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Collective efforts for the introduction of AI in healthcare

An empirical study of two Norwegian initiatives

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The collective dimension of AI is crucial to ensure sustainable and ethical outcomes of AI implementation in society; accordingly, the introduction of AI in healthcare is a collective concern. In this paper, we examine this collective dimension of AI introduction by drawing on an empirical longitudinal case study of two initiatives aimed at introducing AI into the Norwegian public healthcare services. The first initiative is an inquiry process led by the Norwegian Directorate of Health, as part of a project initiated by a government policy plan outlining a vision for AI in healthcare. The second initiative is a nationwide, informally established network of professionals engaged with AI in healthcare. Drawing on insights on hybrid knowledge production in collective efforts, as well as practice-oriented and relational understandings of technology, our analysis of the two initiatives focuses on how the collective effort was carried out, the role of the orchestrators and the implications

of such efforts on their outcomes. Our findings show that the two initiatives, while seeking to produce hybrid knowledge on how to best introduce AI in healthcare, faced different challenges, both in generating such knowledge, in achieving consensus-based results and in enacting visions of AI in healthcare oriented to clinical practice. We suggest that to contribute to a consensus-based and inclusive introduction of AI in healthcare, collective efforts should pay attention to the inclusion of heterogeneous stakeholders and their interaction modes, the politics of agenda settings and modes of orchestration.

Introduction

The introduction of AI in healthcare refers to the implementation, adoption and use of AI-based technologies in healthcare practices, and it is currently the focus of much scholarly and public discourse. Much of this discourse is centred around technological efficiency and performance, and it is preoccupied with understanding how advancements in AI will enhance the diagnostic accuracy and operational efficiency of healthcare professionals (see, for example, national policies like the Danish 'National Strategy for Artificial Intelligence' [Danish Ministry of Finance & Danish Ministry of Industry, 2019] or the Norwegian 'Nasjonal helse- og samhandlingsplan 2024–2027' [Meld. St. 9 (2023–2024)]). However, AI technologies are not a set of discrete technology devices being implemented to improve isolated healthcare tasks; rather, they have the potential to profoundly transform healthcare practices, services and systems (Alami et al., 2020; Noorbakhsh-Sabet et al., 2019; Periáñez et al., 2024; Alowais et al., 2023). It is then critical to examine how this transformation unfolds, especially in the public healthcare sector of the Nordic countries.

In the Nordics, policy-making and societal development are traditionally characterised by consensus-building, dialogue, inclusion, and collective action (Kuhnle & Alestalo, 2017, p. 18; Lægreid, 2017). These are reflected in the current approach to the introduction of AI. In Norway, for instance, the government's vision of AI, as presented in the Nasjonal helse- og sykehusplan 2020-2023 (Meld. St. 7 (2019–2020)), emphasises that enabling AI in healthcare requires a broad mobilisation of actors and public-private collaboration (p. 89). Although processes striving for consensus are typically time-consuming, the results are often less radical yet more sustainable than those of faster-moving reformers, such as countries like the UK (Lægreid, 2017, p. 85). Moreover, scholars within AI ethics underscore that collective approaches are of great importance in achieving "a good AI society" (Floridi et al., 2018). Floridi et al. argue that a multi-stakeholder

approach "is the most effective way to ensure that AI will serve the needs of society, by enabling developers, users and rule-makers to be on board and collaborating from the outset" (Floridi et al., 2018, p. 701). However, in an AI in healthcare context, knowledge of how such collective work can be done to ensure sustainable, ethical, and otherwise ideal societal outcomes is still limited. In this paper, we aim to explore how a collective approach to AI can be enacted. Our research is guided by the following research question: *How can collective efforts be organised and carried out to contribute to a consensus-based and inclusive introduction of AI in healthcare?*

To address this research question, we have conducted a longitudinal case study focusing particularly on two initiatives characterised by a collective approach in the early phases of AI introduction in Norway. The first initiative is an inquiry process led by the Norwegian Directorate of Health as part of a project initiated by a government policy plan outlining a vision for AI in healthcare published in 2019 (Meld. St. 7 (2019–2020)). The second initiative is an open nationwide network of professionals aiming to enable AI in healthcare. The initiatives were followed for five months and two years, respectively, using an ethnographic approach and data collection methods including meeting observations and interviews. Our findings indicate that the two initiatives encountered distinct challenges stemming from their differing collective approaches. The study contributes to the understanding of how the collective dimension of AI can play out, and our findings have implications for future initiatives that aim to collectively produce knowledge to better comprehend the challenges associated with emerging technologies and societal change.

The paper is structured as follows: It starts by introducing relevant literature on hybrid knowledge production and collective efforts, followed by a description of the two cases studied. The methods and materials are then accounted for, whereafter the findings are presented and subsequently discussed. Lastly, a section on the final remarks is included.

Hybrid knowledge production and collective efforts

This paper focuses on collective efforts for introducing AI in healthcare. By collective efforts, we mean initiatives in which multiple diverse actors are organised and coordinated, share a certain degree of interest, and exercise collective agency. In collective action, actors coordinate their activities towards an outcome that would not be possible for any of them to achieve alone.

The dynamics of collective efforts have received much attention in research. Classic studies have, for instance, addressed the fundamental and complex tension between individual and collective interests. The seminal work of Olson (1965) on the logic of collective action questions the ability of groups to realise individuals' interests. This work points to the role of cooperation and coordination among the members of the collective, arguing that smaller groups of homogeneous actors are more likely to form collectives and achieve their goals (Olson, 1965). The underlying argument is that in large groups, actors find it more challenging to see their own benefits realised, and therefore they lose interest in contributing to the group. The concept of 'tragedy of the commons', for instance, indicates a dynamic in which individuals are driven by their own benefits in using common resources, such as natural resources, and do not consider the cumulative impact of their actions (Hardin, 1968). Thus, individuals' interests are put above the group's shared interests, resulting in unfavourable outcomes. Research has proposed ways to address this problem. Ostrom studied collective action and the role of institutions in the governance of common goods (Ostrom, 1990). Her research shows that self-organising collectives can govern common resources without centralised regulations and strong institutions and overcome the "tragedy". Thus, she argues for the importance of social interaction to address social dilemmas and shows that heterogeneous groups can achieve their goals by focusing on long-term solutions (Ostrom, 2005).

Other research has investigated how knowledge is produced in collective efforts. According to Gibbons et al. (1994), when a heterogeneous group of actors is involved, knowledge is produced through negotiations and interactions in which the actors' heterogeneity is a constitutive element. Negotiations allow for reflexivity and higher transparency as actors question each other's perspectives, underlying values, and visions (Gibbons et al., 1994). According to Callon, Lascoumes, and Barthe (2011), collectives can be viewed as hybrid forums that blend various forms of interaction among heterogeneous actors, including laypeople and experts, acts and values, and humans and non-humans, representing diverse interests and communities. They are also hybrid because "the questions and problems taken up are addressed at different levels in a variety of domains" (Callon et al., 2011, p. 18). In doing so, hybrid forums facilitate knowledge sharing and the production of hybrid knowledge (Gibbons et al., 1994) which is considered necessary for understanding and beginning to address the uncertainties typically associated with technological advancements (Callon et al., 2011).

Collective efforts to produce hybrid knowledge are fundamentally shaped by, but also potentially constrained by, the very constellations of actors that

constitute them. These actor constellations are central in relational and practice-based theories within Science and Technology Studies (STS), which hold that what technologies "are" depends on how they are enacted by various actors in concrete practices. For instance, Annemarie Mol (2002) shows that there are not only multiple perspectives on a given phenomenon or object within certain group constellations. Most importantly, there is ontological multiplicity: Actors enact technologies differently in practice based on their realities. In addition, technologies are envisioned and made to work according to the resources available in a specific contextual practice, where different under-standings of a working technology emerge. Thus, what is considered technology success or failure varies (de Laet & Mol, 2000). Furthermore, in this view, as humans and machines are not fixed entities, and as what they are and their roles are continually produced and negotiated in practice, this ongoing interaction also produces and changes the practices (Suchman, 2007).

Additionally, the outcome of collective efforts is shaped by their orchestrators (Reypens et al., 2021). Reypens et al. (2021, p. 62) conceptualise three modes of orchestration: consensus-based, dominating and hybrid (the latter being a combination of the former two). They argue that while consensus-based orchestration works in small collectives, it can be challenging for the orchestrators to discern how relationship-building and knowledge production unfold when the number of stakeholders involved is high. Larger collectives can become opaque, making good communication and proper collective work harder. In such a case, a dominating orchestration might be a better option (Reypens et al., 2021). However, if the network consists of stakeholders with a wide range of expertise, dominating orchestrators will not have the same level or breadth of expertise and will face difficulties in maintaining legitimacy. Thus, Reypens et al. suggest that hybrid orchestration may be a solution for managing both many stakeholders and their diversity to achieve inclusive collective efforts and outcomes (2021, p. 62). By hybrid orchestration, Reypens et al. refer to orchestrators switching between a dominating mode and a consensus-based mode during different phases. For instance, during phases of connecting stakeholders in a network and initiating the first meetings, a dominating orchestration could be beneficial. Differently, when aiming to facilitate bottom-up collaboration and relationship-building, a consensus-based orchestration could be more appropriate. Moreover, when effective outcomes and concrete results are in focus, a dominating orchestration mode could again be more successful (Reypens et al., 2021, pp. 69, 76).

Based on this conceptual ground, we analyse two initiatives aimed at contributing to the introduction of AI in the Norwegian public healthcare services.

In doing so, the paper aims to advance our understanding of AI introductions as collective, negotiated and situated processes.

Case description

This paper is based on a study of two key collective initiatives in the early phases of introducing AI into Norwegian public healthcare services, prior to the implementation of notable AI deployments in real-world clinical settings.

The national inquiry process (case 1)

The first initiative, *the national inquiry process*, was carried out in 2021 and led by the Norwegian Directorate of Health. It aimed to gather insights from multiple stakeholders on how to enable AI in healthcare.

In November 2019, the first Norwegian policy plan addressing AI in public healthcare services was published (the Norwegian National Health and Hospital Plan (NHSP) 2020-2023). It contained the first formally articulated governmental vision of a future with AI in the healthcare services:

> *"Artificial intelligence makes it possible to utilise national medical databases to provide faster and more accurate diagnostics, better treatment and a more effective use of resources. The regulations make it possible to use medical data to bring maximum benefit to the community, the directorates provide guidance on legal restrictions, and ethical problems associated with the use of artificial intelligence are handled in cooperation with other European countries. The health and care service has established a culture of innovation and knowledge-sharing, and works closely with businesses to develop the tools needed by the service and patients"* (Meld. St. 7 (2019–2020), p. 26).

The policy plan also stated that relevant government agencies should coordinate efforts to enable AI in healthcare (Meld. St. 7 (2019–2020), p. 98). Consequently, a national cross-public-agency coordination project was established. The agencies involved included the Directorate of eHealth, the Norwegian Medicines Agency, the four Norwegian regional health authorities and the Directorate of Health, which was set to manage the project. As one of its first activities, the project team initiated an inquiry process (case 1) to identify challenges and recommend actions to ensure the safe and appropriate implementation and use of AI in the healthcare services (Helsedirektoratet et al., 2021, p. 2).

The inquiry process lasted for five months (January-May 2021) and involved approximately 100 stakeholders with diverse backgrounds and expertise, including AI researchers, vendors, project managers, physicians, hospital managers, procurement officers and patient organisations. By focusing on radiology – a medical area that was (and still is) at the forefront of AI development and implementation – the project team expected to generate knowledge and experience that would be relevant and transferable to other medical areas. Three types of meetings were carried out during the inquiry process: insight meetings, workshops and feedback meetings. As the process took place during the Covid-19 pandemic, the meetings were all held digitally. The number of participants at each meeting typically ranged from 10 to 25, including approximately three to four members of the project team (details about the case are also reported in Kannelønning, 2023).

The nationwide network (case 2)

The second initiative, *the nationwide network*, was established in 2020 and led by a secretariat. It aimed to bridge what they called the 'implementation gap' in clinical AI – the gap between existing technologies and their limited implementation – by facilitating knowledge and experience sharing among its members and influencing relevant decision-makers.

The network was initiated by a group of eight individuals with shared interests in AI in healthcare, including a private company researcher, a public agency department manager, two research centre managers, and a manager and a senior adviser from two different regional health authorities. They formed the secretariat that organised the network and facilitated its activities in the years that followed. According to a member of the secretariat, the network was founded on the belief that enabling AI in healthcare requires collaboration among people with diverse expertise and worldviews, and that introducing AI entails addressing technical, organisational, legal, ethical, and financial issues. The network aimed to accelerate the introduction of AI by bringing together professionals with relevant expertise to share knowledge and experience. Furthermore, the network aimed to influence relevant decision-makers based on the knowledge it produced. This informal 'bottom-up' collective effort and its goal of affecting the agenda of crucial decision-makers were emphasised as fundamental and explained by an informant as follows:

> *"It's quite simple: Keeping the focus on what the people with knowledge of AI in healthcare perceive as difficult or useful, what the solutions to the problems are, and*

so on, will result in a more professional-oriented agenda than a political one. If we [the network] *find different potential* [in AI], *which the top management either doesn't see, doesn't include in strategies, or doesn't make decisions about, then you have to do what you normally do: Try to let it [the knowledge] trickle upwards in the system, talk to your bosses and so on"* (a secretariat member, our translation).

The main activities of the network were quarterly digital meetings and three or four in-person seminars per year. The first official meeting took place in early 2021 and had 20 participants from across the country. With a membership policy stating that it was open to anyone interested, the network steadily grew over two years to include approximately 200 professionals from different fields, organisations and sectors with an interest in AI in healthcare. The largest group of members was researchers from the hard sciences (e.g., informatics and medical physics) from universities, university hospitals, or research centres. The second-largest group consisted of hospital employees (e.g., from IT, research, or procurement departments), followed by bureaucrats with backgrounds in medicine and/or technology who worked on digitalisation and innovation in healthcare. The remaining members were representatives from software companies, interest organisations and municipalities. Despite these professional roles, the membership was emphasised as personal, meaning members were expected to express their personal opinions rather than represent the official standpoints of their affiliated organisation. Additionally, as of February 2023, the network had 32 listed observers. This included the first author of this paper[1], project managers, and senior advisers affiliated with organisations such as the Norwegian Directorate of Health, the Norwegian Board of Health Supervision and the Norwegian Board of Technology (details about the case are also reported in Kannelønning, 2024a)

Methodology, data collection, and analysis

The study followed a longitudinal qualitative case study design. The first author collected data through observation of digital meetings, document analysis and online interviews as fieldwork was conducted during the pandemic. More

1. After emailing a member of the secretariat, the first author obtained permission to observe the network for research purposes. She is a social scientist affiliated with a Norwegian university and does not work in the healthcare sector. The research project and data management practice, including anonymisation procedures and data storage, was approved by SIKT – the Norwegian Agency for Shared Services in Education and Research. The interview informants were informed about the procedures and signed a consent form.

specifically, knowledge of the inquiry process (case 1) was gained through non-participant observations of eight stakeholder meetings (of approx. two hours each), content analysis of five reports produced by the inquiry process project team, and three meetings with the project manager. The knowledge of the nationwide network (case 2), its organisation, meetings, and activities were similarly gained through non-participant meeting observations of ten network meetings (of approx. three hours) during a two-year period (2021-2022) and analysis of documents like PowerPoint presentations from the network meetings and the network's website. Six of the secretariat members were also interviewed (see table 1 for details on the data collection, methods, and materials). While these interviews provided knowledge about the network as a collective effort from the organisers' perspective, the meeting observations of both initiatives provided insights into how the collective effort unfolded among the stakeholders involved.

***Table 1**: Data collection: meetings, documents, interviews*

	Case 1	**Case 2**	**Total**
Number of meetings and approx. duration	8 meetings 17 h 30 m	10 meetings (incl. conferences) 57 h	18 meetings 84 h 30 m
Documents analysed	5 documents 152 p.	-	5 documents 152 p.
Interviews and approx. duration	-	6 interviews 6 h	6 interviews 6 h
Meetings with project manager	3 meetings approx. 2 h		3 meetings approx. 2 h

The data were analysed using an abductive approach, moving back and forth between data and theoretical concepts (Timmermans & Tavory, 2012). We started the process by immersing ourselves in the data, reading the material line by line and identifying and highlighting content relevant to the theme of collective efforts. As we extracted data from fieldnotes, interview transcripts, and documents, we began writing empirical narratives while engaging with the core concepts of hybrid knowledge, hybrid forums, and orchestrator modes. We iteratively revisited the empirical narratives, guided by the concepts, and re-read the relevant literature to interpret the concepts guided by our data. This process

helped us identify additional details in the material and analytical points that were not apparent during the initial reading phase. For instance, guided by the literature on orchestration modes, we became aware of the organisers' role in facilitating knowledge production within collective efforts in different ways and across phases. Thus, having initially focused on the characteristics of the collective effort, including the stakeholders involved and the activities carried out, we began paying attention to the role of the orchestrators as well. Finally, through this iterative analytical process, we identified a third category of findings relevant to the research question, namely, how the combination of the characteristics of the collective effort and the orchestrators' role affected the outcome of the collective work. In short, the process of analysis proceeded from initial codes such as 'aim of initiative', 'stakeholders', 'activities', 'topics discussed', and 'outcome' to a broader categorisation of the findings into three themes: (1) collective activities and knowledge production, (2) the role of the initiators, and (3) the process' outcomes.

Findings

In the following section, we present our findings, structured according to the three themes that emerged during the analysis: collective work for hybrid knowledge production, the role of the orchestrators, and the outcome of collective efforts.

Collective work for hybrid knowledge production

The national inquiry process and the nationwide network brought together various stakeholders interested in promoting and facilitating the introduction of AI in Norwegian healthcare services. Both initiatives can be viewed as collective efforts, but with different modes of communication and interaction among participants.

In the case of the national inquiry process (case 1), the collective work, including knowledge sharing and production, among the involved stakeholders started with a series of six insight meetings, one for each group of stakeholders: 'Managers/project managers', 'Clinical staff', 'Procurers', 'User representatives and patient organisations', and 'Industry and research' (the latter group met twice). These meetings began with a presentation by the project team members from the Directorate of Health. They presented the rationale behind the process in relation to the policy plan (the NHSP), the coordination project, and finally, the course and aim of the inquiry process, highlighting the need for feedback from relevant experts (the participating stakeholders) on their needs and perceived

challenges regarding the introduction of AI in healthcare. After the presentations, the participants would then voice their concerns as the meetings proceeded into phases of discussion. For instance, in the meeting with the 'industry and research' stakeholders, when asked to point out what the premises to start using AI were, many concerns were listed. For instance, the following were mentioned:

> *"Knowledge and trust must be built among healthcare professionals* – [about what AI can do and cannot do] *knowledge will create trust. We can't just introduce a product without proving an effect.* […] *we must have clear evidence that the solutions work – this is partly lacking in the products we see today. Relevance for our patients: Evidence is not necessarily the same as the technology being relevant because the solution can be based on other data than our own"* (observation notes, industry and research meeting).

This excerpt illustrates the openness of the initial round of inputs, spanning themes such as trust, AI effect, and clinical relevance.

Similarly, during the meetings with the procurement group, the participants' input was open and varied, and they voiced concerns about various aspects of procuring AI solutions. For instance, they discussed what is particularly important to ensure good clinical practice when using AI, the perceived challenges for procurers, and how actors at the national level can contribute to addressing these issues. They also discussed how healthcare services could facilitate the use of AI, and whether the procurers needed guidance on procuring AI. As such, the participants shared their concerns, experiences, and understandings broadly. For instance, one of the participants expressed that:

> *"If you ask what you can help me with: We use little AI today* [in Norway], *but we have started a thinking process: How should we take it into use?* [...] *What can an AI algorithm do for us? Should we put together such an algorithm that satisfies needs – the AI lab* [developers] *know what they can offer, the users do not necessarily know. Using helicopters as an example: We cannot fly helicopters from day one. We need to know something about turbulence, mechanics, etc."* (Observation notes, procurement meeting).

Overall, these meetings were guided by a specific set of questions prepared by the project coordinators and opened up a range of themes in the form of concerns, hopes, and expectations. The insight meetings produced written summaries that included the stakeholders' needs and challenges related to introducing AI in healthcare. During the meetings, participants shared knowledge not only with the coordinators but also among themselves, contributing collectively to the production of hybrid knowledge.

The insight meetings were followed by three workshops involving mixed stakeholder groups. The workshops aimed to discuss the findings from the insight meetings and generate ideas for further initiatives and possible solutions to enable AI in clinical practices. The topics discussed included access to sufficiently large high-quality data sets for research and product development, enhanced AI competencies among healthcare personnel, and guidance within current regulatory frameworks. They also discussed how to enable more collaboration between researchers, product developers, and clinicians, as well as ethical issues and healthcare personnel's information needs. Again, the outcome of these workshops was written summaries of ideas for solutions to the issues discussed.

Finally, various stakeholders were invited to two feedback meetings: one open to the public and announced on the project's website, and the other for invited people from radiology environments. The topics discussed aligned with those from the workshops. However, the aim was now to gather feedback on the opinions and suggested solutions raised during the workshops. As the process ended, findings from all meetings were processed into a report for the Ministry of Health and Care Services. The report included a list of recommended activities to be carried out in the following year(s), potentially by the public agencies involved in the project team.

In case 2, the nationwide network enabled collective knowledge production during its meetings and seminars. These events included presentations and/or panel discussions with time set aside for audience questions at the end. The presenters were typically invited experts from the research or hospital sector, the industry, the Ministry of Health and Care Services, various health authorities, and other relevant directorates or authorities (e.g., the data protection authority). Thus, unlike the inquiry process, the network meetings consisted mainly of presentations and discussions among specially invited participants rather than activities facilitating interaction and discussion among its members. It was through these meetings and presentations that the network attempted to achieve the main goal of enabling knowledge sharing between otherwise separate stakeholders, the importance of which was emphasized by one of the informants as follows:

> *"It would be very wrong if people like me, pure technologists or statisticians or something like that, were to sit around working with artificial intelligence in the health service. It's no use. Then we'd get nowhere. So, having that dialogue across… and sharing expertise... is in a way a very basic prerequisite for us to achieve anything"* (Secretariat member, 4).

While the meeting agendas for the inquiry process were set by the organisers, the network's agendas were informed by a list of topics ranked by the members

through digital polls made available at the end of each meeting. The topics to vote on represented pressing issues that both the secretariat and the members perceived as important to address to enable AI in healthcare. This included topics such as 'Validation and adjustment of AI solutions to local conditions', 'Ethics and legislation regarding AI', 'Make or buy', 'Competence development within the sector', 'Policy and financial incentives', and 'Infrastructure and cyber security' (see Kannelønning, 2024a).

The fourth meeting in 2021 is an example of how the network's meetings were conducted and how various stakeholders were involved. This meeting, which lasted for four hours, focused on a topic voted on at the previous meeting: 'Introduction and testing of AI procurements – Practical experiences and the role of the authorities' (our translation). The meeting consisted of five presentations and a final open discussion. The presentations concerned 1) AI procurement based on the experiences from the first larger AI procurement process in Norwegian hospitals, 2) the final report of the national inquiry process (case 1) presented by the project manager, 3) how to proceed from AI development to AI products based on experiences from an AI development project, 4) the Norwegian Medical Products Agency (previous Norwegian Medicines Agency) on their role and tasks related to clinical testing of AI, and 5) the Norwegian Institute of Public Health's role and product portfolio in a new national system for introducing new methods. Most of these presentations were made available on the network's website.

The role of the orchestrators

The national inquiry process and the nationwide network were collective efforts orchestrated in different ways.

In the national inquiry process (case 1), the collective effort was orchestrated by the initiating project team led by the Directorate of Health. They structured the process into insight meetings, workshops, and feedback meetings, and set the agenda for each meeting, including the modality of interaction (e.g., within or across stakeholder groups). In their communication to the invited participants, the team emphasised their openness to feedback and commentaries as this excerpt from the observation notes describes from the observer's perspective:

> *"They* [the organisers] *keep emphasising that these* [findings from the meetings regarding perceived needs/suggestions for further activities, etc.] *are just suggestions.* [They are saying:] *you can give feedback if you think otherwise. We are very, very open to input. If you think we are doing something too badly in some way. Or in the wrong order. We want your voice to be heard"* (Observation notes).

By fostering an open feedback culture in meetings, they aimed to build consensus throughout the process. However, when the time came to produce the report, the organisers – representing specific authorities and public agencies – prioritised certain findings over others based on what they deemed most important.

The network (case 2), on the other hand, was only partly orchestrated by its secretariat. The secretariat members took the role of orchestrators by initiating the network and inviting colleagues and other stakeholders to participate. However, after this initial "recruitment", people interested in joining could sign up and become members through the network's website. Furthermore, the theme of the meetings was determined based on the members' opinions, after which the secretariat prepared detailed agendas and invited presenters. In this way, the secretariat took on a stable role as organisers on behalf of the members rather than a dominant one steering the agenda and curating a specific outcome.

Outcome of collective efforts

The activities of the inquiry process (case 1) were closely connected to the production and use of various documents. Apart from being initiated by a document (the NHSP), documents were produced before the stakeholder involvement began to inform stakeholders about the upcoming process, its background and aim, the organisation and course of activities. Documents were also used to communicate insights and feedback from the meetings back to the participants and other relevant stakeholders throughout the process. These documents, or meeting summaries, were typically shared via email and on the project's website to give stakeholders the opportunity to provide feedback or comments if desired. The main findings were also used as points of departure for discussions in subsequent meetings. Thus, these documents served to inform, engage, and mobilise people. For instance, the feedback meetings were organised to get feedback on the summaries of findings from both the insight meetings and the workshops. An early version of the final document was also published on the website, allowing interested stakeholders to read and comment on it before finalisation.

The recommendations and suggestions for further activities prioritised in the final report concerned areas such as developing regulatory guidelines for AI procurements, offering courses on digital competence and basic AI understanding, stimulating to more interdisciplinary collaboration across the sector, improving the technical infrastructure (registries and databases) for easier data access/sharing, and establishing activities addressing ethical issues (Helsedirektoratet et al. 2021, 48–57). After its publication, the final report influenced further which

activities the agencies represented in the project team prioritised the following year(s). For instance, the report was sent to the Ministry of Health and Care Services, and through their yearly allocation letter to the Directorate of Health, they emphasised that the directorate was to continue focusing on adapting relevant national frameworks and prioritise supporting the healthcare services with guidance on legal issues related to AI:

> *"The Directorate of Health are to continue the work of adapting national framework conditions so that the health and care services can safely use Artificial Intelligence for patient treatment. In 2022, especially interdisciplinary guidance related to legal issues is to be prioritised"* (Helse- og omsorgsdepartementet, 2022, p. 36, our translation).

However, as the final report addressed only a subset of the topics discussed by the stakeholders involved in the inquiry process, the prioritisation in both the report and the allocation letter similarly favoured a specific trajectory for further work, leaving unexplored other relevant issues raised by the collective. Consequently, crucial issues concerning and even contesting the future of AI in healthcare, as depicted in the NHSP's vision, were not put on the agenda. This included worries about whether specific AI technologies are accurate enough to produce valuable outcomes for healthcare personnel, whether AI use in healthcare will cause a deskilling of physicians, whether the healthcare personnel have sufficient competencies to properly use AI, whether the personnel can come to rely too much on the AI result (automation bias), or whether (commercial) AI technologies are applicable for local Norwegian healthcare settings, including their specific patient populations.

The outcome of the network activities (case 2) was less evident or concrete, taking the form of knowledge sharing over time. However, this outcome was also affected by certain restraints. Despite gaining approximately 200 members, the network's heterogeneity seemed somewhat limited. The list of members showed that most were from the hard sciences or the bureaucracy, reflecting a particular (technological) view of AI, while members representing AI users or AI technologies in real-world settings were hardly represented. As the topics perceived as most important to discuss by the participants concerned AI implementation and use in clinical practice, rather than, for instance, AI development or technical infrastructure, the overrepresentation of members with technical expertise, situated far from clinical practices, made it challenging to share experiences and produce the relevant knowledge. This included knowledge on topics such as how healthcare providers should validate AI technologies before

implementation, whether the outcome of AI use is fair and safe, independent of the patient group, whether the healthcare professionals as users can trust the accuracy of the AI results, or whether the hospitals are allowed (legally) to adjust commercial medical AI technologies to local conditions. Thus, these dimensions, similar to the unaddressed issues in case 1, remained unexplored uncertainties, though for slightly different reasons: Actors with the necessary experience and knowledge to enable the discussion were not fully represented in the network or in the sector more broadly. However, it was not only this skewed composition of members that inhibited inclusive knowledge-making. The focus and structure of the meetings and their digital form had an effect too. As the meetings mainly consisted of presentations by invited experts and panel discussions, the members became passive spectators except for the occasional opportunities to ask questions. At the same time, the digital meeting format created additional distance among the members and between them and the presenters. Digital meetings offer fewer opportunities for informal or spontaneous interactions, as, for instance, in-person coffee breaks might do. They also make it harder to interrupt or claim space to speak during the meetings (Lampa, Sonnentheil, Tökés, & Warner, 2021, p. 4). Other constraining factors for interaction in digital meetings include the ability to turn the camera on and off at will, or the ease with which participants can distract themselves by working on other tasks on their computers while seemingly listening in.

Although the network's knowledge production was less tangible (no summaries or reports were produced), a secondary outcome was achieved through the secretariat's involvement in various activities outside the network, acting on its behalf. This included participating in workshops organised by the coordination project in case 1 on AI adoption in healthcare, writing a letter for the Ministry of Health and Care Services emphasising the need to pay more attention to the process of enabling AI in healthcare, and hosting an event at Arendalsuka in 2022, Norway's largest annual political gathering. On this occasion, they highlighted the need for a national "roadmap" to address the challenges of introducing AI in healthcare services.

Discussion

Nordic countries are currently introducing AI into public healthcare services, and these initiatives reflect their tradition of policy-making and societal development characterised by consensus-building, dialogue, inclusion, and collective action

(Kuhnle & Alestalo, 2017; Lægreid, 2017). While research indicates that a collective dimension is crucial for ensuring sustainable and ethical outcomes of AI implementation in society (Floridi et al., 2018), there is still limited understanding of how collective efforts contribute to the introduction of AI. In this paper, we have analysed two experiences of collective efforts in the Norwegian healthcare sector while addressing the following research question: *How can collective efforts be organised and carried out to contribute to a consensus-based and inclusive introduction of AI in healthcare?*

In line with literature on collective efforts (e.g., Olson, 1965; Hardin, 1968), our findings suggest that processes of mobilising heterogeneous actors for collective agency are complex and can take different forms with different implications. The collective efforts described in the two cases of the present study both involve a large number of stakeholders with diverse expertise and practices. Their main activity is meetings, where knowledge is negotiated, shared, and generated as various topics are presented and discussed. However, the collective efforts of the two cases differed in types of initiators, orchestration modes, activities, engagement of the participants, duration, goals, and outcomes. In the following subsections, we discuss the implications of such differences in collective efforts in relation to hybrid forums and their orchestration, hybrid knowledge, and AI enactment.

Collective approaches and orchestration mode

Our findings suggest that the national inquiry process (case 1) is a collective effort formally established as a "top-down" initiative with an orchestration mode predominantly resembling the dominating mode (Reypens et al., 2021). The project was initiated by a policy plan, and the organisers set the agenda and selected which parts of the produced knowledge was included in the final report. Still, during the meetings with the stakeholders, we also observed a consensus-based mode at work. The meetings were forums for open discussion, with the main aim of facilitating the sharing of knowledge, expertise, and opinions among 100 participants representing a wide variety of practices and realities. However, the organisers' dominant role made visible the limits of the consensus-based mode, which was confined to meetings and had limited effect beyond these. In a way, the politics of the collective efforts make the consensus-based mode function as a legitimation for the higher-level political agendas of the organisers, thereby limiting the collective character of the effort.

In the second case, variations in orchestration modes were also observed, but these were less pronounced. Even though the orchestration of the network had characteristics like the dominating mode – the secretariat initiated the network, formulated the aim, and organised the activities – many of its characteristics also aligned with the consensus-oriented orchestration mode. The network was an informally organised "bottom-up" initiative open to anyone interested, with an agenda set by the participants through voting. Our findings suggest that the members' interests were considered and, to a certain extent, met, at least with respect to setting up the meeting agendas. The orchestrators also aimed to develop a common understanding of the voted topics by inviting presenters with relevant expertise. Thus, in this case, the dominating role mainly worked by facilitating activity coordination, while the consensus-based mode at work in the meetings had effects beyond the meetings, shaping the agendas for what would be further discussed. The two orchestrators' modes were more aligned in this case than in the first.

These findings are in line with Reypens et al. (2021), showing that collective efforts can be orchestrated according to various modalities. Our findings show that it is not only the co-existence of different modalities that matter, but also their relationship. This relationship shapes how the collective effort develops over time, the knowledge it produces, and what outcome it achieves.

Hybrid knowledge

Overall, our findings suggest that the collective approach in both cases contributed to the introduction of AI in healthcare by creating a meeting place and a knowledge-sharing opportunity across expertise and domains of knowledge. In both initiatives, hybrid knowledge was produced to varying degrees through guided discussions and presentations. This knowledge was further concretised in official and internal reports, presentation slides, meeting minutes, meeting invitations, and letters. However, the production of hybrid knowledge faced limitations in both cases.

In the first case, the inquiry process, the production of hybrid knowledge was constrained by participation and the role of the orchestrator. The number of stakeholders involved at each meeting was never especially high, and the expertise, at least at the initial group-based insight meetings, was not particularly diverse or hybrid. This aspect affected the outcome of the process as reflected in the final report. In addition, as the report was carefully curated, and crucial issues raised by the participants remained unaddressed and further unexplored, hybrid

knowledge was only partially produced. As the report was mainly based on enactments of AI introduction as technically and legally challenging, the follow-up work prioritised by the agencies of the project team was subsequently steered in those two directions – technical and legal.

In the second case, our findings suggest that despite the network's open, flexible, and inclusive approach, its ability to produce hybrid knowledge was challenged by the very topics members perceived as most crucial for enabling AI implementations. These topics were the most voted-for discussion points, remaining at the top of the list over the two years of observation. Again, this limit was due to an overrepresentation of technology-focused interests, while (potential) AI users, representing the practices AI was meant to become a part of, were scarce in the member list. Consequently, the knowledge produced was not particularly hybrid, which in turn influenced the type of knowledge shared as the outcome of the network's collective work. Other constraining factors for the network's hybrid knowledge production were the limited opportunities for actual interaction and knowledge sharing among the participants during the meetings, only partly occasioned by the meeting structure (mainly presentations) and their digital format.

Based on Olson's (1965) argument that the larger and more heterogeneous a group is, the harder it becomes for participants to see their interests served, such passive attendance in a large network might lead to a loss of interest and a further decline in contributions from actors who become merely spectators. Therefore, despite Ostrom's (2005) claim that larger self-organised collectives could overcome this "tragedy of the commons", the lack of interaction constitutes a limiting factor for hybrid knowledge production.

Hybrid forums and the politics of AI enactment

The discussions unfolding in the two cases and their outputs contributed to moving the introduction of AI in healthcare one step forward in certain directions, even if not directly materialising in actual implementations. In line with the purpose of hybrid forums as outlined by Gibbons et al. (1994) and Callon et al. (2011), the study's findings further suggest that the collective approaches contributed to a secondary outcome in terms of a maturing process for the participants and the orchestrators in their understanding of the complexities, opportunities, and challenges of introducing AI in healthcare and to the production of shared awareness within the collectives.

However, the findings also show that, in both cases, hybrid knowledge is not just about combining perspectives and visions into a shared understanding through negotiation, but also about enacting conflicting visions of AI in healthcare, where some are more dominant and thus more visible than others. In both cases of the present study, certain technology-focused futures with AI in healthcare were enacted, which could potentially clash with the realities of less-represented practices, particularly as AI is being implemented (Mol, 2002; Suchman, 2007).

Thus, overall, our findings show that in hybrid forums, where actors such as technologists, clinicians, hospital managers, and health authorities are gathered, different "AI technologies in healthcare" are enacted depending on who the actors are, what they voice, and what they consider as important priorities in relation to their knowledge. As such, the stakeholders within hybrid forums represent various, partially connected sets of realities, and as their enactments interfere with one another, the different practices develop. Based on this, decisions concerning what is crucial for introducing AI in healthcare, which kind of AI should be implemented, how, and for whom, are also political (Mol, 2002). As our findings show, the practices of the most represented and powerful actors within the hybrid forums will strongly influence how the future of AI in healthcare unfolds.

Implications for designing future collective initiatives

Building on our findings, we draw three implications for future initiatives that aim to bring together heterogeneous stakeholders to gain knowledge and a deeper understanding of the challenges associated with the introduction of complex emerging technologies, such as AI, into society.

First, we suggest that the work of including stakeholders as participants plays a critical role. The participants bring their expertise and knowledge to the collective discussions. These discussions and the knowledge produced as they unfold are, in turn, shaped by both the present and the absent expertise and knowledge. As in the case of the network of professionals, the discussion did not move forward on topics such as validation processes, ethical concerns, and the (mis)use of AI, in part due to limited hybridity in the expertise represented among the participants and other contributors. Based on this, we argue that striving to include actors representing multiple practices and to facilitate ways to explore issues related to missing knowledge should be prioritised when aiming for hybrid knowledge production. In this context, paying attention to further potentially constraining factors, such as less inclusive or less engaging meeting formats (digital or not), could also be crucial.

Second, our findings suggest that agenda-setting and the curation of the topics discussed and reported through collective efforts also play a critical role. Here, we recognise and confirm the critical role of orchestrators. For instance, in the case of the national inquiry process (case 1), the project team selected and guided both the discussion and the final reporting. This work was shaped by the national political agenda and a strong vision of the role of AI technologies in transforming healthcare services. Exploring, rather than overlooking, emerging uncertainties that challenge the dominant technological vision could further increase the likelihood of a succesful implementation process, as knowledge of potential future challenges can already be addressed or mitigated.

Finally, this paper contributes to research interested in understanding how advanced and complex technologies, such as AI, are introduced in healthcare services through collective efforts. Recent research has shown that heterogeneous constellations of actors are mobilised in different ways (Kannelønning, 2024b) and how controversies emerge through such collectivity, revealing crucial challenges and uncertainties in the introduction of AI (Kannelønning, 2023). Research has also recognised that many aspects and applications of AI will require some form of collective action, meaning that collectives should be involved in improving the outcomes of AI development to ensure that AI contributes to good outcomes for society (de Neufville & Baum, 2021; Floridi et al., 2018). We find this research to be especially relevant in the context of the Nordic countries and their experiences with collective participation and consensus- and dialogue-oriented policy traditions.

Final remarks

The results of the longitudinal case study presented in this paper suggest that in consensus-oriented countries like the Nordics, establishing collective efforts can be a way to address and improve understanding of pressing challenges associated with the introduction of emerging advanced technologies. Initiatives involving a broad set of stakeholders can also use such collective efforts to legitimise the need for certain solutions or future activities to be carried out by, for instance, the organisers themselves, regardless of the actual knowledge produced by the collective. However, when the technology in focus moves towards implementation, the overlooked or not yet fully explored challenges and uncertainties brought to the surface within the hybrid forums might strike back and require (costly) adjustments or a resetting of the course of the technology introduction. Thus, aiming for multiplicity both among the actors involved in the process and in the

accumulated outcome could be key to preventing collective efforts from becoming purely cosmetic.

Thus, we suggest that in future initiatives aimed at fostering collective efforts focused on consensus-building to better understand and cope with challenges in technology introductions, a hybrid orchestration mode can be strategically applied across various phases of the project. However, these initiatives should pay attention to how and when different orchestration modes are enabled to ensure that they do not undermine the aim and strength of collective approaches to sustainable futures with the emerging technology in focus. If collective efforts are not achieved or if their mission to produce hybrid knowledge somehow fails, the risk might be, as de Neufville and Baum argue, that "society may stumble blindly into outcomes that are collectively worse" (de Neufville & Baum, 2021, p. 9).

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