE MONITORING OF WATER QUALITY ON INSHORE CONSTRUCTION PROJECTS

DHI Group, a global consultancy with in-depth experience in all aspects of the water environment, have been working with clients in Southeast Asia to enhance the effectiveness and efficiency of water quality monitoring in the nearshore environment. The company is progressing activity in multiple streams of digital solutions related to IA, including AI, digital assessment tools, and more. It is their approach to combined technology solutions to deliver fast and engaging monitoring is that is particularly worth exploring here.

DHI has experience and trust in delivering digital monitoring water solutions, including having operated environmental water monitoring sampling via autonomous survey vessel in the busy waters around the port of Singapore. As such, when a number of different projects IAs identified the risk of impacts from water turbidity from developments at and around the port, they were able to develop a digital solution to this process.

The environmental monitoring requirements indicated that daily environmental compliance reporting on water quality and turbidity impacts around marine development was required. DHI's solution was to conduct the monitoring using autonomous drones flying twice a day around coastal area. The drones' cameras check for sediment plumes and record any identified, with the data fed back to their in-house computers to be validated against numerical modeling of impact acceptability—linked to the IA findings. Where the real-world drone-gathered data goes beyond triggers set in the model, DHI's automated decision support system sends an alert to an app informing the client, so they are able to take action. The daily findings are also captured and presented in the app, which is available to the developer, environmental staff and regulators. This turns information that would have been presented in tables in a PDF report into a more accessible and a user-friendly presentation, provides the opportunity to review the data over time, and helps in the identification of trends.

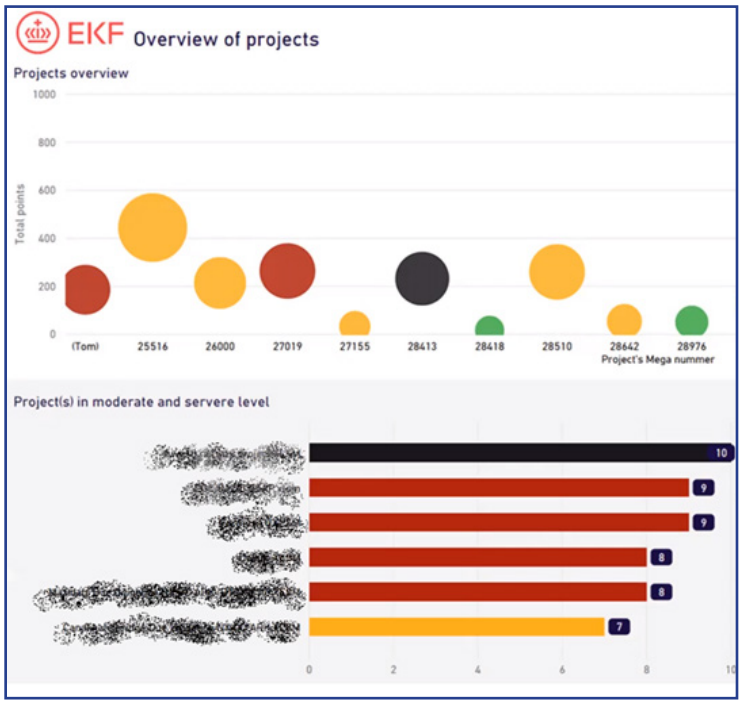
DENMARK: DIGITAL MANAGEMENT OF ESG FOLLOW-UP BY THE DANISH EXPORT CREDIT AGENCY

EKF, the Danish Export Credit Agency, has developed a digital system to collate and track the environmental and social risks and actions related to its projects, clients, sectors, and geographies of operation. The system brings together data that would previously have been managed by individual E&S specialists within multiple PDF reports for each site into a collective user database and accessible interface for the organization. The digital environmental and social data management system allows information to be interrogated across projects, risks to be grouped and better understood and its visual user-oriented interface makes collaborative discussion of emerging issues on both individual projects and across the organizations portfolio easier (see Figure 4.5).

The project required the organization to review its existing environmental and social due diligence, monitoring and ESAP (Environmental and Social Action Plans) processes, and the content from these captured in PDF reports to define the data requirements that would be needed in an interactive online system. Digital dynamic ESAPs were developed and information is now directly input into this system by staff, to feed into the user interface. At the current time, external consultant reports are still in PDF format. Time is needed for staff to extract the information from these documents and place it in the system. EKF is exploring ways to improve the efficiency of this process, with the potential for setting data reporting standards to allow direct transfer of the information needed in the digital system in the future.

Figure 4.5: The user dashboard of EKF's E&S follow-up tool allows oversight of risks to IFC performance standards across all its projects in a dynamic manner

[Note: EKF disguised project names in their IAIA21 slides to share images and retain confidentiality]



The development and operational application of the new digital system has transformed the management approach to EKF's ESG risks by enabling them to be:

- More effectively actively managed across their ES team.
- Understood more widely in the organization, including in reporting risks to the Board and senior management.
- Analyzed in a live way across projects to identify and evidence trends that may otherwise have been missed or only recognized by specific individuals.
- Tracked over time to enable review the collective context across multiple projects to identify situations that tend to raise/reduce ESG risks and use this to enhance future systems and further capacity building efforts.

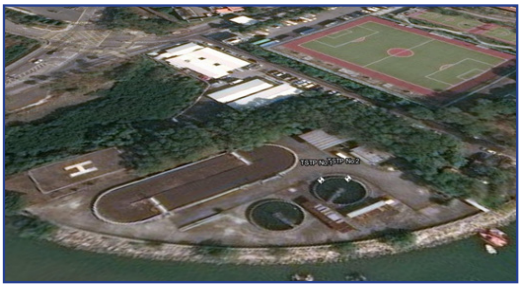
CHINA (HONG KONG): THE USE OF HYBRID REALITY VISUALIZATION IN IA FOLLOW-UP

The Environmental Protection Directorate (EPD) in Hong Kong is responsible for IA and subsequent follow-up and enforcement. The EPD has been using drone flights to monitor the construction progress and environmental protection measures on development sites. They have recently started a pilot of more detailed drone observation of the selected site, to produce Hybrid Reality (HR) models of monthly progress (Section 4.7 provides further discussion on the use and differences between VR, AR and HR).

The images in Figure 4.6 show, in A) a VR view of the pre-development site overlaying aerial photographs onto a 3D landscape model, in B) an HR image of the site during construction and C) an overlay of the BIM-generated digital design of the complete structure.

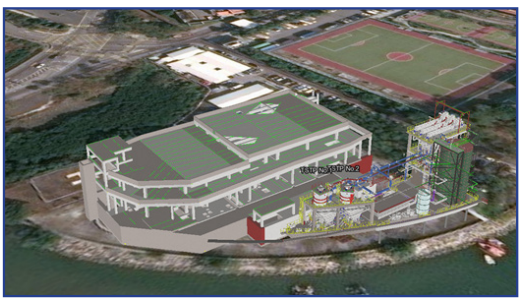
The hybrid reality allows the EPD to look at sites in high definition from every angle to monitor what is happening onsite. They can provide a broader view than may be achieved by a real-world site walkover visit. It should be noted, however, that the use of HR by the EPD is in pilot stage and intended to act as a supplementary resource to site visits and other approaches to monitoring, rather than a replacement to these existing good practice activities.

Figure 4.6: Monitoring progress on IA projects using VR and HR techniques Sha Yau Kok Sewage Treatment Plant, Hong Kong (Images © & provided courtesy of Hong Kong EPD)



A) Base layer of 3D reality model with original site photograph overlayed

B) HR of construction, a high-definition image of the site viewable from any angle



C) HR of 'completed site', by adding project design layers to the system

5. Key Themes and Trends in Digital IA

Several key themes and future trends emerged from the research that are likely to shape the future direction of this fast-moving area of practice. As digital IA matures, these thought-leading examples will become common practice approaches, and therefore more relevant to the wider IA community. This section reports the views and analysis of the experts working across digital practice; it is not a trends analysis nor does it set out a vision for digital IA. The main ambition of this section is therefore to set out key trends identified by the research in relation to wider advances in digital technologies (Section 5.1) and themes related to the future development of digital IA practice (Section 5.2).

A series of "challenge questions" to the IA community are posed in Section 5.3, with the aim of stimulating discussion. The questions focus on what the longer-term implications of the global digital transition and IA's own adoption of digital approaches and technology could mean for the future of IA as a decision support tool to enable better environmental, social, and sustainability performance.

5.1 Trends related to wider advances in digital approaches and technology

There are many reports into advances both within specific digital and technology sectors and across wider sectors that are going through a digital transformation. This sub-section can therefore only provide a very broad overview of some of the key trends that IA professionals should be aware of when considering whether and how to apply digital advances in practice.

The three trends considered are:

- The normalization of digital-first approaches.
- The influence of COVID-19 on the adoption of digital approaches.
- The pace of change in digital capabilities.

Digital first is the future

Digital and technological transformation is not limited to IA, but is occurring in virtually every society, government or organization and in individual lives around the world. Equally, the uptake and integration of digital interconnected devices has been going on since at least the turn of the millennia and has accelerated with the uptake of smartphone technology.

As early as 2019, it was estimated that those born after 1996—often known as Generation Z, i.e., those that have grown up in this "digital" world—accounted for a third of the world's population. While there are clearly differences between countries, cultures and economic bands regarding the ability for individuals to access and apply such technologies, the shift to a digitally interconnected world is everywhere and only set to continue.

While it is essential to recognize the very real value IA practice gains from field studies, face-to-face engagement, and site inspections/follow-up, it is equally important to recognize that existing and new technologies will be developed and deployed that act to support, supplement,and in some cases supplant these activities. To put it simply, a global digital revolution is already well advanced and IA practice cannot seek to stand aside from this and ignore it; the uptake and acceptance of digitally supported/led

service delivery is something that must be accepted for practice to advance.

IA practice should continue to evolve good practice principles and traditional approaches by adopting appropriate advances in digital approaches and technologies. In some cases, this will require experimentation with new approaches that are found not to deliver the quality of results needed, whereas in other cases it may be that wholly new approaches—enabled by digital advances—can be deployed, which outperform established practices.

The case examples provided within this report—notably within Section 4—demonstrate that across the globe many IA professionals are actively working to experiment with, adopt, and deploy digital advances in practice. The questions for the IA community, however, are whether:

- The various digital technologies relevant to IA are being adopted at the right pace.
- Such advances—and learning from their application—are being effectively shared.
- There is sufficient review of how well digital approaches deliver against good practice principles in different contexts and areas of the assessment process.

Several groups of IA professionals already exist in various locations around the world that seek to discuss and debate digital IA and keep up to date with practical advances. Given the global scale of the digital transition, however, all IA professionals should ideally have some role in and access to this debate. As such, there is a need for greater coordination of regular detailed consideration of the implications of IA's digital transition, both within and across IA institutions and organizations. IAIA's conferences have proved a useful opportunity to demonstrate examples and prompt discussion in this area. In future, a more formal strand of coordination may be needed to enable the IA community to efficiently share, learn, and apply digital advances for the good of practice, rather than seeing benefits being limited to smaller groups who have become aware of specific approaches.

The influence of COVID-19

The beginning of the pandemic in 2020 and the ongoing nature of restrictions to protect populations around the world has led to an incredible acceleration in the adoption of digital approaches. While in some cases new technologies have come to the fore, in most cases organizations rapidly transitioned to digital approaches that had existed for some time but had never made it to mainstream acceptance. COVID-19 forced the hand of the IA profession, as it did with all sectors around the world, to "find a way" to continue to deliver services without the potential for travel and face-to-face engagement. Beyond this, the global and ongoing nature of the pandemic—unlike previous regional disruptions, such as the Icelandic volcanic ash cloud that disrupted European and transatlantic flights in May 2011—meant that there has been sufficient time for such "new" approaches to become embedded in the working experience all around the world.

This forced acceleration in the adoption of digital approaches and technology will undoubtedly see some degree of rollback as restrictions lift and site visits and face-to-face events and meetings become feasible in different locations around the world. However, the communal experience of using digital meeting spaces, undertaking virtual site visits, and monitoring with smartphone and drone technology will remain far more advanced than it would have been if the pandemic had not generated the ultimate need case to adapt our common ways of working.

The pandemic has also generated many other trends that need to be considered alongside the uptake of specific technologies/solutions[34], which include:

- Backlogs in face-to-face interaction and on the ground reality checking, which will vary between country, sector, and institution.
- Opportunity for individuals, organizations, and governments to take a step back and reconsider how their future strategies relate with natural systems. This includes how to seek to mutually address Net-Zero, the biodiversity crisis, climate change adaptation and resilience, and resource use/establishing the Circular Economy, alongside wider societal and economic goals.

34 A blog post by IAIA Executive Director David Bancroft (August 2020) provides further insight into the use of digital technology and other adaptations/implications of the pandemic: https://www.iaia.org/news-details.php?ID=123

- Risks that the economic impacts and wider societal backlogs generated by the pandemic will be used as an excuse for a temporary relaxation on IA requirements, or as a route to watering down future application of IA legislation.

The implications of the pandemic will continue to have an influence across the globe in different ways and its implications be discussed for years to come. For IA professionals, however, there is a need to communally consider what worked and didn't work as a result of our forced adaptation to digital approaches, to determine what should be adopted more widely into standard practice. Additionally, there is the need to identify areas of IA that are less well served by current digital approaches, have seen reductions in the quality of practice as a result of COVID-19 restrictions, and may therefore require additional short-term focus to ensure standards are returned to in future.

Many professional IA organizations and institutions have already had and are continuing to have discussions on the pandemic's implications on practice. Such discussions should seek to include consideration of how the adoption of effective digital approaches and technologies in IA can links to these implications for practice. IAIA has been effective at engaging IA professionals in identifying the impacts of the pandemic on the profession and potential trends, including undertaking member surveys[35] and using this information in its actions as an institution. For example: IAIA's Strategic Plan 2019-21 includes a goal to create a virtual Center of Excellence for Impact Assessment, with the aim of advancing the concept of IA over the next 50 years.

The pace of change across digital technologies

The scale of the developments in digital approaches and technologies over the last twenty years has been incredible and has only accelerated with greater speed and reliability of connectivity. The ability for human- led systems to keep pace with the rate of data collection at present and the accelerated gathering of data in the future is being surpassed. As such, there is greater and greater reliance on automated systems and the use in advances in other areas of digital technology to enable this flow of data to be transformed into useful information.

In an environmental context, this can be seen in the availability of open-source satellite images. The volume of images gathered by the pair of craft that make up the European Union's Sentinel-2 satellite constellation means that terabytes of data is downloaded daily at 10m resolution. Previous classification of this data to produce a global land cover map by researchers has meant that the output was often not available until late in the year due to processing, checking, and validation of the results. However, in the development of ESRI's 2021 "Living Atlas," the company worked in partnership with Impact Observatory to use AI to undertake the land classification. The result was that the analysis of global land use cover was produced in under a week. Such advances provide the tantalizing possibility of satellite land cover images being available on a weekly, or even daily, basis for specific targeted areas in the near future. The implications of such data being available either as open source, or through some form of subscription service, could have significant benefits to IA practice, especially in future baseline and follow-up work.

Such developments across digital technologies and approaches, however, cannot be adopted and utilized by IA professionals if they are not aware of them and understand their implications and opportunities. While some such advances will come into practice through wider sources, such as the adoption of a digital technology/service by an institution or a specific

35 The findings of the IAIA's two surveys on COVID-19 can be found here:

The Impact of COVID-19 on IA: An Initial Rapid Review (May 2020): https://www.iaia.org/uploads/pdf/COVID%20SURVEY_Section%201_1.pdf?_zs=VaC3b&_zl=pH7B2

Tracking How the Pandemic is Affecting the Practice and Profession of IA (August 2020): https://iaia.org/downloads/COVID-SURVEY_Section2.pdf

project, others will need more consideration to see their potential to enhance IA be realized. As such, this report into the state of digital IA practice circa mid-2021 should be seen as a building block for the IA community to further enhance the connections needed to keep professionals up to date with developments in technologies and their potential uses in and around IA. Maintaining a regular exchange of ideas, examples, and advances in digital approaches and technologies of relevance to IA will help to continue to demonstrate the art of the possible, as well as enable informed debate on risks and benefits of such approaches. Keeping up to date with all such developments will not be possible, but establishing greater links with partners and organizations that play key roles in the digital sector, including greater engagement of IA examples into their events and digital technologies into our own, will also act to avoid IA practice falling "behind the curve" in the global digital transformation.

5.2 Trends in digital IA

The research conducted to produce this report identified a series of trends related to the application of advances in digital approaches in IA. These trends were noted in multiple interviews and can also be seen reflected within the case studies presented earlier in the report. The initial three trends presented are relevant across the whole of IA practice, with the later trends considered more specific to the application of digital IA practices, as presented in Figure 5.1.

Figure 5.1: Trends in digital approaches across IA practice and within digital IA

Digital trends **across** IA practice		
Digital IA is a spectrum of activity across practice not a distinct sub-field	Digital approaches are key to IA generating more value from its data	Digital is not a silver bullet for the delivery of "perfect" IA

Trends **within** digital IA
Making the case for digital approaches in IA is getting easier
Effective digital IA systems embrace wider advancements in technology and software
Digital approaches are becoming more integrated into the IA process
The skill set required to deliver IA is expanding
Blending established and digital approaches delivers effective outcomes
Increasing opportunities for truly local to global IA teams

Digital trends across IA

Digital IA is a spectrum of activity across practice, not a distinct sub-field

Digital tools have become commonplace across professional and personal lives. While the application of advances in digital technology within IA often requires a specific project or pilot, the broad-scale adoption of such advances is not always a major step change. The growth in the use of GIS in IA over the last 15 years has been incremental and gradual. Actions initially carried out by a limited number of technical or digital experts can often become normalized into the work of IA practitioners over time.

While it is therefore useful to understand the scale and speed of advances at the leading edge of digital IA across global practice, it is equally useful to recognize we have all adapted to a range of digital advances before, not least a move for many to online working in the past 18 months. As such, it is important that the whole IA community has opportunities to engage in discussions around the application of digital approaches and technologies to IA; otherwise there is a risk that practitioners feel detached from such advances, or fearful of what they mean for the profession's future.

Digital approaches are key to IA generating more value from its data

The IA process uses much existing data, but also—especially at the project level—generates significant volumes of new data. Unfortunately, this data is all too often trapped in the individual IA and the value of this intellectual capital cannot be manifest. Multiple case studies in Section 4, from the Western Australia SAFE project, through the Malena AI, to the work in Denmark and Chile on environmental follow-up, demonstrate the potential of digital approaches to extract and reuse data with IA reports and gathered in monitoring programs.

The benefits of reusing data can help inform improvements and efficiencies in existing IA processes—generating a better understanding of environmental and social risk across current and historic portfolios of investments and helping to confirm how effective mitigatory measures are in practice. Difficulties in sharing the data gathered specifically for an individual IA cannot always be resolved by digital solutions, but the trend for common online data sharing around environmental and social issues is likely to add pressure to release IA specific data in the future. Intellectual capital is not only in newly gathered baseline data, but also in how the IA findings contribute to wider understanding of specific development types, such as common impacts, effective monitoring, implementing mitigation and delivering enhancements.

IA practice is only just beginning to scratch the surface of how digital technologies could release greater opportunities in the use of environmental and social data. Sebastian Elgueta, from the Chilean Government's SMA, summed up the opportunity for future progress in this area in his interview, indicating: "*When you have the data and the digital infrastructure it becomes easier to identify the possibilities a digitized environmental monitoring system can achieve*."

Digital is not a silver bullet for the delivery of "perfect" IA

Advances in digital technology undoubtedly present opportunities to re-examine current practices and, as with many of the examples presented in this report, demonstrate approaches that can improve existing challenges in IA practice. However, as can be seen in the case of online/digital IA reports and virtual engagement, they can also generate their own challenges and risks. The study's interviewees agreed that digital is only one part of IA's future.

It is critical to understand the problem(s) you are trying to resolve and the issues that surround these problems first, before assuming that a digital solution is the best approach to improving the situation. Resolving more complex or more embedded challenges to the effectiveness of IA practice, including overcoming gaps in professional capacity and addressing cumulative effects, can be assisted by digital IA approaches. These issues cannot be fixed by technology alone, however. Capacity can be enhanced using online means, but engaging with real people and real projects on the ground provides insight that is yet to be effectively

captured in digital monitoring data or taught through e-learning. As discussed in Section 3.2, having trust in the IA process is critical. Such trust is not simply gained by the adoption of a new digital approach/technique. Advances in digital approaches are tools for IA professionals to consider, experiment with, share experiences with, and understand the reason for adopting them into practice. The IA profession has been adopting digital advances throughout its 50+ year history; the difference in today's world is the scale and pace of change, as discussed in Section 5.1.

Trends in digital IA practice

Making the case for digital approaches in IA is getting easier

The research found that making the case to either trial or fully apply digital approaches and tools within IA is getting easier. The experience and learning achieved in the development of early digital IA reports, application of virtual reality for engagement, and many other approaches discussed above have helped many parties involved in IA become less wary of seeking to apply digital solutions. Interviewees explained that their initial efforts to generate interest and action around digital IA applications were sometimes met by skepticism from colleagues, nervousness from clients and bemusement from consenting authorities and statutory consultees.

As more and more examples of digital IA approaches are seen in practice and become available on the market, these perspectives are being eroded. Clients, colleagues, and statutory bodies are becoming much more open to applying aspects of digital IA. The interviews indicated that conversations related to digital opportunities are now more commonly met with inquisitive discussion. This is not to say that all digital IA approaches are as widely recognized as others, with the use of AI currently requiring major investment and partnership working and thus demanding a considerable business case to justify its application.

The key is therefore to establish links that direct those organizations interested in progressing a digital IA to the right types of digital tools for the challenge or situation they are seeking to resolve. In this regard, further work is needed to improve awareness across global practice—and the wider community that engages with IA—to understand the scope and scale of developments across digital IA. This report is hopefully a major step toward this, but there will be a need for the IAIA and other IA organizations to provide opportunities for future updates as digital IA practice continues to rapidly evolve in the coming years.

Effective digital IA systems embrace wider advancements in technology and software

While the development of a bespoke digital IA system is tempting, such approaches risk becoming inflexible to wider developments in technology and new sources of data. Many of the leading digital IA examples highlighted in this report are based on key links to open-source technology, be they data systems, machine learning/natural language processing AI, and embedded existing GIS software systems. Digital IA needs to adapt developments in technology to its own needs, which may involve modifying these so an NLP can recognize key project EIA terms in Danish, as per the DREAMS project, but the IA professionals did not need to learn to build an AI themselves. Partnership working with digital specialists, the use of open-source systems/data and engaged discussions on both the functionality and needs of the intended user are more likely to provide a recipe to success in digital IA, over existing professionals feeling they need to retrain as technology specialists.

Digital approaches are becoming more integrated into the IA process

This trend was described succinctly as an ongoing "left shift" by Fiona Wilson and Paul Morgalla in the expert interview held with Atkins. This is to say that as digital IA practice is developing, we are seeing new approaches and technology being integrated at earlier stages in the planning of an IA process. Initially, the approach to the application of digital IA to a project, for example, was to take a traditional EIA, then consider how to convert it into an online format as an end-of-pipe solution. While this is still a solution available in the marketplace and provides a route to a digital IA report, practice has learned that to get greater efficiencies and benefits from digital approaches it is more useful to embed them within the IA process at an earlier stage.

What we are increasingly seeing is the development of much more holistic approaches, where real-time digital systems connect across both the design and IA process. This can build out of the application of digital platforms for scoping that are then extended into the assessment process, the IA report, and later stages of engagement. However, there is an increasing trend for consultancies and developers who are seeking to "go digital" in one or more of their IAs, sitting down before the process begins, and considering how data and digital approaches, technology, and software can be brought into the IA process. This early integration, or "left shift" in thinking about what digital IA is aligns with more advanced stages of the digital IA spectrum discussed above and can be seen in the digital IA workspaces discussed in Section 4.4.

To deliver this "left shift" requires changes to the structure and make up of what could be described as the 'traditional' EIA team. There is often the need for partnerships with organizations that specialize in the technologies and approaches that will be applied and a need for deep collaboration to ensure their application effectively contributes to the goals of the EIA process, without being hampered by established processes that may no longer be required or may have a less prominent role. Facilitating this requires a cultural shift among IA professionals, which is explored further below.

The skill set required to deliver IA is expanding

Applying some aspects of digital IA, such as linking to additional online data sets or using drones to collect data, is unlikely to generate large changes to the IA process or the make-up of the team working to deliver it. Those working with the information clearly have to understand its provenance to be satisfied it is of sufficient quality and is trustworthy. Once this is confirmed, however, it will be used by the topic specialists alongside more traditional sourced pieces of evidence. This changes where an entire stage, or the whole, of the IA process is seeking to adopt a digital approach, influencing the approach taken and team members needed to design and deliver the assessment.

New skills and knowledge are needed at the start of the process to define what digital technologies can provide, how data will be managed across the system. Such a change in approach needs to be managed, as it will be unfamiliar to many IA professionals, even down to the language and terminology used by the digital specialists being brought into the IA team. As such, IA coordinators may need to place greater emphasis on applying effective facilitation and change management skills, alongside needing to initially act as a bridge between the new digital personnel and the traditional environmental and social specialists.

Experienced IA professionals will need to consciously seek to take an open-minded approach when initially working in a more integrated digital IA context, with a need to be patient in understanding the value their new digital colleagues can bring, while taking the time to explain what they need from the system. This may mean moving away from established approaches to the process, but it does not mean abandoning good IA practices or the application of expert professional judgment. A balance needs to be made between the desire to apply digital solutions and the need for the IA to deliver compliance and effective outcomes. IA professionals need to avoid becoming barriers to appropriate digital technology, but equally have a role in debating the challenges and benefits that advances in digital technology generate as they are increasingly adopted into IA practice.

Blending of established and digital approaches deliver effective outcomes

Several presentations and discussions at IAIA21 and other IA events highlighted a strong view that effective social IA *"needs face-to-face"* interaction. As discussed in Section 3.3, stakeholder engagement is an area that can be both enhanced and inhibited by the introduction of digital approaches. This is particularly the case when it comes to engaging with Indigenous peoples, local communities, and hard-to-reach groups where relationship building, respecting cultures, and establishing trust are key. Digital approaches inevitably place an additional factor in this process over the opportunity for face-to-face interaction. However, when face-to-face interaction becomes impossible, as has been the case during the pandemic (see Section 5.1), the availability of digital technology to enable engagement has been an essential, if somewhat second best, alternative.

The trend in practice is to recognize that the best approach in many cases will be a blended approach, with digital solutions being used to supplement

traditional engagement approaches where appropriate. Such approaches may not deliver the efficiencies (cost savings) often associated with digital IA, as they may be needed as an addition to existing techniques. This should not be seen as a negative, however, as understanding social impacts and working toward a social license with communities is a challenging area of IA. It must be remembered that a core desire from IA professionals is that wider efficiencies enabled across an IA via digital approaches are used to focus resources on more challenging areas in the IA process. Thus, enhancements in stakeholder engagement and social IA achieved by blending digital and traditional approaches into a more comprehensive approach has the potential to drive improvements in outcomes for communities, developers, and investors.

Increasing opportunities for truly local to global IA teams

Digital technology already allows IA teams to be staffed from locations across the world, through email exchange, web meetings and cloud-based computing and data storage. Advances in digital IA systems have already been shown to be capable of extending this further as discussed in the application of the Envigo digital IA system in Vietnam (see the case study in Section 4.5).

The project's interviews highlighted that this trend is likely to continue in coming years as both IA processes and the follow-up monitoring of projects that underwent assessment adopt integrated digital systems. For example, in Western Australia, extractive projects are seeing increasing use of site automation in relation to environmental monitoring and systems requirements. This is enabling sites to be operated by a smaller group of staff, which in turn is influencing the type of skills needed by the environmental professionals. The trend is towards more generalist skills on the ground, who can work with multiple monitoring systems, with the detailed professional support being delivered by on-call specialists who provide knowledge and inputs from offsite. Monitoring data can be livestreamed to specialists anywhere in the world and advice and actions returned, with online discussions with the generalist on site, or bringing in additional specialists and regulators in a more efficient and timely manner.

The trend presents a future where digital technologies could be used to better enable the use of in-country ESG leads who are supported by a combination of digital solutions and international experts who are mainly available online. A theoretical example could see the IFC's Malena AI used to assist a private in-country bank's E&S staff identify likely risks related to a proposed investment. As in-country personnel progress the E&S risk management process—based on their request or perhaps through the project's risk rating—online support could be made available at key stages from a pool of topic specialists based anywhere in the world. The system could be used and funded by multiple IFI and donor agencies, rather than each requiring their own separate systems of internal and contracted support as is often the case in current practice. This would not overcome the need for more formal capacity building programs but could act as an effective system to supplement the management of ES investment risks, in a time when international travel has increasing challenges due to the pandemic and climate impacts.

5.3 Conversation starters—how digital approaches and technology could change IA practice in the longer term

The review of the state of digital IA practice presented in this report is based on how digital approaches and technologies have emerged and been applied in practice. The examples have therefore more often been the result of organizations and consultancies looking at existing challenges in the IA process related to a project/plan and developing digital tools to resolve these. This approach provides a useful snapshot to IA professionals indicating where practice is applying advances in digital technologies now; however, it does not deliver a more strategic view of what and how global digital trends can be harnessed to reshape IA.

The report did find some initiatives that are taking a more systemic review of applying digital technologies and approaches into IA within specific contexts. The 2019-20 Digital EIA Project in the UK, the activities in Western Australia around Digitally Transforming Environmental Assessment, and the ongoing Danish DREAMS project are all examples of this.

In drawing this report to a close, it is therefore worth recognizing that to realize the potential of digital in IA, professionals needs to consider what problems the IA process should focus on addressing in the future and therefore what this might mean for the way practice is delivered. This debate and shared vision/understanding of the potential futures of the IA concept is needed if current IA professionals are to actively evolve practice. Without it, we risk an external revolution reinventing or replacing much of what we currently see as the professional role of an IA practitioner.

With the world recognizing the complex interconnected sustainability challenges and increasingly wanting to have a better understanding of how they link to a specific project or plan, the future of IA related activity is bright. But whether such assessment activity is similar to the practices of the existing professional IA community, or these approaches are duplicated/replaced by different approaches using advances in technology, is not clear. The recent growth in the market around ESG (Environmental, Social Governance) metrics and reporting, which is often data heavy and has overlaps with the aims of ESIA, is an example of how change may be defined and debated at some distance from the core of the current IA profession.

The global IA community needs to build upon the discussions and debate at the 2019 IAIA conference theme of "Evolution vs. Revolution," to ensure it is playing an active role in defining the future of environmental and social consideration in decision-making. This involves identifying and agreeing on the problems that future IA needs to solve and then defining the issues and challenges that need to be overcome to develop such solutions. What may have been considered impossible, or at least infeasible, with the digital technology 5 years ago may well be eminently possible and practical with the myriad of digital advances that are now becoming available.

As such, the professional IA community needs to focus on the environmental and social challenges that face society today and consider how the concepts and learning of IA can help to solve them. From this, we can help to better define future directions for IA as a decision support tool within a digitally transformed future and understand the barriers that need to be overcome. Understanding how advances in digital approaches and technology can aid the future direction the profession sees for IA will also help us collaborate and share innovations towards such a vision.

To contribute to this process, the authors have defined four question areas (Questions A-D, overleaf) developed from the views shared with information gathered during the project. Each question covers an existing area of digital transformation and considers this over the medium to long term. It is hoped that the global IA community will use these questions to support discussions on the implications of digital transformation for our profession and IA's ongoing role as a crucial decision-support tool.

The project's desk review, expert interviews, and case examples have found that IA professionals are already beginning to explore aspects of the concepts set out in the Questions A-D, overleaf. However, there is currently no centralized coordination of such discussions, with the study identifying a desire from multiple groups for more collective discussions on the role that advances in digital approaches and technology can play in defining the future of IA in the medium to long term. Given IAIA's existing global reach and network, it is recommended that the Association pro-actively seek to integrate such engagement into its existing plans to develop a virtual Center of Excellence for Impact Assessment.

A. Do digital approaches provide new ways for IA to meet the increasing aims of plan makers and project proponents to demonstrate positive environmental and social outcomes (e.g., net-zero GHG emissions, biodiversity net gains, ensuring societal benefits)?

- Does the profession need to take a step back from reviewing the potential of digital technology on an IA procedural/stages approach and instead consider whether such advances present new ways of understanding environment and societal consequences?
- Could advances in AI and real-time/short-term digital monitoring, follow up, and reporting change the balance where the focus of environmental and social risk management is needed in project appraisal?
- Can the negative environmental and social consequences of undertaking an IA be reduced by digital approaches, and what are the sustainability challenges within the use of these new technologies?

B. What role will AI play in the future delivery of the IA process?

- Should AI's role be limited to a mix of mass data analysis and roles that support a human IA professional?
- Are there situations where AI could be tested to conduct more simple assessments?
- What is the appropriate balance of such AI technologies alongside human practitioners?
- What are the intangible aspects humans bring to the process that mean they have a long-term role in IA delivery?

C. Could digital advances provide the opportunity for IA to break from assessing single plans/projects and instead provide the basis for collective IA services focused on specific geographies?

- What might such a system of holistic IA look like? How might such a system be funded? Who would need to be involved in its development to ensure it delivers quality and is trusted?
- How do we overcome the current issues of individual IA processes selecting their own data sources and often not sharing newly-generated data for use in other future assessments?
- How would such a system ensure that those responsible for providing updates to data are fairly compensated for the intellectual capital they provide to the central service (e.g., data gathered by NGOs and volunteer groups, any supplementary data generated by specific plans and projects, etc.).

D. Could open-source digital data and tools enable the democratization of IA?

- What could be the benefits and challenges of enabling communities and other stakeholders to undertake their own assessments of a plan/project in their area?
- Does this risk more and more data being thrown at a plan/project IA without effective understanding and interpretation of relevance?
- Who would be responsible for acting as arbitrator(s) should differences emerge between current professional-led IA findings and those developed from potential future online digital IA hubs used by stakeholder groups?

6. Further Information and Links

This section provides links to additional resources identified by the authors that we believe would be of value to IA professionals seeking to better understand the current state of digital IA practice approaches around the world in 2021.

6.1 Details and links related to specific digital IA Initiatives

Denmark—DREAMS Project (2020—Ongoing)

- Homepage. https://dreamsproject.dk/
- • Report 2020: Digitalisation in Environmental Assessment. International frontrunners. https://dreamsproject.dk/download/2882/.

International Finance Corporation (IFC)—Artificial Intelligence in IA & ESG (2019—Ongoing)

- 2019 Webinar AI and IA: *Meet MALENA: Using Artificial Intelligence to Strengthen Environmental & Social Risk Management*. https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/company-resources/ifc_sustainability_webinars#MALENA_2019-09-26.
- 2021 Report AI and ESG: *Artificial Intelligence Solutions to Support Environmental, Social, and Governance Integration in Emerging Markets*. https://www.ifc.org/wps/wcm/connect/d1d93264-54b7-4d23-a1d7-6a385aa3d868/IFC+Amundi_AI+ESG+Research+Paper.pdf?MOD=AJPERES&CVID=nCzWYlt.

Netherlands—Digitizing the EIS (2016—Ongoing)

- IAIA 2017 Presentation: "Digital EIS Houtribdijk." https://conferences.iaia.org/2017/uploads/presentations/Digital%20IA%20opportunities%20and%20constrains%20B%20Barten%20-%20IAIA%202017.pdf.
- Royal Haskoning DHV iReport. https://www.royalhaskoningdhv.com/specials/ireport.

UK—IEMA Digital IA Working Group (2017—Ongoing)

- Homepage: https://iema-mottmac.digital-engagement.co.uk/?page_id=69.
- Report 2020: *Digital Impact Assessment - A Primer for Embracing Innovation and Digital Working*. https://s3.eu-west-2.amazonaws.com/iema.net/documents/A-Primer-for-Embracing-Innovation-and-Digital-Working.pdf?mtime=20210521114212&focal=none.
- Thought pieces: *IA Outlook Journal - Volume 6: Digital Impact Assessment in Practice.* https://www.iema.net/document-download/43122.
- Recording of the 1-hour long launch webinar for the above report. https://vimeo.com/394460612.

UK - Digital EIA Project (2019-2020)

- Homepage: https://digitaleia.co.uk/.
- 2020 Report: *Digitizing the Environmental Impact Assessment (EIA) Process: A user-centred approach to designing an EIA process for the future*. https://digitaleia.co.uk/wp-content/uploads/Digital-EIA-Report.pdf.
- Recording of the 1hour long launch webinar for the above report. https://vimeo.com/421444416.

Western Australia—Digitally Transforming EIA (2019—Ongoing)

- Homepage. https://wabsi.org.au/our-work/projects/digitally-transforming-environmental-impact-assessment/.
- 2019 Report: *Digitally Transforming Environmental Assessment: Leveraging information to streamline environmental assessment and approvals*. https://wabsi.org.au/wp-content/uploads/2019/10/Digitally-Transforming-Environmental-Assessment_Working-Group-Report.pdf.
- Guide: SAFE—A guide to a shared analytic framework for the environment. https://wabsi.org.au/wp-content/uploads/2021/07/SAFE-Guide-V1.1P.pdf.
- Forthcoming 2021: *Dynamically Transforming Environmental Assessment*.

6.2 Useful links on digital/advanced technology in IA

IAIA President - Marla Orenstein thought pieces (January-February 2017 and 2018 Webinar)

- *Emerging Technology and the Future of Impact Assessment*. https://www.linkedin.com/pulse/emerging-technology-future-impact-assessment-marla-orenstein/.
- *Working with the Robots: Machine learning, artificial intelligence and Impact Assessment*. https://www.linkedin.com/pulse/working-robots-machine-learning-artificial-impact-marla-orenstein/?trk=prof-post.
- *Who Wins and Who Loses When IA Adopts New Technologies*? https://www.linkedin.com/pulse/who-wins-loses-when-ia-adopts-new-technologies-marla-orenstein/.
- IAIA Webinar 2018: *A rapid tour of emerging technologies and IA*. https://www.iaia.org/webinar-details.php?ID=18.

Other useful videos/webinars on digital IA

- **June 2021:** "Augmented Reality and EIA" (Cameron Orr and Amanda Chan for the UK Institute of Environmental Sciences). https://www.youtube.com/watch?v=oSXGdgSG2MA.
- **May 2021:** "Envigo—an endeavour in the digital transformation of IA" (Nikola Nikacevic presentation at IAIA21). https://www.youtube.com/watch?v=yQK5j-n6hho.
- **May 2021:** "Digital Transformation and EIA" (90-minute 3-speaker session from Day 3 of Scotland's EIA Conference). https://www.fothergilltc.com/eiaconference-day3.

- **March 2021:** "Digital EIA—Data, mapping and visualization (Mark Elton for the UK Institute of Environmental Sciences). https://www.youtube.com/watch?v=3cC-EwSpdb8.
- **May 2019:** "Going digital: Is this evolution or revolution?"(6 short presentations from IAIA19 session on social media and EIA.
    - Paul Eijssen (Session Chair/Netherlands). https://www.youtube.com/watch?v=C3TWE-NDroQ.
    - Rob Verheem (NCEA—Netherlands). https://www.youtube.com/watch?v=Dw_I7cPuSPc.
    - John Sinclair (Canada). https://www.youtube.com/watch?v=GaC59RQXfng.
    - Timothy Peirson-Smith (China—Hong Kong). https://www.youtube.com/watch?v=KTQPQWwiVTU.
    - Kathy Friday (Australia). https://www.youtube.com/watch?v=fRsflZ699Jg.
    - Bart Barten (Netherlands). https://www.youtube.com/watch?v=O8UQbFe-yzg.

IAIA Section—Emerging Technologies

- Coordinators: Jiri Dusik, Alan Bond, Miltos Ladikas
- Homepage. https://www.iaia.org/contact-iaias-emerging-technologies-section.php.
- Article: "Should we have IAs for Disruptive Technologies?" https://www.iaia.org/news-details.php?ID=108.

The State of Digital Impact Assessment Practice

This report provides impact assessors and other professionals with a snapshot of where digital IA practice stands around the world in the middle of 2021. It presents insight from the global IA profession from interviews with experts working on different advances in digital IA and wider perspectives from case studies and a practitioner survey. The benefits and challenges of digital IA are explored, before presenting the core review of the current state of ten different areas of digital IA practice:

- Inter-IA & Online Environmental & Social Management Systems
- Digital Screening Tools
- Digital Baseline Data Capture Devices
- Digital IA workspace
- Artificial Intelligence (AI) in IA
- Digital Stakeholder Engagement
- IA and Virtual, Augmented & Mixed Realities
- Digital EIS and Web-based Reporting
- Online learning and capacity building
- Digital Follow-up - Monitoring and Auditing

The report also presents a review of key themes and trends in the use of digital approaches and technology in IA, considering the implications of the COVID-19 pandemic and how these can be effectively blended with existing practice. It concludes by posing a series of questions to the professional community on what this digital transformation might mean for the future development of IA in coming years.

About Fothergill Training & Consulting Ltd

FothergillTC is a bespoke sustainability consultancy providing practical solutions to complex challenges and the resulting change management processes needed to improve performance. We work across Impact Assessment, Sustainability Strategy, and the Circular Economy, taking a collaborative approach that helps ensure clients take ownership of the work we develop and deliver with them. We act to develop the capacity of the organizations we work with, leaving them better equipped to delivery in a more sustainable manner. Find more at www.fothergilltc.com.

About the International Association for Impact Assessment

IAIA is the leading global network on best practice in the use of impact assessment for informed decision making regarding policies, programs, plans, and projects. Find more at www.iaia.org.

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