Technological Innovation in the Media Sector: Understanding Current Practices and Unraveling Opportunities

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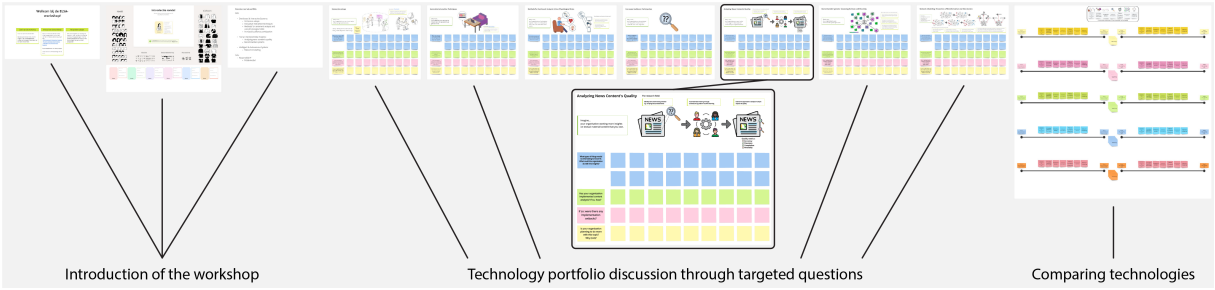

Figure 1: Focus group workshop Miro environment

ABSTRACT

AI technologies offer significant opportunities for the media sector, including content production, distribution, and audience engagement. This case study aims to bridge the technological expertise of the AI, Media & Democracy lab in the Netherlands to stakeholders in the media sector, identifying current technology implementation practices and outlining the potential of our technological expertise. First, a visual portfolio of the expertise of the researchers was created. Then, focus group workshops were held with broadcasters and media institutions, using an interactive online Miro environment. Results include insights on current implementation of the presented technologies by the media organizations, and opportunities for further implementation. Key takeaways are the broadcaster need for short-term implementation possibilities and the importance of having both B2C (broadcasters) and a B2B (the entire sector) perspectives present in focus groups to provide confirmation of findings and offer a broader viewpoint on the media landscape.

CCS CONCEPTS

• **Computing methodologies** → *Artificial intelligence*; • **Human-centered computing**;

KEYWORDS

artificial intelligence, industry practice, case study, media sector, focus group

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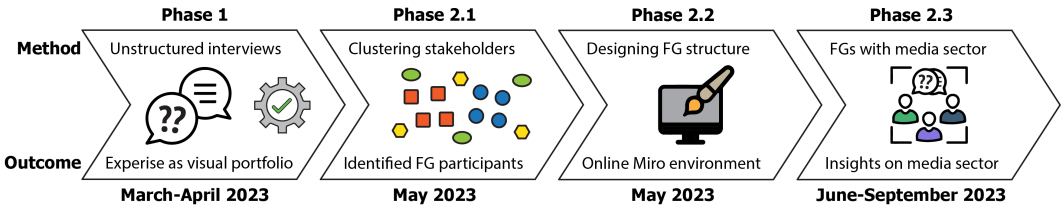


Figure 2: Timeline with the phases of the case study.

1 INTRODUCTION

The media sector acts as a pillar in any democratic society and plays an important role in informing citizens to make political choices [1]. Also, the democratic role of the media is inherently intertwined with the advancement of (information) technology as this has significantly shaped the ability of various media branches to fulfil diverse roles in society [17]. Artificial Intelligence (AI) presents novel and powerful opportunities for the media sector throughout its entire value chain, encompassing research and investigation, content production, distribution, and audience engagement [5]. However, it is important to acknowledge that the media sector faces challenges in fully harnessing the potential of AI and other emerging technologies. Many media organizations struggle to develop their own systems due to a lack of skills, resources, and financial constraints. As a result, they depend on (costly) third-party solutions, which is particularly challenging for smaller, local, and public media outlets. Additionally, considerable uncertainty about the ethical, legal and societal implications of the use of AI is an obstacle for the media to use the full potential of AI [2].

To strengthen the AI-driven innovation in the media sector, and support their democratic function, the AI, Media and Democracy Lab[1] (AIMD lab) has been established in the Netherlands. This lab investigates possible and current uses of AI and explores its social, ethical, and legal implications. The lab plans to develop and test new conceptual models and AI-applications in actual media production spaces. Hereby, they involve the entire knowledge creation value chain: from deeply conceptual research to participatory design, field testing and using the results as input for (theoretical and applied) research in computer science, law, ethics, social sciences and the humanities. Ultimately, the lab aims at strengthening AI-driven innovation in support of national and local media's democratic function; initially with the focus on the Dutch media landscape.

1.1 Present study

This case study is part of AIMD lab's aim to set up an experimental test bed for novel ways of applying AI-technologies in the (Dutch) media sector. More specifically this study aims to bridge the technological expertise present at the AIMD lab with the practices of the media sector. The outcome serves the purpose of identifying and selecting challenges in the media ecosystem to co-create solutions together with the media sector. The computer science technological expertise in the AIMD lab is represented by the work performed at CWI, the National Research Centre for Mathematics and Computer Science in the Netherlands. In total, three CWI research groups are involved with the lab: 1) Distributed & Interactive Systems, 2) Human-Centered Data Analytics, 3) Intelligent & Autonomous Systems.

2 METHODOLOGY

This case study consists of two phases, see Fig. 2. The first phase translates the expertise of the researchers into a comprehensible portfolio of visuals, which is the preferred explanation method of complex technologies for lay users [14]. Subsequently, in the second phase, this portfolio was utilized as the foundation for conducting focus group workshops with stakeholders in the media sector.

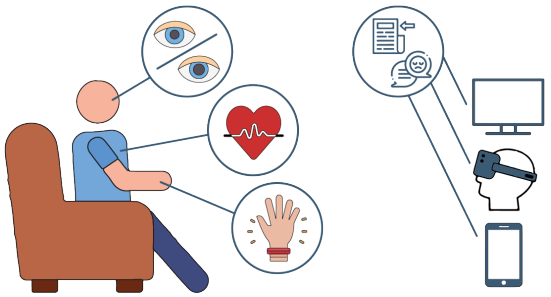
2.1 Phase 1: Translating the researchers' expertise to a portfolio

Per research group, an open-ended unstructured interview of 45 minutes was conducted with one or two representative researchers to gain insight into their complex technological expertise. Thereafter, visualizations were made that encapsulate the discussed expertise. Finally, iterations on the visualizations were made, through feedback from the researchers, until a satisfactory outcome was achieved. A satisfactory outcome here means a balance between the complexity of the technological expertise being incorporated into the visualization and its comprehensibility for a non-technical audience.

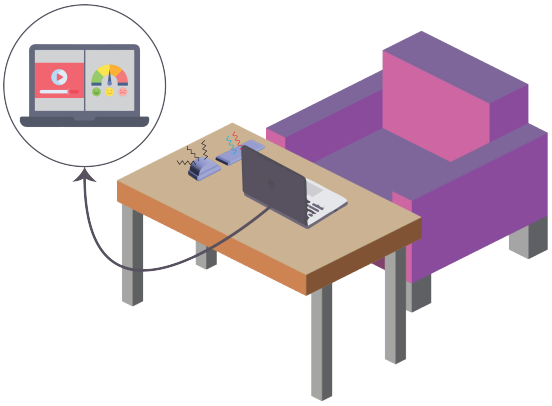
2.1.1 Distributed & Interactive Systems group. This group describes themselves as follows: "A focus on facilitating and improving the way people use interactive systems and how people communicate with each other. Combining data science with a strong human-centric, empirical approach to understand the experience of users. This enables designing and developing next generation intelligent and empathic systems."[2] The systems this group is able to research and develop within the context of the lab can be split into three categories: 1) Methods for measuring user physiological state, in line with work in the news context on for example pupillary dilation and skin conductance[10, 13], 2) Innovative interaction techniques, like their earlier work on haptic stimulation of news videos[9], 3) Immersive setups, like their current involvement in projects like TRANSMIXR[15] that aim to create a platform for remote content production and consumption via social virtual reality. Additionally, this group is open to explore the topic of 'increased audience participation' and is curious what the practices of the media sector currently are and if they can contribute with their expertise. Examples of portfolio visuals can be seen in Fig 3.

[1] https://www.aim4dem.nl/

[2] https://www.cwi.nl/en/groups/distributed-and-interactive-systems/



(a) Portfolio visualization of 'Methods for sentiment analysis and user physiological state'



(b) Portfolio visualization of 'Innovative interaction techniques'

Figure 3: Two examples of the expertise areas of the Distributed & Interactive systems group as visuals.

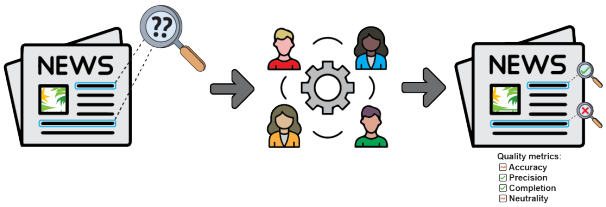
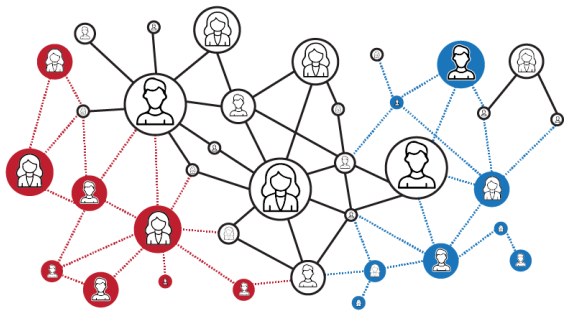


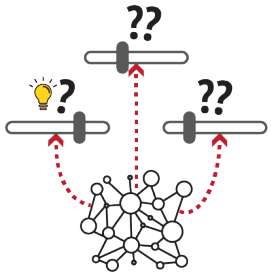
Figure 4: Example of the portfolio visualization of the expertise area 'Analyzing news content's quality'.

2.1.2 Human-Centered Data Analytics group. This group describes themselves as follows: "Addressing questions on how to ensure that digital systems are inclusive, promote diversity and can be used to combat misinformation. Through analyzing empirical evidence of human interactions with data and systems, deriving insights into the impact of design and implementation choices on users."[3] Their expertise on digital systems can be split in two topics related to the lab: 1) Analyzing news content's quality, like their earlier work on review quality[3], 2) Diverse and fair recommendation metrics, like earlier work on hidden author bias in book recommendation[4]. An example of a portfolio visual can be seen in Fig 4.

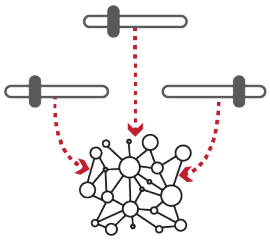
[3]https://www.cwi.nl/en/groups/human-centered-data-analytics/



(a) Question 1: What behaviours are possible in the system? E.g. polarisation / segregation



(b) Question 2: How does these behaviours depend on parameters?



(c) Question 3: How to interact with these network behaviours?

Figure 5: Process of building network models explained through the questions that arise

2.1.3 Intelligent & Autonomous Systems group. This group describes themselves as follows: "Studying generic and fundamental mechanisms that enable the emergence of various degrees of organization, intelligence and autonomy in complex cyber and cyber-physical systems. These systems are dynamic networks of interacting nodes (or agents) that continuously exchange digital or physical resources, including data or information, energy, materials and products."[4] Within the lab's context this group's expertise focuses on modeling the dynamics and prevention of disinformation and polarisation. E.g. through studying complex networks formed by humans as well as automated agents, and modeling how agents in the network are susceptible to be influenced by the spread of fake news, and influence others[16]. This topic continues their earlier work on dynamics in collaborative tagging systems and sponsored search markets [11, 12]. Portfolio visuals of the process of building a network model can be seen in Fig 5.

2.2 Phase 2: Focus group workshops with the media sector

With a complete portfolio in place, this phase focuses on connecting with the stakeholders in the media sector through focus groups. Rather than doing separate interviews with each stakeholder, focus groups allow for gathering a range of opinions together and getting more nuanced feedback [7]. The approach adopted in this phase involves first mapping the stakeholders to talk to and clustering

[4]https://www.cwi.nl/en/groups/intelligent-and-autonomous-systems/

them effectively, then designing a focus group workshop that incorporates all desired conversation topics, and finally executing the focus groups with the selected stakeholder clusters.

2.2.1 Identification of focus group clusters. For this study the existing partner connections of the AIMD lab were utilized to have access to a wide variety of stakeholders within the media sector. To create meaningful conversation during the focus group workshops, clusters of stakeholders were made that have similar roles in the media sector. Cluster 1 consists of 4 media broadcasters, 3 of which are public broadcasters (NPO in the Netherlands, BBC in the UK, and BR in Germany) and 1 scientific broadcaster Nemo Kennislink located in the Netherlands. Cluster 2 is composed of media institutions in the Netherlands, of which 2 archival institutions: Sound & Vision media archive and the National Library of the Netherlands, 1 research foundation Waag, and 1 business-to-business (B2B) organization Media Perspectives supporting the media sector as a whole. Participants were selected to possess a sufficient breadth of knowledge regarding technological practices within their organisations, for example in the role of lead/coordinator (responsible) innovation, lead experiment team, innovation strategist, lead future internet, and data/innovation journalist.

2.2.2 Focus group workshop design. Aiming to understand the current practice of the media sector in relation to the technologies, the main questions to answer through the workshops are:

- Is the media sector currently using these technologies (see section 2.1)? And if so, to what extent and are they planning to broaden the usage?
- Have challenges already been identified while implementing these technologies?
- What are possible, yet unexplored, applications for these technologies within the media sector?
- When comparing the technologies, which are most/least likely to have successful implementation within the media sector current practice? And which spark the least/most amount of curiosity to explore?

To answer these questions in an easily accessible manner for the workshop participants, we chose to do the focus group workshop in an online Miro environment[5]. A dedicated section was created for each technology in the portfolio to gather input specific to that technology, see Fig 1 for an overview of the entire Miro board and Supplementary material A for an example section. Each section features the portfolio visual and a textual description of the research field at the top, this combination makes sure lay people gain optimal understanding [14]. The main questions are listed below, accompanied by sticky notes for workshop participants to fill in. The questions are presented in a specific order, beginning with an open brainstorm question to encourage participants to consider all possible applications for the technology. Next, participants are asked to relate their organisation's practice to the technology, including any implementation setbacks. Finally, participants are asked to describe their organisation's vision for expanding the use of the technology. To answer the last main question of comparing the likeliness of implementation and curiosity towards the technologies, a separate section was created in the Miro environment.

[5]https://miro.com/workshops-async-collaboration/

2.2.3 Focus group workshop procedure. The workshops, which took place in June 2023 with cluster 1 and in September 2023 with cluster 2 (see 2.2.1 for cluster participants), had a duration of two hours. Workshops began with an overview of the purpose of the workshop, namely to gather insights on the use of AI technologies in the media sector. Then, the technologies that would be covered during the workshop, originating from CWI research, were described shortly. Following this, an informal introduction round was conducted through a Miro icebreaker exercise[6], aimed at fostering a comfortable and engaging conversational environment. The majority of the workshop time was dedicated to covering the entire technology portfolio. This was structured as follows: 1) the technology was introduced alongside the broader field of research and an imagined scenario, 2) participants were asked to fill in the sticky notes addressing all questions, 3) the sticky note responses were utilized to initiate a collective discussion about the technology. The duration of each technology discussion ranged from 10 to 15 minutes, depending on the level of input from the participants. To conclude the workshop, participants shared their thoughts on how these technologies compared in terms of implementation and curiosity for their respective organisations.

3 RESULTS

In this section two types of results are shared: 1) insights on the topic of the case study, namely the opportunities of innovative technologies in the media sector, and 2) lessons learned on doing a case study in the context of the media sector.

3.1 Opportunities per technology

With a varied portfolio of technologies come varied opportunities. While certain technologies can seamlessly integrate with the existing practices of the media industry, others are entirely novel in this context. The following section outlines the opportunities that each technology can offer within the (Dutch) media sector, obtained from the sticky notes and additional comments of the participants in the focus group workshops.

3.1.1 Immersive setups. The media institutions with archival responsibility are primarily interested in this technology. One potential application is the use of a digital librarian to guide visitors through media stories from the past based on their interests. This allows for a conversation with the archive and enhances the visitor's experience. Furthermore, the conversion of fragile and expensive media artifacts into a virtual experience is highly valued as it ensures the preservation of these items while also enabling audience interaction with them. In addition, two broadcasters have expressed their involvement in VR and/or AR projects. However, it is crucial to consider accessibility to the technology, such as using AR on a phone instead of a VR headset. This accessibility is essential for mass media platforms, as they aim to reach a wide audience.

3.1.2 Innovative interaction techniques. Both broadcasters and institutions acknowledge the hardware limitations of technology that incorporates the sense of touch. Innovative touch-based interactions may require additional hardware for audiences. One potential

[6]https://miro.com/miroverse/character-mix-and-match-icebreaker/

use of haptics, as mentioned by a broadcaster, is to enhance accessibility by conveying information in alternative ways for those who struggle with traditional channels. Another potential application coined by the library institution is to create immersive interaction in the institution buildings, using for example sound or wind, to let visitors engage more deeply with textual media.

3.1.3 User physiological state. The discussions during the workshops primarily focus on the desirability of implementing this technology in the media industry. Broadcasters express apprehension regarding potential user resistance and privacy issues related to the gathering of physiological data. Two institutions suggest integrating this topic into their practice by offering visitors the opportunity to undergo physiological measurements and educating them on the implications of the data collected, such as providing recommendations based on excitement levels.

3.1.4 Increased audience participation. Workshop participants unanimously agree that audience participation is a strategic priority and a base revenue model, and happens increasingly online [8]. Media broadcasters currently employ comment features (one even mentions AI detection of comments addressing the newsroom), idea submission on forums, radio DJ interaction, and giving screen time to people during city visits. One broadcaster emphasizes their aim to democratize audience participation by facilitating interaction between audience members. Similarly, one institution seeks to foster discussions on local topics and connect people based on shared interests.

3.1.5 Analyzing news content's quality. The workshops yielded two key areas of opportunity. Firstly, the ability to measure quality in terms of authenticity and source traceability. One broadcaster highlights the importance of ensuring that their content is not affected by fake statements or deepfake imagery because they have a trustworthy reputation. Secondly, analyzing methods can be used to add data to existing content, while one institution is working on (semi-)automatic title description this can be broadened to automatic keyword/summary/review generation and determining the difficulty of a text. Additionally, one institution focused on archiving emphasized the need for AI analyzing methods for audio and video.

3.1.6 Diverse and fair recommendation metrics. The recommendation of content on broadcasters' and institutions' websites is an area of active experimentation. One broadcaster is facing the challenge of reaching consensus on what responsible and fair recommendation is while testing systems and evaluating people's exposure to diverse content over time. Another broadcaster lacks a recommendation system, despite user expectations for personalized content. An archival institution values recommendation that explores societal topics in-depth, enabling users to shape their opinions and broaden their knowledge with trustworthy material. The B2B institution notes the challenge of operationalizing diverse recommendation within the sector without organisations becoming part of the normative framework.

3.1.7 Network modeling. The media broadcasters are naturally interested in gaining insights into the dissemination of their content. However, they rely on external tools for this purpose. The B2B institution that collaborates with numerous media broadcasters also emphasizes the potential value for these companies in obtaining more detailed insights into the mechanisms behind content spread. This institution has also raised the issue of measuring the trust individuals place in news sources and how this influences their sharing behavior. Another institution recognizes the potential of incorporating this technology into their media literacy program, aiming to educate individuals about encountering online disinformation and the consequences of spreading it.

3.2 Lessons learned

3.2.1 The broadcasters' need for short-term implementation. Media broadcasters raised concerns in the workshops about the limitations associated with implementing future-oriented technologies. Virtual reality, for instance, has been identified as having low user adoption rates and limited accessibility for some audiences. While two broadcasters have experimented with virtual reality projects in their R&D departments, there is limited interest in exploring this technology in the short-term. Similarly, haptic technology, which incorporates the sense of touch, faces implementation doubts due to the lack of a platform or user base. However, media institutions are more open to exploring the possibilities of immersive experiences, including augmented and mixed reality, in the long-term. They view immersivity as an important step for the media industry and are more willing to pilot such projects. A key factor in dynamically transforming the practice of media organizations when novel technologies arise are innovation labs [6]. Our participants with job titles like 'lead (responsible) innovation' and 'innovation strategist' will therefore play key roles in the future implementation of the presented technologies.

3.2.2 Importance of combining B2C with B2B perspectives for all-encompassing insights. The B2B organisation and broadcasters (B2C) share a lot of similar opinions on opportunities and constraints, such as concerns about the necessary hardware for incorporating touch into the media experience. In the workshops, both emphasize the importance of traceability of news content sources for the quality analysis technology. The B2B organisation also highlights the need for AI tools for audio and video content analysis, illustrating a failed attempt at detecting violence in scenes. While everyone agrees on the potential of recommendation systems, defining criteria poses challenges. Broadcasters face this challenge from the perspective of 'how to incorporate public value and diversity' and 'what is best practice around evaluating fairness' while the B2B organisation indicates the already existing dependency: 'recommendation systems shape opinion on the media sector as a whole, a lot cannot function without it, it's already vital'. Also, the broadcasters show interest on network modeling to prevent the spread of disinformation and gaining insights in how their content circulates; the B2B organisation confirms this by saying it is 'an interesting application that must be of interest to media broadcasters'.

However, certain technologies prompt the B2B organisation to present a more comprehensive outlook on the current state of the sector and the potential future of technological implementation. The broadcaster workshop expressed skepticism towards immersive setups due to the costly hardware required by the audience. The B2B

organisation advocates for a broader understanding of immersive media, stating, 'We see immersivity as an important step for media. But in varying amounts of immersion, the viewer must be able to choose, and the industry must offer the levels. Don't just look at solutions with VR glasses. Immersivity can take on many forms'.

The broadcasters expressed skepticism towards the usefulness and desirability of measuring physiological state. The B2B organisation acknowledges that it is improbable for the media sector to create devices for physiological sensing. However, they provide a broader view on what this technology could mean for the sector by mentioning the concept of 'the engagement loop' in which consumer feedback actively influences the creation process. Physiological sensing could be part of this feedback, however 'likely only with a smart watch or something, how people act after they watch content will remain most important'.

4 CONCLUSION

4.1 Summary

In order to enhance the AI-driven innovation within the media sector and uphold its democratic function, the AI, Media and Democracy Lab has been established in the Netherlands. This case study explored how to bridge the technological expertise present at the lab to the stakeholders in the media sector. This exploration encompasses identifying the current practice of technology implementation in the media industry and outlining the potential of our technological expertise within this context. Activities undertaken include: (1) conversations with technical researchers to understand their expertise technology, (2) translating this to visualizations, and (3) reworking these visuals in accordance with obtained feedback. Then, clusters of stakeholders were identified to present the portfolio to in a focus group (online) setting. Once clusters were formed, focus group workshops were held with the broadcaster cluster and the institution cluster. During the focus groups an interactive Miro board was used for participants to directly write down their thoughts and experiences. The focus within these sessions was to obtain insights on whether the discussed technologies have been implemented by them, how this turned out, and whether they would be curious about further development of each of the technologies. Together, these sets of focus groups led to insights on where the opportunities for the technologies lie in the media sector. Additionally, two key takeaways of doing a case study in which research and industry come together are: 1) The need for short-term implementation possibilities can be an obstacle when trying to bridge future-oriented research and thus must be taken into account when presenting this to industry stakeholders, 2) Having both the B2C perspective (of the broadcasters) as well as a B2B perspective (on the whole sector) present in the case study can provide confirmation of findings but also offer a broader viewpoint on the opportunities of technology implementation.

4.2 Limitations

The primary limitation of this work is that doing a case study with many stakeholders within the media sector requires careful planning and quite some effort goes into ensuring attendance of all invited stakeholders. Nonetheless, a diverse and substantial group of stakeholders representing a significant portion of the media sector participated in the workshops. The addition of a commercial media stakeholder would have provided a even more comprehensive perspective on both public and commercial media practices in broadcasting.

Regarding the research process, certain aspects of our research design were successful, while others could have been approached differently. For instance, our bottom-up approach proved effective in both phases. During the portfolio-making phase, researchers had the freedom to openly discuss their expertise in unstructured interviews, allowing them to have significant influence on how their expertise was portrayed in the portfolio. In the focus group workshop phase, it was beneficial to have a wide range of technologies to discuss, enabling participants to decide how much attention to allocate to each one. One aspect that requires consideration is whether to conduct focus group workshops in person or online. Due to the geographical spread of our participants, we chose the online option. However, conducting group discussions with individuals who are unfamiliar with each other online presents its own challenges. In our online setting, we selected Miro as our platform of choice due to its familiarity and the convenience of participants being able to join the Miro board without creating an account. Other online platforms were not considered in our case study, as Miro provided all the necessary functionality. However, for more complex workshop sessions, it may be worthwhile to explore alternative platforms.

The process has revealed another learning outcome, highlighting the inherent difficulty in creating a visual portfolio that effectively conveys the technical expertise of researchers while remaining accessible to non-technical stakeholders. This requires a combination of technological knowledge and design expertise. During the case study, some technology visuals were readily comprehensible due to prior familiarity, while others, such as network modeling, required additional explanation but were ultimately understood by participants.

4.3 Future work

This case study provides both specific opportunities for the AIMD lab's AI-technology research in the media sector, as well as an approach on how to bridge technical research to the media sector. Within the lab, this study serves as the foundation to select opportunities in the media sector for further technology development. For instance, immediate next steps may involve engaging in technology-focused discussions with interested organisations or deepening the conversation with individual organisations to identify the most relevant/meaningful technological innovation opportunity within their practice. This will then lead to concrete co-design sessions, followed by development, implementation, and evaluation in experimental test bed settings in line with the AIMD lab's aim of applying AI-technologies in novel ways in the media sector.

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