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"Samhandling": On the nuances of resilience through case study research in emergency response operations

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Abstract

Standard emergency-management procedures offer guidance on how organizations can improve their handling of all types of emergencies. However, such a generalization undermines uncertainties and oversimplifies the complexity of real work practices during an emergency response operation (ERO). The handling of the COVID-19 pandemic highlights how uncertainty and escalating consequences reinforce the need for resilience in EROs. To illustrate the key elements of our suggested approach and its practical implications, we discuss the issues in light of a case study related to a COVID-19 outbreak on a floating oil rig in the North Sea. The analysis reveals several instances of creative problem solving, and individual and collective efforts beyond the scope of the standard procedures. It also underlines how the shortcomings of resource allocation and over-planning might lead to inflexibility, thus harming EROs' efficiency. Our analysis highlights that the key to resilient EROs lies in robust coordination, the ability to improvise, transparency, and trusting communication between the actors involved. Greater focus on network building—proactively maintained through regular training and exercise activities—strengthens resilience in emergency-management systems. All these traits link to the Norwegian term "samhandling," a notion which is here proposed to summarize and connect these resilience capacities.

KEYWORDS

coordination, emergency management, emergent learning, resilience engineering, uncertainty

1 | INTRODUCTION

Emergencies have the potential to devastate standard operational routines being propagated over multiple interconnected systems. Dealing with emergencies requires immediate responses. The various response organizations need to act urgently and initiate a range of activities in collaboration with the affected community. Recent academic research argues how modern sociotechnical systems' increasing complexity and interconnectivity add to the plethora of uncertainties when facing ill-structured problems such as emergencies (Adekola & Clelland, 2020; Boin & McConnell, 2007; Steen & Patriarca, & Di Gravio, 2021). In such a high-velocity environment (Bourgeois & Eisenhardt, 1988; Mitchell et al., 2011), the extension and impacts of an emergency depend on the capacity of the emergency management (EM) system in place, and how successful it is protecting its vulnerability. In particular, the EM system must be

prepared for, and able to respond to expected and unexpected events. It must also have the ability to recover from the impacts of an emergency—in other words, the EM system must be resilient.

To this end, several empirical studies have explored how tools and concepts rooted in resilience engineering (RE) provide the necessary grounds for effectively shaping the nature of EM (Son et al., 2020). RE promotes holistic approaches to dealing with emergency response operations (EROs) dynamics, which acknowledge the critical role of interdependencies and tight coupling between different elements of any EM system (Boin & Van Eeten, 2013; Steen & Ferreira, 2020). Managing individuals, teams, and conflicts within the system's goals, recognizing changes in a dynamic working environment, and dealing with uncertainties are issues beyond the boundaries of standard EM procedures. In particular, among the most critical aspects that contribute to resilience in an ERO are distributed situational awareness (SA) (Salmon et al., 2009), interaction, and effective coordination (Christensen & Lægreid, 2019; Klein et al., 2005; Steen & Rønningsbakk, 2021; Wolbers et al., 2018), adaption and improvisation (Woods & Branlat, 2011), and reliable communication (Rivera & Kapucu, 2015; Shittu et al., 2018) between the stakeholders involved.

Nevertheless, from an operational perspective, resilience in any safety-critical operation is only recognized and affirmed during actual scenarios (Mendonça, 2008), that is, looking at what the system *does*, rather than what the system has (Hollnagel, 2018). Consequently, in this study, we take a closer look at EROs related to a COVID-19 outbreak in offshore operations. Adopting a case study research approach, we analyze the course of actions on a floating oil rig in the North Sea and explore resilience capacity as embedded in the situation itself. The analysis follows the perspective of the Norwegian emergency response organization involved at the tactical level. Through document and content analysis and semistructured interviews, this study aims to provide a structured learning opportunity from a complex dynamic environment. We aim to delineate the operational traits an effective EM system should have for different emergency response functions. We discuss how they might suport decision-making in future emergencies, emphasizing the role of coordination in each EM stage. That's where the Norwegian term "samhandling" becomes relevant, as frequently reported by informants. Samhandling refers to a set of resilience capacities that in this paper are examined unveiled, and explored, and shed light on the crucial role of interactions, joint actions, mutual trust, and cooperation between actors (Steiro & Torgersen, 2013, 2018; Torgersen & Steiro, 2018).

The remainder of the paper is organized as follows. Section 2 briefly outlines prior research on EM systems with particular reference to the domain of this paper's investigation, that is, offshore installations. Section 3 covers the case study research methodology used to delineate the resilience traits of an effective EM system. Section 4 discusses the results of the study and their interpretation for EROs. Finally, Section 5 summarizes the outcomes of the study and outlines recommendations for further research.

2 | RESILIENCE FOR EM

Operating companies and their partners in Norwegian petroleum activities must prove they are prepared for handling incidents by having systematic EM systems in place: they must have well-defined plans, instructions, and measures to avert or limit harmful consequences, as required by the Petroleum Act §20 (Petroleum Safety Authority [PSA], 2021). These measures span three operating dimensions: prevention and planning for adverse events, notification, mobilization and handling demobilization, and completing a normalization phase after the incident (Lunde, 2019). While standard emergency procedures "provide guidance to organizations to improve the handling of all types of incidents, […] and crises" (International Organization for Standardization, 2018), they undercommunicate the inherent uncertainty and complexity of real work practices during an emergency incident. Situations involving a high degree of uncertainty, time pressure, and escalating consequences reinforce the need for resilience in emergency preparedness work. Resilience can thus be interpreted as the capability of an emergency-management systems (EMS) to be prepared for, cope with, and recover from any disorder (withstanding or tolerating surprises to deal with unexpected events and complexities) in an emerging situation. Furthermore, Normandin and Therrien (2016) point to the coexistence of stability and adaptability as two aspects of resilience system. Accordingly, a system dealing with an emergency must also exploit opportunities to improve its functionality through proactive learning. In contrast to robustness, where potential threats are known in advance, and the absorbing system needs to be prepared to face these threats, *resilience* refers to a strategy against unknown or highly uncertain events (Steen & Aven, 2011). Vital in this respect is the system's ability to anticipate, respond to, synchronize, and learn proactively (Provan et al., 2020):

- Anticipation is about creating foresight on future operating conditions and revising risk models. Anticipating future scenarios allows an organization to monitor the conditions and threats associated with these scenarios and build resources and capacities to respond.
- Readiness to respond concentrates on maintaining deployable reserve resources to be available to keep pace with demand. Deployment entails that employees have sufficient autonomy to make decisions about their work in real time. This requires employees to have the psychological safety to apply their judgment without fear of repercussion.
- Synchronization focuses on the coordinated information flows and actions across the networked system. This synchronization provides a constant opportunity to understand the changing shape of the system, the extent to which operations remain within safe operating boundaries.
- Proactive learning is about seeking context and understanding what is needed to support safe adaptation and success on the front line. It emphasizes a search for brittleness, gaps in understanding trade-offs in the underlying elements, and

reprioritisations. Organizations should embrace and monitor the adaptive cycles of work to create proactive learning.

A resilient system remains viable by anticipating and adapting to changes in its operating environment. The extent of the adaptation depends on the quality of the intelligence and the availability of appropriate resources.

2.1 | The conceptual structure of EM systems

EM is advocated as the discipline dealing with risk and risk-avoidance strategies (Haddow et al., 2010; p. 2). Its practical implementation passes through three interwoven phases: (i) Preparation, (ii) ERO, and (iii) Restoration (recovery and mitigation). These phases are operated in three tiers—the operational (first line), tactical (second line), and strategic level (third line). Whereas the first-line response activities are performed by those closest to the scene (e.g., on a platform installation or rig), and the third line acts as the organization's strategic unit, the second-line emergency response provides operational and tactical support to both the first- and third-line. International and national standards (e.g., ISO 22320, 2018), handbooks, organizational procedures, and prescriptive work largely prescribe these activities. Sommer et al. (2017) distinguish between two categories of activities in EM in practices that may ensure the system's resilience: the command structure and exercise of command. The command structure outlines underlying roles and responsibilities, decision domain, a span of control, and levels of command (e.g., strategic, operational, and tactical). Exercise of command includes decision-making and coordination activities.

Several factors affect these activities: the management structure (centralized vs. decentralized) and the mutual relationships between the actors involved (Christensen & Lægreid, 2019). Son et al. (2020) identify five main challenges in coordination activities: assigning the equivalent role of EM function in the organizations involved; coordinating loop asynchrony when changes occur at a different tempo across actors; supporting asymmetry, caused by the level of gained support across various organizations; familiarity and expectancy/span> in resource acquisition and allocation; and lack of trust among the actors involved. A common feature emerging from these analyses is thus referred to as coordination and collaboration in EM.

2.2 | Strategies for resilient coordination

In the past decade, resilience as a concept has been defined and applied in various scientific fields, including safety management, organizational management, psychology, ecology, and so forth (Hosseini et al., 2016). D. D. Woods (2015) sketches resilience concepts in four categories: (1) as a rebound from trauma; (2) as a synonym for robustness; (3) as the opposite of brittleness, that is, as graceful extensibility when surprise challenges boundaries, and (4) as network architectures that can sustain the ability to adapt to future surprises as conditions evolve. While this typology is useful to categorize generic resilience concepts, for EM systems it remains relevant to confront the implementation of strategies and adapts management responses in several dimensions, as delineated by Margerum (2011) in the following "six Cs":

- *Communication* involves one-way or two-way sharing of information. It is the key aspect of any interactive process, and effective two-way communication is essential for collaboration.
- *Consultation* is interpreted as a formal communication engagement with a community of people that governmental organizations or NGOs may conduct. In collaboration, a consultation can be important for stakeholder groups that need to obtain feedback from the broader public.
- *Conflict resolution* describes a series of formal or informal processes to resolve differences between parties. While it is an integral part of collaboration, it begins with a defined problem. The collaborative processes founded on a shared vision begin with the stakeholders defining common goals and then resolving differences related to achieving those goals.
- *Consensus building* refers to the series of steps through which individuals come together, share information, and reach mutual agreement about the issues at hand. It could be considered as the planning phase of collaboration.
- *Cooperation* can be ascribed to a process whereby participants work independently toward a common goal. It is a focal implementation approach for a collaborative plan.
- *Coordination* is a process whereby participants work jointly toward a common end and function together in a manner that allows for mutual adaptation and adjustment. It is a fundamental implementation approach for a collaborative group.

Alongside these "six Cs," coordination can be further detailed as (i) a form of directive action (Boin & Bynander, 2015), or as (ii) the process of bringing together a set of differentiated activities into a unified arrangement (Wolbers et al., 2018), or even as (iii) the process of managing dependencies between activities (Malone & Crowston, 1994). While definitions (i) and (ii) address the key issues of working together and having a common goal, the third definition (iii) points to the dependencies between activities. These dependencies revolve around two dimensions, vertical and horizontal: the former concerns relations between actors, that is, different hierarchical levels of governance, ranging from the international to the local levels; the latter concerns actors who need to coordinate at the same level, while they don't have any hierarchical relationship with each other (Boin et al., 2017). For instance, in the face of resource limitations, when conflicting goals becomes inevitable. The way each stakeholder (actor) trades-off such goals is closely related to how they perceive their operational environment and the demands it imposes through vertical and horizontal relationships (Hollnagel, 2009). These trade-offs have been formalized recently through the WAx framework (Work-As-x), where diverse representation of work has been discussed depending on multiple roles (Patriarca et al., 2021).

As systems' scale grows larger and increases in interdependencies, the underspecified nature of operations is intensified. Alongside complexity, the issue of uncertainty causes a challenging atmosphere for coordination, which should be empowered by *robustness*. Klein et al. (2005) point to a set of concepts that have a crucial role in coordinating joint activity, and the authors categorize them in three aspects: (i) Criteria for collaborative efforts, including basic compact (an expectation that the parties have a continuously reinforced agreement and are committed to some degree of goal alignment) and interdependence of the parties' actions. (ii) Requirements for joint efforts, which consist of three aspects: inter predictability (being able to predict the other parties' actions with a reasonable degree of accuracy), common ground, and its degree of quality, as well as directability, defined as "deliberate attempts to modify the actions of the other partners as conditions and priorities change." (iii) Choreography of the joint effort concentrates on the phases of the activity and is "influenced by the opportunities the parties have to signal to each other and use coordination devices."

3 | METHODOLOGY

This study applies grounded theory as a qualitative case study research. This design choice is considered particularly suited to the purpose of our study for two reasons. First, we sought to trace elements such as uncertainty, time pressure, and escalating consequences and their effect on the ability of emergency managers at the sharp end in dealing with a challenging situation in a real-life setting (case study). Second, we aimed to use our findings as a basis for developing a framework to enhance resilience in EM. Our research strategy was based on the constitution of a set of essentials for grounded theory, stated by Birks and Mills (2015, p. 9). These essentials include initial data gathering and categorization, comparative data analysis, inductive and deductive logic, identifying a core category, and advanced theoretical integration.

3.1 | Case study

Sharan and Tisdell (2015, p. 39) refer to a case study as an "in-depth description and analysis of a bounded system." Here, the emergency-management system was bounded in its capacity to deal with a concrete event of the COVID-19 outbreak at West Phoenix (WP) floating drilling rig in the North Sea. We looked closer at the ERO conducted by the Operators' Association for Emergency Response organization (OFFB) in response to the outbreak. OFFB is a second-line ER organization for oil and gas operators on the Norwegian continental shelf.

Wednesday July 29, 2020, a helicopter takes off from Kristiansund Airport. On board, among others, is a British citizen who works in the Norwegian oil sector. The helicopter flies to the Seadrill oil rig, WP, in the Norwegian Sea, and operates on behalf of the oil company Neptune Energy. This passenger has not been quarantined or tested for the coronavirus and feels in good shape after spending 24 h in a hotel in Kristiansund. At this time, the United Kingdom was on the Norwegian COVID-19 green list, and no test and quarantine was needed. On the oil rig, the British man is in contact with both the day and night shifts. Soon he's starting to feel bad. The responsible doctor at the rig decides the man must go to hospital but does not suspect that the patient is infected with the COVID-19 virus. On Saturday August 1, at about 2.30 p.m., he is evacuated by helicopter to Molde Hospital, while 126 people are left on the rig. Since the doctor does not suspect coronavirus, a normal medical evacuation is conducted, during which those on the rig don't wear infection-control equipment. On Saturday at 8:00 p.m., the second-line emergency manager at the OFFB receives a call from the duty doctor on the WP. The crewmember tested positive for COVID-19 at Molde Hospital. The hospital is in control of the patient, but the duty doctor is concerned about the potential of the infection spreading among the crew, other staff, and passengers on the rig, employees at the Kristiansund hotel, and members of the helicopter tours. Later, 46 people were identified as close contacts and quarantined on the rig. In addition, 15 people without safety-critical duties on board were sent to the oil company's quarantine hotel onshore to relieve the crew. Over the following 12 days, extensive testing detected a further three new cases of infection on the rig. WP's first-line ER handled the situation at the tactical level, OFFB at the operational level, and Neptune Energy's third line at the strategic level. On August 5, Neptune Energy chose to transition from a traditional contingency organization to a project organization. The drilling rig was declared infection free on August 13. Kristiansund municipality's emergency response organization played a central role in handling the situation on land. Besides the Neptune Energy and Seadrill company, many other actors, both governmental, NGOs, and public and private health resources were involved in the emergency response process (see Figure 1).

Figure 1 illustrates stakeholders engaged in WP's ERO. Built on the power/interest grid is a matrix (Bryson et al., 2011; Raum, 2018) that delineates the critical roles they played during the ERO operation and its outcomes, and how they were of interest in WP's COVID-19 outbreak event. The High-power-High-interest stakeholders (top-right part) were the key decision makers who had the biggest impact on the response process. For instance, in terms of influence, the trained paramedic at the rig provided prehospital/emergency medical services, basing treatment on local observations. Moreover, in the "samhandling" zone, we see the role of other O&G operators having high interest and high influence in ERO. For instance, the largest Norwegian state-owned multinational energy company, Equinor, was responsible for helicopters used for medical evacuation. Besides, the state-owned company that operates most civil airports, Avinor, was responsible for air traffic management. A wide range of stakeholders—individuals, groups, and organizations—were indirectly or directly affected by the event and needed information followed up and coordinated. Numerous guidelines and other legislation provided by the PSA and other authorities apply to

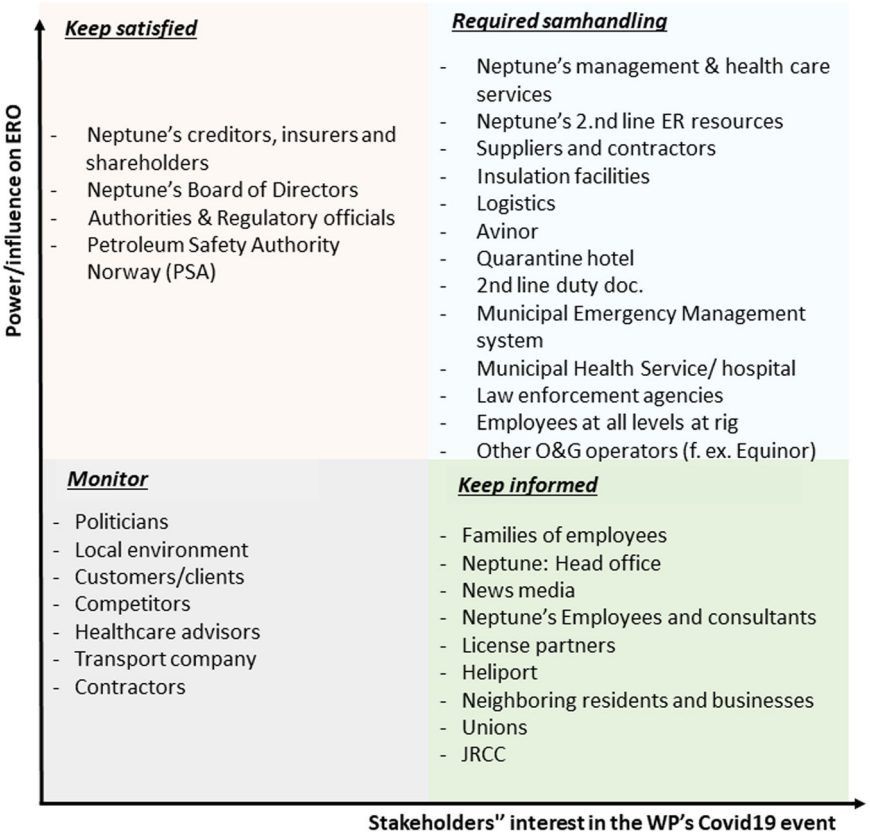

FIGURE 1 Stakeholders and involved organizations in WP's ERO. ERO, emergency response operation; WP, West Phoenix.

handling emergencies at offshore installations in Norway. While these regulations have to be respected and followed, the second-line emergency plan clearly defines the responsibility between the rig owner and the operating company, Neptune Energy. Regarding our case, Neptune Energy has overall responsibility for health, safety, and the environment (HSE) from the time the rig arrives at the 500 m zone, until it leaves the area again. Rig owner Seadrill, on the other hand, is responsible for coordinating all HSE activities on board the rig, and the platform manager has the highest responsibility for all personnel on board. As, the entire ERO was related to a health-related incident, the Joint Rescue Coordination Center, the Heliport and some other actors, as well as families of employees in the (Figure 1, Low power—high interest part), had interests in ERO, with rather limited influence in response process.

In Section 5, we highlight how discussion "samhandling" between key actors involved with ERO enhanced the response process.

3.2 | Data gathering

We employed a triangulated qualitative research paradigm to gather our data, including document and content analysis and semistructured interviews. Triangulating provides "a confluence of evidence that breeds credibility" (Eisner, 2017) by comparing and cross-checking the consistency of information derived within qualitative methods (Patton, 2002).

3.2.1 | Document and content analysis

We studied the second-line emergency response plan developed by OFFB. The document provides a basis for OFFB's second-line proactive management of emergencies in close cooperation with its member in the first- and third-line activities and other parties involved. Our focus was on understanding how EMS was initially designed, how the coordination process was organized, which roles and activities were defined, and how they interplayed with each other. We have also studied OFFB's ERO evaluation report on the incident. This report was prepared as an internal investigation about the ER operation at WP. Content analysis was applied to the data registered at CIM, a standard tool in an emergency-management system for information sharing relating to a crisis/emergency and unwanted event, media inquiries, and mobilization of resources.

3.2.2 | Semistructured interviews

We carried out four in-depth semistructured interviews (online, using MS Teams). Our respondents either actively participated in the ER operation as emergency managers or supported the ER operation from a strategic level. The 60 min interviews were conducted from October to December 2020. To match our participants with the objectives of this study, we used the "purposive" sampling approach, which involves participants who have adequate expertise in the

domain of interest (Campbell et al., 2020). The four participants were coded and referred to later in the discussion.

While attempting to link our topics of interest to the interviewee's context, we used a semistructured question style. Following Sommer and Njå's (2012) approach, our interviews focused on the three aspects of ERO, including content (coordination and collaboration issues), context (characteristics of the working environment regarding dynamism, complexity, and uncertainty), and commitment (personal involvement and interaction between the involved actors). For each of these topics, we asked the following questions:

- What was your task during the WP's COVID-19 ER process?
- Let us say that such an event happens again; what would you have repeated/done again? What would you have changed? What did you miss?
- Can you talk about critical feedback you received regarding your efforts in ER operation after the situation got back to normal, and how did you respond to it?

All interviews were recorded and transcribed. To increase reflection among the informants, they were sent both an information letter about the purpose of the study and interview questions in advance. To improve reliability and further verify the study's empirical findings and check the information, we returned the transcripts to our participants. This allowed them to make comments and give us feedback on their transcripts in a 1-week time window (as we planned). Nonetheless, we received few comments about some specific details provided in the interviews, yet they needed to be removed from the transcripts due to the confidentiality of information. In addition to participants' knowledge and experience, Bernard (2002, p. 2016-220) points to the importance of willingness to participate and the ability to communicate experiences and opinions reflectively as critical factors that affect the quality of an interview. In this regard, we provided an open and relaxing atmosphere for the interview process, recognizing the key role of the informants for the operational practices, as well as their instrumental contribution to the development of a scientific project. The confidentiality we guaranteed on personal information and our authentic interest in learning from—rather than auditing—their practices created an engaging attitude toward a positive dialog environment.

3.3 | Data analysis

Our data analysis relies on coding, which is a process of breaking down transcriptions into smaller pieces of data and assigning a label to them (V. Elliott, 2018). In particular, we read our transcriptions line by line and wrote reflection memos. In our reflections, we sought to identify patterns across our transcriptions and to make sense of them. Then, we highlighted phrases, repeated topics, and assigned initial codes to articulate their content, according to the study's conceptual framework. Codes included uncertainty, time pressure, improvisation, communication, tacit knowledge, resources, training activities, and so forth, and were iteratively refined and restricted. After establishing initial codes, we used terminology from the study's theoretical background as a template to categorize our codes in the next step (Table 1). A complete set of identified codes and themes is presented in Appendix A.

Note that our case study is related to the response phase of EMS. Therefore, it does not adequately cover the preparation and restoration phases. It is also important to emphasize that all interviews were conducted in the Norwegian language. When we

TABLE 1 Examples of excerpts from interviews, codes, and derived themes

Raw data: Excerpt from interviews	Codes: Specific segments of data	Themes: Emerging patterns
(1) Uncertain what requirements the municipality and hospital required **(2)** The good effect of joint preparedness activities and exercises **(3)** Mutual trust and good relations developed in advance had good effect on "samhandling" **(4)** We got a common situation picture through regular online meetings **(5)** Use of affirmative communications 36. Effective and credible communication requires an engaging and reliable attitude. Routines must be put in place, both on how to communicate internally and to the press in ambiguous situations, make a balance between reaching stakeholders' factual information while navigating uncertainty, is a challenging task 37. In ambiguous situations, make a balance between reaching stakeholders' information while navigating uncertainty is difficult task	(a) Coordination [3, 4, 6, 25, 10, 13, 16, 22, 24] (b) Informal planning [19, 4, 7, 13, 15, 18, 20, 28] (c) Planning [9, 14, 19, 27, 28] (r) Collaborative climate [2, 30, 31, 32, 34]	Sense-making [d, c, f, i] Info. gathering & Sharing [a, b, c, d, e, f, i, k, n, o] Improvisation [b, e, g, i, m, n] Joint decision-making & interaction [a, e, f, q, r]

translated our findings, we faced some challenges in reflecting on cultural issues, which impacted specific terms. The most critical one was the term "samhandling" mentioned in our interviews in many respects. This term relates to collaboration, cooperation, teamwork, and coordination. As expected, coordination and its wider interpretation is a central element of EM response.

Nevertheless, it is also related to human aspects in the coordination process, as participants' tacit knowledge, dedication, and various skills and experiences. The main objective in "samhandling" is the "complementary handling in action" during a multi-agency response operation (Torgersen & Sterio, 2018). As the discussion about the distinct cultural role in ERO is beyond the scope of the current study, we focus on the different aspects of the term "samhandling" in the next section to elicit resilience traits that are relevant for EMSs.

4 | RESULTS,' DISCUSSIONS AND IMPLICATIONS

This section discusses how the identified themes and lessons from WP's ERO might enhance our knowledge of fostering EMS resilience. To do so, we link our identified recurring patterns (themes) from empirical data with the study's conceptual framework. This framework consists of emergency-management stages, on the one hand, and the four resilience cornerstones on the other (Figure 2).

Our logic behind the framework (Figure 2) is that the four aspects of ER should continuously be applied in the entire EMS cycle. In terms of a timeline, this cycle is illustrated in Figure 3.

In Figure 3, the *(i)-th* and *(i + 1)-th* events represent the ERO duration related to two incident/adverse events, the past *(i)* and *(i + 1)* the future, which could have different lengths.

4.1 | Resilience in the preparatory stage of EMS

The preparation area of EMS involves proactive activities that enable an organization to anticipate future threats and prepare appropriate responses to deal with them. Learning from experiences, the *(i)-th event*, as well as day-to-day operations (Figure 3), enhance the EM system's capacity to be prepared for dealing with the next events *(i + 1)-th*.

The PSA in Norway specifies a set of elements as the main components of emergency preparedness for the O&G industry (PSA, 2021). They include, among others, a description of the purpose, scope, and responsibility, a description of action plans, a description of fields and facilities, regional and external resources, instructions for emergency preparedness personnel, and coordination procedures. As the complexity and uncertainty associated with EROs increase, EMS's capacity to anticipate and monitor future changes (cornerstones of the RE field) becomes increasingly vital. Thus, understanding how to foster these capacities within the system also becomes critical. Following Groenendaal and Helsloot (2020), resilience characteristics of the preparatory functions are embedded in their adaptability (ability to adjust or transform in response to changing conditions), cohesion (the existence of processes that preserve continuity), efficiency, and diversity.

Conventionally, contingency plans and buffer capacities, which in turn are grounded on "risk and vulnerability analysis," following the as-low-as-reasonably-possible principles (Tveiten et al., 2012) provide insights for developing scenarios as a part of EMS preparation. These scenarios are built on a sense of predictability of future events, and attempt to bring the future into the present, based on the available data and underlying assumptions. However, the difference between the conventional approach and the resilience-based approach is the way risk is defined, and the emphasis that is put on the "ability to make

Lessons learned from ERO

EMS- functions	Resilience capacity			
	Anticipation	Readiness to respond	Synchronization	Proactive learning
Preparation	-Sense-making -Org. culture: Supporting exchange foresight - Info. gathering & sharing	-Resourcefulness & diversity -Thoroughness of protocols & plans	-Network -Org. culture: collaborating climate	-Debriefing & reporting -Org/ adm. support to promote knowledge
ER operation	-Sense-making -Info. gathering & sharing	-Improvisation -Dynamics and communication in ERO -Flexibility & updating plans	-Group dynamic -Joint decision-making & interaction	-Flexibility & updating plans -Improvisation
Restoration	-Info. gathering & sharing -Org/ adm. support	-Resourcefulness & diversity	-Coordination structure -Network	-Training activities -Debriefing & reporting

FIGURE 2 Framework for fostering resilience in an EMS

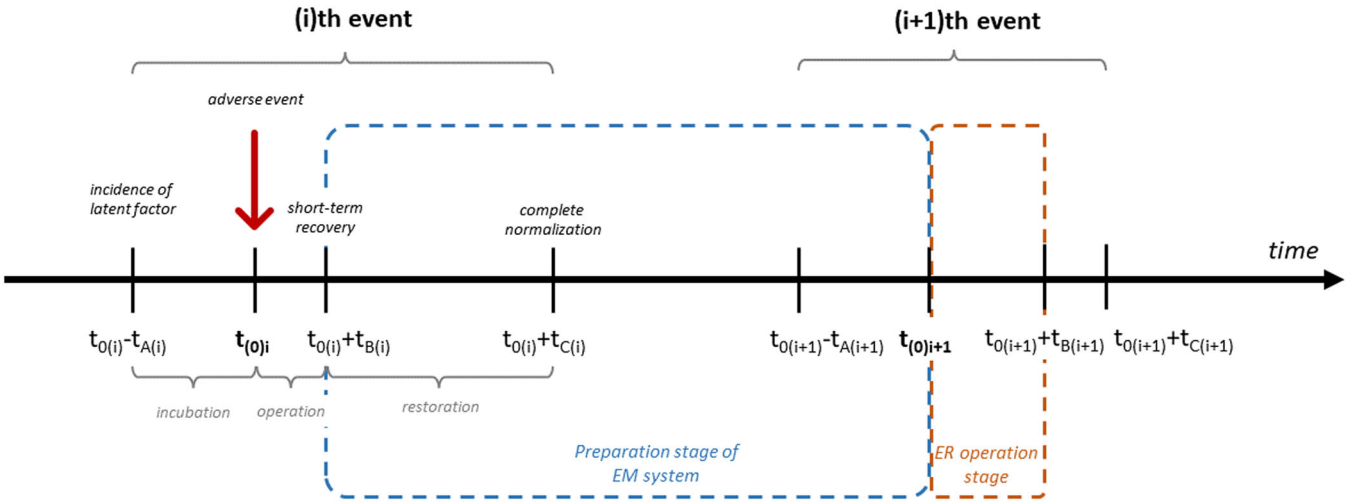

FIGURE 3 Timeline (cycle) in an emergency management system

sense" of ongoing changes and collaboratively to update the risk picture. To increase relevant knowledge, the risk- assessment part of the EMS must provide a broader risk picture (i.e., addressing uncertainty). Sense-making here is a process by which the actors involved with ERO, based on their experiences, grasp changes and reflect on what is going on in their circumstances. These reflections, in turn, serve as the prime impetus for taking action (Weick et al., 2005), and establishing redundancy.

The resilience-based approach also acknowledges possible future risks that result from performance variability. Insight from our interviews addresses several instances of such variability beyond the scope of the actors' emergency plans. Outbreaks of infectious diseases on oil rigs and platforms are among the OFFB's emergency plan scenarios. Yet, the COVID-19 outbreak was different in many respects. The high level of uncertainty was related to the nature of the disease and how to deal with it. In addition, guidelines, and orders from the authorities for handling COVID-19 changed in line with the acquisition of new knowledge. The dynamicity of the situation affected sense-making, decision-making, and communicating the decisions. The ERO had limited experience in handling the effects of COVID-19. In the weeks preceding the incidents surrounding the rig therhad been significant media pressure in Norway on how the shipping company Hurtigruten had handled a COVID-19 outbreak on board a cruise ship. In the first phase of the WP incident, there was a focus of lessons learned from the Hurtigruten ship, MS Roald Amundsen. The ERO investigated the potential effects of the situation and how to handle them. The operating company had the overall responsibility for the operation, the rig company was responsible for the operations on the rig, and the municipality was responsible for handling an infectious disease. The decisions made had to be coordinated between these involved parties. The professionally responsible physician of the operating company, the contingency physician in the rig company, and the infection-control doctor in the municipality, were also involved in decision-making related to the testing, isolation, and quarantine of personnel. Furthermore, all decisions had to be communicated to several stakeholders.

Our interviews pointed to the importance of learning from experience (Appendix A, code "n"). The second-line emergency response organization (OFFB) had previous experience in dealing with Norovirus offshore, but less training in handling situations that hadn't been described in the planning and standard procedures. The organization also had little experience in making project-based decisions at a pace required by the emergency. A difference between a resilience-based and conventional approach to ER preparation is the learning source. While incident investigations and evaluation reports are generally used as sources of (re-)learning, learning in proactive mode is obtained by discussing experiences, challenges, and successes. Moreover, we must consider any "imaginable" surprises in planning for training activities that may extend beyond known risk factors. Here, we are talking about a continuous cycle of information gathering and using those data to (re)plan, train, and equip. The existing network was also an invaluable resource to tackle the challenges in our case study (Appendix A, codes "a, c, f, i"). Previous table-top and full-scale exercises between the operating company, rig company, and the municipality, made the parties familiar with each other. Mutual trust and good relations that were developed in advance had a good effect on "samhandling." Networking here is about establishing strategic alliance partners to ensure access to required resources to support adaptive measures (Lengnick-Hall & Beck, 2009; p. 51).

As a process, networking takes time and requires an adaptive leadership style (Nelson & Squires, 2017) and willingness to change embedded in an organization's overall strategic planning. It requires a collaborative and deliberate effort for a functional and interactive learning process (Steiro & Torgersen, 2013; p. 335). Involving external actors who would not normally participate in ERO meetings is an example of establishing "strategic alliance partners" as such the municipality's doctor joined in several updating meetings and shared his views and expectations. According to our informants, the

response process was based entirely on interdisciplinary collaboration and cooperation, in which the management was broadly involved and supported the emergency response team's ad hoc decisions. The fact that the personnel involved knew each other beforehand through a joint training activity enhanced communication flow, and hence, the ad hoc planning process. Appendix A (excerpts from interviews no. 10, 18, 21, & 26) show how such collaboration enabled emergency managers to deal with a quite stressful situation at the risk of dire consequences.

4.2 | Resilience in the emergency response stage of EMS

At the operational level of the EM functions (Figure 2), the focus is on the immediate response to the situation at hand (Figure 2). Here, resilience is about the ability to withstand and rebound from unforeseen challenges. Responding to WP's COVID-19 outbreak was a demanding process. Resource allocation (in terms of technical, organizational, physical, emotional, and medical support) and synchronization shaped the effectiveness of the response process. Uncertain elements associated with these functions were related to the issue of accountability. Resources should be available in advance, so it was crucial to identify them (e.g., who was responsible for which tasks, what kind of material, equipment, and so forth) and how to access them. The response process in our case study took about 2 weeks. During this period, the operating company had to control the infection situation so that the drilling operation could be continued (business continuity). Our findings show that the COVID-19 patients got appropriate medical help, and further infection was stopped at the rig. Experience gained from our case study confirms that SA, available resources, and efficient information gathering and sharing made it possible for response organizations to implement response measures effectively (concerning the time aspect). SA included many elements. For instance, besides the medical aspect of the outbreak, transferring patients and other personnel by helicopter depended on the weather conditions. Thus, a part of SA was following weather forecasts with information on wind conditions, wave height, temperature, and visibility. In such a multifaceted ERO, the key to success lies in the ER's adaptability, that is, flexibility in managing resources to absorb changing circumstances.

Furthermore, a resilience approach was pursued in the operational planning, based on informal decision-making processes. According to our informants, the response process was based entirely on interdisciplinary collaboration and cooperation (see Figure 1), where the management was broadly involved and supported the emergency response team's ad hoc decisions. For example, sending COVID-19 test equipment and a nurse to the rig, or recruiting nurses who could provide medical assistance to infected patients during the flights. Another example is the establishment of an additional COVID-19 test center on shore to relieve the Kristiansund municipality. Note that the outbreak occurred at the beginning of August 2020, and by then there controlling the pandemic and accessing critical medical care, which required trained health-care professionals and personal protection equipment. The second-line emergency response team, OFFB, participated in the coordination of helicopter transport, personnel reception at the airport, bus transport, additional COVID-19 testing, accommodation, support, and care of the personnel sent ashore. Several of the actions carried out were not described in the planning system, and one depended on transparency and improvisation in the organization to find good solutions.

While formality in the decision-making process is about command-and-control systems, informality refers to the decisions taken by those who have the expertise to solve specific challenges, often at the sharp end. As the bridge-builder between accumulated knowledge and skills, and collective action, it enables continuous updating of the actual operating situation. The real-time exchange of information (Figure 2) enables response operators (Figure 1) to anticipate the consequences of changes quickly and helps reduce any remaining uncertainty to a manageable level (Nesheim, 2016). Informal decision making often involves improvisation, which requires cognitive capacities, competence, skills, and authority. In our case study, the findings pointed to several cases of informal and intuitive decisions, and problems were solved as they arose due to time pressure. (e.g., infection-control equipment from several sources sent out to the rig for COVID-19 testing on board). (Appendix A: excerpts from interviews no. 10, 11, 13, 20, 21, 25). During the incident, the management of the operating company had broad involvement in the operation and supported the ad hoc decisions.

The unique face of the COVID-19 situation posed many challenges. For instance, it required access to a COVID-19 test machine, medical test equipment, and additional nurses. At the same time, the infection-control chief in the municipality demanded that separate COVID-tests be taken and sent for analysis at the hospital. None of these health and logistics tasks had been described in the ER plan and the tasks were new to the second-line ER organization. To deal with the situation at hand several ad hoc solutions were found through an informal decision-making process to deal with the situation's intensity. Two examples of improvisation were using a completely new PCR test machine at the drilling rig, which the operator had set up at a separate test center. These unique adaptations streamlined the testing process and were implemented without burdening the public health capacity. Improvisation can also lead to undesirable and irreversible consequences. This can be understood from the "Catch-22" problem: the importance of trying out solutions beyond well-defined frameworks; simultaneously implementing solutions is often resource intensive. If the result is not ideal, it can lead to new challenges. Apropos our case, assembling a new and advanced COVID-19 test machine was a complicated task. It was conducted by the emergency response team, who assembled this machine at the drilling rig without any previous experience. Yet, they did the job with the help of telephonic guidance. This successful adaptation resulted from effective "samhandling," which in this case refers to interorganizational coordination and collaboration across roles and responsibilities. However, the result could have been

different, and could have resulted in many unprecedented challenges. This analysis refers to what Groenendaal and Helsloot (2016) mention as contextual issues, the possibility of overlooked signals, and the role of various decision-making biases that affect sharp-end operators' ability to assess the situation.

We try to draw your attention here to the strategic dynamics and formal versus informal decision-making pattern. A top-down command and control style (Boin et al., 2017; p. 140) often takes time and might weakened the capacity to improvise in the critical stage of ERO, hence the resilience of the EMS. In our case, an example is related to logistic issues. The ERO plan suggests that OFFB should utilize the Norsea Logistics Florø. However, the drilling manager on the rig recommended contacting Neptune's Logistics Manager in the Drilling and Wells department. To get work done, OFFB complied with this suggestion, which led to continued collaboration and interaction. Still, this variation in practice created other issues afterwards. The logistics manager in Florø later indicated that he was not satisfied with this action. This issue could be linked to the matter of ownership on implementing measures. ERO's flexibility and adaptive behavior sometimes require "emergent strategies" and improvisations rather than following the original plans. Nevertheless, it might create resistance in the organization related to power relations. This resistance can hamper interaction if the conflict is not resolved.

The biggest challenge during the entire operation was coordinating all the activities through interaction. The electronic crisis-management tool, CIM, was used at the operational and strategic levels of the operating company. Information-entered CIM helps the organization maintain a common situation picture through the system's various functions (ongoing status updates, meeting logging, proactive staff methodology, focus, plan, actions, personnel status, logistics status, action cards, planning, and so forth and more). Using CIM and video conference meetings, phone calls, mail, and SMS correspondence ensured the synchronization of various ERO activities, thus strengthening the ability to interact. This mechanism is linked to operational communication strategy. Communication strategy, in turn, has to be grounded on trust, respect, and openness between the parties involved (Pollock & Steen, 2020). In our case, data indicate that during the first 4 days of the outbreak, emergency managers logged nearly 250 phone calls. Many of the conversations had a high level of detail, which was considered important to ensure good common SA. These elements improve group dynamics in a collaborative decision-making process (Jones & Roelofsma, 2000). Resilience in this context enhances the process through effective and proactive communication. While effective communication is about communicating all relevant information in an open, honest, accurate, and precise way (Spetalen et al., 2004), it proactivity embraces being at the forefront of changes in situations. Proactive communication in our case is related to the frequent joint-status video meetings between the ER actors during the first week of the outbreak. In addition, e-mail and SMS were used to enhance effective communication during the incident.

Nonetheless, despite many efforts to improve the thoroughness of emergency planning, our findings indicate that there is still a need for a more adaptive approach. A rigid and detailed plan can lead to over-planning, thus suppressing the variability and uncertainty of operational conditions. However, adaptation is not always about changing strategies, models, or previous approaches, but about the potential to revise and modify them (D. Woods, 2018).

4.3 | Resilience in the restorative stage of EMS

Following the response phase, the restoration stage (Figure 3) aims to repair, reconstruct, reorganize, and mitigate possible damage. The time frame and extent of these activities depend on the severity (scope of the damage), available resources, and how the actors involved interact. Bouncing back to normal operation is the goal of the recovery process, both in the conventional approach and resilience-based one. However, it differs in its transformation process in terms of the duration of the recovery process and the efficiency of the recovery operation (Cantelmi et al., 2022; Lengnick-Hall & Beck, 2009; p. 57; Vugrin et al., 2011). In our case, restorative capacity was acquired through established networks, coordination structure, continuous monitoring, and the skills and competence of the actors involved. For instance, in cooperation with the Kristiansund Municipality, a support team was established to carry out the reception and follow-up of offshore personnel at the heliport, the quarantine hotel, and isolation facilities. The support team ensured that the quarantine personnel were tested as well. These services were quite unusual. The existing ER plan at the time provides guidelines for an Operators Center for Evacuees and Next of Kin (OSEP), available in CIM and at OFFB. However, in the shadows of the COVID-19 situation, this guideline (for OSEP) was not applicable, as a quarantine hotel was used for medical services. Additionally, the support team established a Covid-19 test center for the WP personnel (cf. Appendix A, Themes, Network "a, c, f, i").

In the restoration phase, learning is an essential element. EROs that were scrutinized in the response stage should be evaluated to draw lessons. Lessons learned, in turn, provide insights to enhance capacity building and improve the entire EMS to be better prepared for handling the next event/incident (Figure 1). Such a process can be understood as "crisis-induced learning" (Broekema et al., 2017; Brown-Devlin et al., 2020; Steen & Rønningsbakk, 2021). In our case, OFFB interacts with several O&G companies in different geographical areas, it has access to a wide range of resources (e.g., information and key personnel). This access allows OFFB to communicate with various organizations with a different organizational culture, leading to a unique opportunity to learn and adapt. The other important issue here is what talks about as requisite for learning: we need to have "learning situations (cases) frequent enough for a learning practice to develop." OFFB has access to many emergency cases. The diversity of experience provides a greater opportunity to learn comparing with an emergency organization that

is a part of one company. These elements indicate that the scope of activities and networks enhance the capacity to learn.

We looked into the OFFB's evaluation report to understand how evaluators used various perspectives to interpret experiences during WP's ERO. The findings indicate that the insights provided in the report were balanced and gave recognition to the involved actors' adaptive behavior and creativity, informal decision-making, and comments about shortcomings of the existing ER plans. For instance, it pointed to the lack of clarity regarding the actors' roles and responsibilities in the context of health events (e.g., COVID-19). We find the evaluation report, however, to be "too general." To improve the thoroughness of the evaluation reports, they could also include a more thorough examination of the decisions and actions taken and reflect on the underlying assumptions and contributory factors. These reflections might be used to assess the fitness of experiences from previous plans in combination with current competence and knowledge.

We asked our participants to comment about their post-event activities (the term we used in our interviews was "corresponding restorative stage") to identify lessons learned. They pointed to the role of debriefing in strengthening learning capacity by reviewing and reflecting on the actions taken during the ERO. At the end of the normalization phase, different levels in the organization (tactical, operational, and strategic) carried out a debriefing after the operation. The experiences from the team and information logged in the CIM system provided insights that were used as a basis in the evaluation reports (cf. Appendix A, Themes, Debriefing and reporting "p"). Undeniably, the after-action review (debriefing) is the most valuable source of learning from EROs. However, it has its limitations. Accordingly, D. Elliott et al. (2000) explore which elements might hamper learning from crises. They identify many barriers on this subject, such as failure to recognize isomorphic properties, the rigidity of core beliefs, ineffective communication, and lack of corporate responsibility. They point to how a reluctance to include comments about near-miss events during operations in debriefing interfered with the process of transferring knowledge, which could prevent an emergency from happening the following year. At the time of writing this paper (September 2021), the WP's related evaluation reports were used to adjust the second-line emergency plan and develop a set of guiding principles for exercise and training activities.

5 | FINAL REMARKS

We identified noteworthy characteristics in how ERO successfully dealt with the COVID-19 outbreak at the WP oil rig: how the actors involved were prepared to deal with the situation and how they jointly acted during a tough period. Our empirical findings indicate that handling a complex emergency event with a high degree of uncertainty requires a proactive, open, and transparent approach with joint decision-making. Interaction and collaboration between the actors involved are important, but a learning-based adaptation is also essential for a resilient response process. This process requires a wide range of sources of innovative solutions at different levels and institutionalized support for allocating resources. Our findings show how ER participants must work jointly toward a common end and be able to function together to allow mutual adaptation and adjustment. To contain communication challenges, the organizations involved need to establish an open information-sharing strategy, accentuating how to deal with uncertainty in decisions and actions. One of the present paper reviewers outlined a critical question: what mechanisms lead to these ends? In our case, the most important elements that capture our attention is OFFB's organizational structure and financing. Many O&G companies own OFFB. This fact gives OFFB a buffet to maneuver, as they do not have a budget restriction for developing exercises and training programs. OFFB's capability-building programs include also continuing education possibilities for employees. This type of program has a double effect; from the company side is about encouraging continuous formal education, enhancing competence and skills.

The academic side is about developing interesting training and education programs that combine scientific aspects with operational context. Consequently, the organization develops its capacity to foster the mindsets and skills needed for dealing with complex situations. The other element is related to OFFB's broad network. These elements indicate that the scope of activities and networks enhance the capacity to learn. However, smaller organizations would benefit from establishing a platform for sharing experiences, for example, engaging committees to exchange lessons learned and empower deidentified events. As a result, capability building extends beyond intraorganization to interorganization learning. In this regard, joint training in crisis preparation between all actors enhances their ability to interact and hence be able to deal with real-life events. For actors to learn from events, assess their needs, and provide adequate decision-making support at the strategic level, it is essential to adopt an effective and transparent reporting system. Joint exercises, developed by responsible organizations, improve mutual understanding of roles and responsibilities in response structures, increasing "samhandling" capacity. In this turbulent world, while the context of any ERO will remain uncertain, a systematic approach to a resilient EMS starts with a recognition of emergent behaviors as a continuous, eager process grounded on a constant learning curve.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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