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Enablers and Barriers to Modularized Scaling of Domestic Crisis Response Capacity

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Civil–Military Crisis Management: Enablers and Barriers to Modularized Scaling of Domestic Crisis Response Capacity

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ABSTRACT

Prolonged crises strain conventional crisis management approaches, as pre-prepared plans often lose relevance when conditions evolve unexpectedly. This study explores how collaboration between civilian and military organizations enables *modularized scaling*—the process of adapting crisis responses by combining, recombining, or shedding response modules, thereby scaling their scope to respond to unpredictable dynamics. Using Denmark's COVID-19 pandemic response as an illustrative case, the analysis examines how civil–military processes of improvisation, sensemaking, and learning facilitated or constrained modularized scaling. It finds that improvisation supported rapid upscaling but lacked strategic foresight, complicating later adjustments. Sensemaking promoted ongoing adaptation through resource reallocation, yet downscaling was often slowed by organizational hesitancy. Learning fostered more durable changes and new module designs, although limited structural support and weak cross-sectoral lesson transfer curtailed its impact. Together, these findings demonstrate how adaptive processes unfold across different temporal horizons of crisis management and underscore the importance of collaborative capacity for scaling responses in turbulent contexts. By elucidating the mechanisms driving or hindering modularized scaling, the study advances our understanding of adaptive crisis governance and contributes to research on civil–military collaboration in domestic crises.

1 | Introduction

Unpredictable societal dynamics, triggered by refugee crises, pandemics, hybrid warfare, natural hazards, military conflicts, and other disruptions, remain a persistent challenge for societies and place significant demands on the flexibility of crisis management (Boin et al. 2020; Torfing et al. 2025; Wolbers et al. 2021). While most crises can be managed using planned responses, these volatile developments often render them insufficient, requiring actors to devise modular responses that allow for the flexible recombination of response units and the scaling of efforts to meet shifting demands (Ansell and Gash 2018; Folke 2006). Modularity refers to the ability to separate, add, or recombine components (Baldwin and Clark 2014; Schilling 2023; Schilling and Steensma 2001), which in turn enables the scaling of crisis response by investing more or fewer resources in the different components (Ansell et al. 2024). Combining these insights, modularized scaling can be defined as the act of combining, recombining, and shedding crisis-management modules while scaling their use up or down in response to unpredictable dynamics (Faraj and Xiao 2006; Moynihan 2009b; Nowell and Steelman 2019). Modularized scaling, however, requires collaborative processes that can procure the knowledge and resources needed for the adaptation of ongoing crisis responses (Boin 2019; Boin and Hart 2010;

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Quarantelli 1997). Unfortunately, we know little of how collaboration and the ensuing adaptive capacities enable or hinder modularized scaling. Further studies are therefore necessary to establish the conditions to facilitate modularized scaling.

Most incident command systems already incorporate modular architectures that allow the rapid adaptation of solutions, resources, and actors (Jensen and Thompson 2016), but crisis management literature has primarily focused on the swift and timely mobilization of the right resources and organizations, as seen through the lens of phase models emphasizing the shifts between mitigation, preparedness, response, and recovery (Ansell et al. 2010; Boin et al. 2010; Kapucu et al. 2010; Kettl 2003; Nohrstedt et al. 2018). These models typically depict a crisis response as an initial escalation followed by gradually scaling down. For example, the Deepwater Horizon oil spill in 2010 began with intensive containment and cleanup before moving to long-term environmental monitoring (McNamara et al. 2014). While such linear models capture overall patterns, prolonged turbulence often requires repeated adjustments to inter-organizational modules to enable both up- and down-scaling. The effectiveness of crisis response, therefore, depends heavily on collaborative processes that hold the capacity to adapt operations by reconfiguring the modular components and providing flexible resource input (Comfort 2007). Three processes are particularly critical to collaborative crisis management: improvisation, which enables real-time action under pressure (Capano and Toth 2023; Ravazzi 2024); sensemaking, which supports recognition of developments and timely adjustments (Weick 1993; Wolbers and Boersma 2013); and learning, which facilitates reflection and improved responses (Lagadec 1997; Moynihan 2008). Understanding the role of improvisation, sensemaking, and learning in collaborative crisis management will allow us to identify how organizations can collectively sustain modularized scaling, thereby enhancing their adaptive capacity and resilience in the face of prolonged turbulence.

During spells of crisis-induced turbulence, inter-organizational adaptive processes are typically characterized by semi-hierarchies wherein one organization holds responsibility while others support, giving rise to a star-shaped pattern of collaboration (Hermansson 2016; Nohrstedt et al. 2018). To examine how these patterns and processes either facilitate or hinder modularized scaling, the role of military organizations during the COVID-19 pandemic presents a suitable case. While military organizations rarely bear the full responsibility for domestic crisis response, they provide crucial support to other government organizations. Hence, the effectiveness of such responses largely depends on the capacity of civilian (i.e., government authorities) and military organizations to engage in adaptive crisis management efforts (Bollen and Kalkman 2022; Erickson et al. 2023; Kaneberg 2017; Kaneberg et al. 2023). Furthermore, the growing acceptance of military involvement in major and long-term crises across societies worldwide highlights the need for a deeper understanding of their role in domestic crisis management (Berni and Gonin 2024; Erickson et al. 2023; Kalkman 2019b, 2019a). During the pandemic, military organizations demonstrated their capacity to support a broad range of critical crisis responses through collaboration with civilian actors (Berni and Gonin 2024; Erickson et al. 2023; Gad et al. 2021; Kalkman 2021; Kaneberg et al. 2023; Khorram-Manesh et al. 2022; Pérez et al. 2024). In so doing, they contributed to modularized scaling by engaging in civil–military processes that adapted response modules to the evolving crisis dynamics.

To examine the adaptive processes that produce modularized scaling through collaboration, this article is guided by the following research question: *How are civil–military collaborative processes of improvisation, sensemaking, and learning enabling or hindering the modularized scaling of responses to crisis-induced turbulence?* Drawing on existing conceptualizations of modularization, scaling, civil–military collaboration, and adaptive processes, the study develops an analytical framework for analysing modularized scaling through processes capable of producing change in crisis management. The research question is examined through a case study of how the Danish Defence and the Danish Home Guard engaged in civil–military crisis management with civilian organizations and how these collaborative dynamics impacted modularized scaling in crisis response.

The article proceeds as follows. First, it conceptualizes modularized scaling, presents the key characteristics of civil–military collaboration during domestic crises, and connects these to to theories of learning, sensemaking, and improvisation. Second, it accounts for case selection and data collection before presenting the case study findings. Finally, the article discusses the findings and concludes by specifying the main implications of the study for crisis management research and practice.

2 | Analytical Framework

Responses to crises and turbulence are rarely handled by single organizations but require collaboration from multiple actors to reconfigure ongoing crisis response effectively (Ansell et al. 2024; Nohrstedt et al. 2018). Collaboration and processes that hold the ability to adapt responses therefore, become an integral element in modularized scaling. The following sections conceptualize modularized scaling, unfold the key characteristics of civil–military collaboration during domestic crises, and present three inter-organizational adaptive processes: improvisation, sensemaking, and learning.

2.1 | Conceptualizing Modularized Scaling

Research has long examined how crisis management adapts under conditions of uncertainty and change. For instance, resilience highlights the capacity to absorb disturbance and adjust to unforeseen conditions (e.g., Folke 2006), adaptive governance and networked collaboration emphasize the flexible coordination of multi-actor responses (e.g., Chaffin et al. 2014; Folke et al. 2005; Kapucu et al. 2010; Nohrstedt et al. 2018), and adaptive capacity denotes the ability of organizations to adjust routines and practices (e.g., Alirani et al. 2025; Staber and Sydow 2002). In contrast, modularized scaling focuses on the operational mechanisms through which adaptation is enacted—namely, the activation, recombination, and withdrawal of discrete modules over time—shifting attention to how response capacity is assembled, expanded, and reduced in practice.

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Modularity provides the structural basis for such processes, referring to systems composed of relatively independent components that can be recombined through standardized interfaces (Baldwin and Clark 2014; Brusoni et al. 2023; Sanchez and Mahoney 1996; Schilling 2023). Crisis response has long been understood as composed of functionally differentiated groups with distinct roles, including established, expanding, extending, and emergent organizations (Dynes 1994), which can be interpreted as modular units activated and recombined during crises. In practice, modules may consist of organizational units or task-specific structures, such as medical teams, search and rescue units, or testing facilities (Bigley and Roberts 2001; Faraj and Xiao 2006; Kendra and Wachtendorf 2003). Modularity enables responses to be constructed by recombining components without disrupting system coherence, while standardized interfaces—such as routines, procedures, and coordination principles—structure interaction across actors.

Building on modularity, scaling entails adjusting the level and intensity of operations in response to changing demands. It is not independent of modularity but represents its operational expression; it reflects the ability to mobilize and demobilize resources, including expansion, contraction, and reallocation of resources across tasks (Ansell et al. 2021). Thus, modular architectures enable units to be added, recombined, or withdrawn, supporting rapid "plug-and-play" coordination (Faraj and Xiao 2006).

Combining these insights, modularized scaling specifies how adaptation is operationalized through the dynamic scaling of modular components. It provides a distinct conceptual lens that builds explicitly on existing insights while specifying how response capacity is constructed and adjusted in practice. Modularized scaling draws on pre-existing organizational designs composed of relatively autonomous and standardized units, but it may also involve the creation of new modules when existing arrangements prove insufficient (March 1991). In this way, it captures both the refinement of established practices and the development of new response configurations. The following section examines how civil-military collaboration mediates improvisation, sensemaking, and learning in the enactment of modularized scaling.

2.2 | Civil–Military Collaboration in Domestic Crisis Management

In domestic crises, civil–military collaboration faces many of the same challenges as other forms of collaboration: diverse interests, blame games, fragile trust, and difficulties in building shared understandings under pressure (Bodin et al. 2022; Boin and Hart 2010; Curnin et al. 2015; Huxham and Vangen 2010). Civil–military settings, however, accentuate certain dynamics. Hierarchies often develop when civilians are treated as "experts" and the military as deployable assets, or when strained civilian agencies allow military partners to assume broader roles (Bollen and Kalkman 2022; Kalkman 2021). Cultural and operational differences, such as military reliance on standard operating procedures versus more science-based or action-oriented approaches in health and police organizations, can further impede adjustment in unforeseen crises (Hedlund and Alvinius 2024; Khorram-Manesh et al. 2022; Kraska 2007).

These barriers can be mitigated when actors recognize mutual interdependence and urgency (Bollen and Kalkman 2022), build on pre-existing relationships (Juling 2022), and operate within flexible but clear legal frameworks that secure civilian oversight (Campbell and Campbell 2010; Erickson et al. 2023). Ultimately, successful civil–military collaboration depends on balancing hierarchical structure with collaboration that fosters shared understanding and mutual adaptation.

2.3 | Adaptive Processes

To respond adaptively to turbulence, collaborating actors must not only coordinate their actions but also continually revise and reconfigure them to fit evolving circumstances. This requires decision-making that balances immediate responses with long-term strategic considerations. Within such collaborative settings, improvisation, sensemaking, and learning emerge as dynamic processes that facilitate adaptation and drive change (Capano and Toth 2023; Comfort 2007; Lagadec 1997; Micacchi et al. 2025; Ravazzi 2024; Stern 1997; Jia Wang 2008; Weick et al. 2005). Improvisation enables swift, creative action in the face of uncertainty; sensemaking helps actors to interpret unfolding events and align their understandings; and learning fosters the refinement or transformation of practices over time. Together, these processes form the cognitive and operational foundation through which collaborative efforts can adjust to situational fluctuations, reconfigure modular responses, and navigate complex crisis environments. These processes differ in timing, dynamics, and requirements, but they often overlap and reinforce one another. They will be analysed separately in this study. Figure 1 shows the analytical model, where civil–military collaboration facilitates adaptive processes that create modularized scaling and, thus, a robust crisis response that maintains key structural or operational architectures in the face of disruptive perturbations (Ansell et al. 2024, 32). While the model depicts a linear sequence in which improvisation, sensemaking,

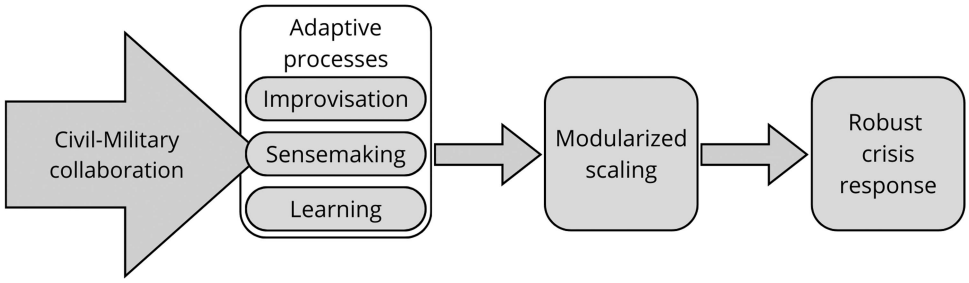

FIGURE 1 | The analytical model.

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and learning occur separately, in practice these processes are recursive and co-evolve over time.

The first process, improvisation, refers to the spontaneous yet deliberate decisions that often occur when pre-planned responses fall short (Ravazzi 2024). During crises, the "logic of responsiveness" suggests that unexpected jolts or surprises can make prior plans irrelevant or incomplete, making it difficult to refrain from taking action or completing a new planning cycle before taking action (Moorman and Miner 1998). Accordingly, improvisation can be understood as "the conception of action as it unfolds, by an organization and/or its members, drawing on available material, cognitive, affective and social resources" (Pina e Cunha et al. 1999, 302). Besides drawing on experiences as well as knowledge of structure, procedures, and resources (i.e. organizational memory), studies highlight how the quality of improvisation is influenced by the level of real-time information and communication, defined as information about operations for which there is little or no time lag between occurrence and reporting, thereby enabling interaction within and between collaborators based on timely information (Vera and Crossan 2005, 208). Moreover, the specialized skills and knowledge that individuals bring to the task impact the quality of improvisational processes, as a larger and more diverse skillset produces more alternatives for developing new combinations of ideas.

This study denotes sensemaking as the act of detecting, recognizing, and interpreting risks for the immediate context by modifying strategies, structures, and actions in real time (cf. Combe and Carrington 2015; Comfort 2007; Weick 1993; Weick et al. 2005). The US National Incident Management System describes how efficient crisis management requires the gathering, coordination, and dissemination of information (FEMA 2017, 44–45) that makes information more readily available. In addition to storing knowledge, Comfort (2007) stresses the need for shared understandings that make actors aware of each other's limitations and able to recognize how they can best collaborate and support one another in a given situation. Sensemaking is therefore the ongoing effort to combine different cues, roles, scripts, and actions that arise from the actors' respective institutional backgrounds into a change in crisis response (Faraj and Xiao 2006; Wolbers and Boersma 2013). To exemplify this, Wolbers and Boersma refer to the trading zone metaphor, where actors exchange ideas, negotiate, and convince each other, thereby making sense and reaching consensus about exchange procedures in a mutually comprehensible language (2013, 189). In addition, sensemaking relies on past experiences, including rules and regulations, that dictate which cues will be extracted to make sense of a situation. Likewise, it is driven by plausibility, meaning that actors do not rely on the accuracy of perceptions when they make sense of an event. Instead, they look for signals that make sensemaking seem plausible. In so doing, they may distort or eliminate what is accurate, potentially relying instead on faulty decision-making when determining what is right or wrong (Helms Mills et al. 2010).

Learning, while slower and often more formalized, helps to embed change through testing and by evaluating responses over time (Capano and Toth 2023; Stern 1997). It facilitates modularized scaling by making corrections without altering underlying assumptions (single-loop learning) or rethinking assumptions and structures (double-loop learning) (Argyris and Schön 1978). In the outbreak of infectious disease, Moynihan (2009a) points out how single-loop learning predominantly occurred through the modification of routines and daily meetings where responders reviewed performance and planned future action. Double-loop learning, he argues, entailed the development of new response strategies because existing strategies are clearly rendered irrelevant by shifting conditions or insufficient response. As such, specific learning processes can unfold through structured meetings or debriefings that draw lessons from past events, which allows organizations to receive updates on the crisis, new changes to practices, and operation plans for the day, including which tasks were to be carried out and where (Lagadec 1997). In a less structured manner, learning occurs when organizations learn from one another, transferring professional knowledge regarding, for instance, diseases or crisis management routines (Moynihan 2009a).

Research has repeatedly been challenged with distinguishing improvisation, sensemaking, and learning as individual processes as they shade into collective action (Frykmer et al. 2018; Maitlis and Christianson 2014). For instance, previous research on improvisation points out how there must be an element of collective design and execution to distinguish collective from individual improvisation (Moorman and Miner 1998), but it is unclear what "collective design and execution" entails. To address this challenge, this study traces not just individual actions but also the interdependencies and mutual adjustments between actors during a crisis to identify how a mixture of intra- and interorganizational processes leads to modularized scaling.

All three processes share traits and rely on similar collaborative conditions. Barriers, such as a lack of trust, misaligned goals, cultural differences, and poor communication, can hinder all three. Fragmented or excessive information, psychological stress, and rigid hierarchies limit flexibility and delay adaptation (Lenz and Eckhard 2023; Staw et al. 1981), while standard procedures may be outdated yet still dominate decision-making (Brändström et al. 2004). However, these barriers can be mitigated. Trust-building, pre-existing relationships, or even the creation of "swift trust" foster collaboration (Hazy and Tivnan 2003; McLaren and Loosemore 2019; Moynihan 2009b). Flexible hierarchies and decentralized decision-making empower actors to adapt in real time (Boin and Hart 2003), while open dialogue across and within organizations enables the early detection of signals and institutionalizes learning (Bigley and Roberts 2001).

3 | Methodology

3.1 | Case Selection and Units of Analysis

This study presents a case study of Denmark's pandemic crisis management with a central focus on civil–military collaboration. Within the case are multiple embedded units—crisis response modules—that reveal how collaboration between civilian and military organizations has contributed to adaptive change. These modules form the basis for examining mechanisms of modularized scaling in collaborative settings. The embedded single-case design allows for the exploration of resource mobilization and reconfiguration during a crisis while also contributing new insights to theoretical understandings of

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scaling and modularization through explanatory enquiry (Gerring 2004; Priya 2021).

Importantly, the case illustrates civil–military collaboration as well as the dynamics of responding to transboundary crises more broadly. Such responses typically involve organizations with formal responsibility working alongside others that provide support (Moynihan 2009b; Nohrstedt et al. 2018). The Danish pandemic management reflected this very pattern: extensive military engagement intersected with shifting civilian partners across a wide range of modules. The case, therefore, captures not just one or two instances of scaling, but rather a wider set of collaborative constellations through which modularized scaling unfolded. Moreover, it is representative in an international perspective, with 95% of countries worldwide using military personnel in some form during the pandemic (Erickson et al. 2023). More broadly, military organizations have increasingly engaged in domestic crisis responses beyond pandemics, such as Hurricane Katrina in the USA (Davis et al. 2007) and recent flooding in Spain in 2024 (Jones 2024). Thus, while the scale and impact of the COVID-19 pandemic were unique, the Danish case reflects recurring patterns of modularized scaling in crises where military and civilian organizations must adapt together.

3.2 | Interviews and Documents

The analytical process followed an abductive approach seeking to better explain how civil-military collaborative processes either hinder or facilitate the adaptation of crisis responses. Accordingly, it adhered to established protocols that attempt to provide a plausible theoretical account to an encountered puzzle (Tavory and Timmermans 2014; van Hulst and Visser 2024). This was an iterative, cumulative process that involved identifying civil-military crisis response modules before seeking to explain how and why these adapted over prolonged periods of turbulence.

Danish military organizations have no formal jurisdiction in domestic crises unrelated to security. Instead of leading the response, they were therefore supporting health authorities, the Danish National Police, and the Danish Emergency Management Agency (DEMA). While their strategic role at the ministerial level was limited, their operational and tactical contributions were substantial. This study draws on 22 semi-structured interviews, primarily with operational-level planners and decision-makers. Several respondents from the Home Guard and Army held roles spanning operational and tactical levels. Therefore, four interviews involved actors whose influence grew as response modules expanded. Nine interviews were conducted with Police, DEMA, and health-sector representatives directly involved in civil–military collaboration. Interview questions included: "How did you mobilize resources for crisis responses?", "How did responses change during the pandemic?", and "How did collaboration influence mobilization and adaptation?" (see Appendix S1 for interview guide).

Documents were collected from the Danish Defence Command and the Police. The Defence materials included emails, notes, reports, and analyses from early 2020 through 2021, totalling 832 pages. From the Police, 879 pages of National Operational Staff (NOST) minutes and decision papers were collected, supplemented by reports on the mink culling (Mink Commission 2022) and early pandemic crisis management (Folketinget 2021). Drawing on existing abductive procedures (e.g., Klag and Langley 2013; Vila-Henninger et al. 2024), the analysis iterated between inductively identifying patterns in the empirical material and engaging with existing theoretical concepts, which guided the refinement and structuring of codes. Analytically, this involved identifying instances of civil–military collaboration in interviews and documents, conceptualized as relatively self-contained crisis response modules that could be scaled. Throughout this process, the data were coded using the analytical framework's core concepts—civil–military collaboration, improvisation, sensemaking, and learning—each refined through subcodes (see Appendix S1 for coding scheme).

Multiple narratives, politicization, and crisis complexity can foster retrospective rationalization after a crisis (Broekema et al. 2017). Moreover, experts often portray their actions as strategically coherent (Littig 2009). Accordingly, I drew on the investigative interview genre (Langley and Meziani 2020), to trace key events, decisions, and interactions, forming the basis for reconstructing the crisis narrative. During analysis, ambiguities and interpretive uncertainties were addressed through iterative comparison across data sources and by revisiting coding decisions in light of emerging patterns. The coding was conducted by the author by repeatedly revisiting the material to ensure consistency and coherence.

3.3 | The Case

Danish civil–military crisis responses operate within the broader Danish crisis management system (DEMA 2021). At the operational level, NOST can be convened when a crisis emerges or escalates. With standing members from key response organizations (e.g., the National Police, Danish Defence Command, Danish Health Authority, DEMA), NOST provides the organizational and physical framework for cross-cutting coordination. While decision-making officially remains within each sector, strategies for crisis response are often designed and aligned in this forum. During the pandemic, the Home Guard had an observing representative in NOST, although they do not hold a permanent seat. At the tactical level, 12 Local Emergency Staffs (LES) are aligned with both police and Home Guard districts, comprised of local representatives from the same sectors as NOST. At this level, the Home Guard is the military representative and frequently assists civilian actors in local crises. During the pandemic, collaboration between military and civilian organizations took place in both NOST and LES.

The Danish Defence includes the operational branches (i.e., the Army, Navy, and Air Force) comprising roughly 16,500 uniformed personnel (Danish Ministry of Defence 2025). The Home Guard consists of approximately 43,000 volunteers and 500 permanent staff across the Home Guard Command, two regional commands, and 12 districts (Danish Home Guard 2025). The Defence Command and the Police can both request support from the Home Guard, which routinely collaborates with the Defence, Police, DEMA, and public health organizations. When soldiers from the Danish Defence are deployed domestically, they fall under the operational command of the Home Guard's regional commands. During the

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pandemic, this meant that military personnel from the services were deployed under Home Guard command.

4 | Findings

Improvisation, sensemaking, and learning all produced modularized scaling but in differing ways and were shaped by both similar and different enablers and barriers in terms of collaboration. The next section presents how modularized scaling unfolded through civil–military collaboration to create robust crisis responses. The following sections then examine how improvisation, sensemaking, and learning processes acted as catalysts for modularized scaling and what hindered and enabled these processes.

4.1 | Modularized Scaling through Civil–Military Collaboration

Modularized scaling was an integral part of the Danish pandemic response. The crisis quickly spread throughout Danish society, demanding that scarce resources be applied flexibly. Soldiers from the Danish Defence and the Home Guard contributed to a range of responses which can be understood as distinct response modules. Call centre operations, testing and vaccination support, border control, transportation, and crisis-specific interventions (e.g., mink management) each represent self-contained functional units that could be scaled and reconfigured. Many were not created from scratch, but were built on pre-existing structures, routines, and capacities enabling rapid deployment and recombination. Table 1 outlines their main deployments across phases of the pandemic, showing how the pandemic caused fluctuating response patterns.

The table illustrates key moments of scaling, including the expansion, reduction, and reallocation of capacity across modules. Some modules rested on established designs and standardized procedures developed before the crisis, enabling modularized scaling. For example, transportation, increased border control, and mink management relied on clearly defined procedures for military assistance and similar previous arrangements. Others, including call centre operations and large-scale testing and vaccination infrastructures, drew on familiar crisis arrangements despite not being pre-designed for the pandemic. Extending the call centre with a contact-tracing initiative further illustrates how new modules were derived from existing ones, maintaining structural similarity while serving distinct functions. Similarly, vaccination efforts were built on existing test infrastructures using similar personnel and procedures.

Military organizations played a critical role in supplying the capacity for scaling these modules by providing personnel, knowledge, and expertise. For instance, the expansion of the call centre was facilitated by military expertise but staffed by private temp organizations. Modularized scaling thus involved not only expansion and reduction but also the reallocation of capacity across interdependent modules, as seen when vaccination support in the winter of 2021-2022 required temporarily suspending the increased border control to redeploy military personnel.

The pandemic's scale required actors to look beyond silos, prompting collaboration between civilian and military actors. As one respondent from the Danish Health Agency noted, *"There was this understanding that this is bigger than all of us, so the responsibility became shared. When one sector can't handle it, you simply must collaborate."* Collaboration combined civilian expertise in areas such as testing with military organizations, providing personnel, and facilitating implementation. The upscaling of the hotline illustrates this clearly. Its creation required organizations to mobilize complementary resources, including technical expertise, personnel, and facilities. Police coordinated responses, health organizations provided knowledge of current guidelines, and military organizations supplied personnel and operational expertise. Meanwhile, existing coordination routines enabled continuous information sharing and adjustment. Similar collaborative processes occurred in other modules, where military organizations supported civilian organizations that lacked the resources or knowledge to carry out the tasks independently. This interorganizational collaboration produced robust crisis responses by enabling the expansion, reduction, and reallocation of capacity across modules in response to shifting demands. In this way, civil–military collaboration allowed response modules to maintain their intended function—whether testing, border control, or public communication—despite fluctuating infection rates.

Collaboration was driven by mutual dependency and shared commitment. DEMA, the Police, and health authorities acknowledged that without a collaborative effort, the scaling of border control or mass testing would be unaffordable and likely impossible. Moreover, the military structure allowed for clear intent and reliable execution, meaning that civilian authorities could give instructions and soldiers would carry them out, especially by relying on the military norms of professionalism and task execution. Shared crisis routines and command structures across the Police, DEMA, and military units supported this, but similar command structures were recognized in the health sector, fostering stronger collaboration through mutual respect, trust, and a task-centred approach. As one officer from the Home Guard noted:

> *We're all emergency response organizations. Most health sector representatives are experienced, too, so I don't think cultural differences were a problem. Sometimes they even strengthened collaboration.*
>
> (Respondent, DEMA)

Additionally, several military respondents emphasized the ability of both DEMA and the Police to act swiftly and assume responsibility as a driver of modularized scaling: "*They quickly put some things together, whereas we'd have approached it differently. Sat down, drew things out, made timelines. But we were under time pressure, so those big, beautiful plans weren't always possible*" (Respondent, Defence Command). This action-oriented approach was complemented by military knowledge of long-term planning, which the Police and DEMA lacked. Thus, collaboration was often situated between differing cultures with different prioritizations contributing to different aspects of scaling and reconfiguration.

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TABLE 1 | Military support during the pandemic.

Year	2020		2021–2022	
Development of the pandemic	Lockdown (March–April)	Society gradually reopened (May–November)	Partial lockdown (December– January)	Gradual reopening of society toward full reopening (February onwards)
Call centres	COVID-19 hotline moved to a Home Guard district and upscaled (March)	Call centre extended by adding a contact-tracing module (June)		Call centres closed (March 2022)
Test- and vaccination facilities	Soldiers from both the Defence and Home Guard assist the test centre module (April)	Continued support to test centres (until August)	Repeated military support to testing (December–January)	The Defence bolsters the added vaccination module (December–January)
Increased border control	The Defence and Home Guard assist the police in increased border control (March)	Increasing demand for soldiers as travel restrictions are relaxed-demand for soldiers reduced again in September.		Soldiers are relieved from border control to assist with vaccinations, and return later (January)
Transportation	The Defence assists health organizations with the transportation of testing samples and the repatriation of Danish citizens (April)	Continued transportation of samples (until May)		
Managing minks		Soldiers from the Defence and Home Guard are deployed to assist in the killing of minks (November)	Soldiers are relieved as the killing of minks was nearly completed (December)	

Source: The table is constructed from documents retrieved from the Danish Defence and Danish Police as well as through interviews, public statements, and previous research (e.g., Dahlberg and Poulsen 2025).

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At the same time, tensions emerged as the Police and health authorities assumed ownership over military personnel, constraining modularized scaling. For instance, the Police decided to scale response modules before consulting military organizations, while health authorities were reluctant to relieve soldiers from test facilities. An officer from the Defence Command describes how this hierarchical relationship affected their work:

> *We were in a supporting role, meaning that they were the ones who knew what needed to be done. We supported with whatever resources we could in those tasks, but honestly, we also felt taken advantage of. It was easy, it was free, and we could be deployed quickly*
>
> (Respondent, Defence Command)

Collaboration supported modularized scaling through mutual dependency, shared commitment, and complementary strengths, as civilian authorities contributed expertise and action-oriented capacity while the military provided manpower and structured execution. Shared routines and trust facilitated coordinated scaling under crisis conditions, yet barriers emerged from differing operational norms and disputes over resource ownership. Civil–military collaboration was thus both essential for flexible responses and a source of tension when civilian authorities unilaterally directed or withheld military personnel. These tensions were often overcome through improvisation, sensemaking, and learning, though not in every instance. The following sections examine these processes in greater detail.

4.2 | Improvisation: Upscaling Crisis Response Modules

Improvisation in crisis management refers to spontaneous but deliberate action taken when pre-planned responses fall short in the face of unpredictable dynamics. In this study, it is understood as drawing on organizational memory, real-time information, and communication. In the examined case, improvisation emerged in response to sudden jolts requiring immediate action. Hence, improvisation was most apparent in moments of urgent disruption, prompting immediate action while also shaping long-term crisis management.

Improvisation was enabled by collaboration across multiple organizations. Often, sudden strategic-level decisions based on civil–military collaboration prompted the establishment or adjustment of crisis management modules. Existing relations and forums, such as collaboration between local emergency staff and in NOST, allowed organizations to voice concerns demanding urgent solutions, but they also eased communication and fostered rapid mobilization. For example, collaboration made it possible to upscale the COVID-19 hotline, enact increased border control, and launch large-scale testing. The dramatic upscaling of the hotline from a limited setup to 300 full-time employees illustrates this as urgent political messaging converged with health-sector concerns about overstretched systems, producing swift improvisation across organizations. Here, improvisation leveraged existing procedures, prior collaborations, and both civilian and military expertise to significantly increase response capacity in terms of both personnel and call-handling volume. The following account from a police inspector in NOST captures how organizational memory, combined with collaborative and real-time communication, facilitated this rapid upscaling:

> *The Danish Health Authority brought it up in the NOST: 'Our phone lines are completely overwhelmed'. And we talked a bit about it: 'Well, what can we do?' And people looked around a bit, and then they asked someone who had quite a bit of insight into the police service centre—and in no time, they had gathered some computers, phones, and so on from various offices. The Home Guard offered personnel. Two classes from the police academy were brought in, and someone remembered, 'Didn't we have some rooms standing empty at the Jonstrup barracks? Oh yes'.*
>
> (Respondent, National Police)

This shows how actors improvised to assemble and expand a response module by mobilizing available personnel, facilities, and expertise. Similar dynamics were observed in other modules. For instance, military organizations and DEMA have previously assisted civilian organizations in controlling the spread of bird flu; however, their support in the culling of minks was marked by improvisation, as it presented an entirely new scope requiring not only personnel but also extensive operational expertise. More broadly, improvisation was rarely hindered by barriers. Instead, it thrived on mutual dependency, shared commitment, and complementary strengths. Yet because improvisation was triggered by urgency, it primarily expanded existing modules without long-term strategic foresight. Instead, ongoing adjustments and future reconfigurations were left to processes of sensemaking and learning.

In sum, improvisation relied on collaboration, organizational memory, and real-time communication, allowing the rapid upscaling of modules in response to urgent disruptions. While often effective in mobilizing resources, improvisation was reactive and short-term oriented, leaving strategic adjustments and reconfigurations to sensemaking and learning.

4.3 | Sensemaking: Reconfiguring Crisis Response Modules

Sensemaking refers to the continuous process of detecting, interpreting, and reflecting on risks in real time to modify strategies, structures, and actions. In this study, it is operationalized as ongoing information exchange and the integration of perspectives that enable the reconfiguration of crisis response modules—both up- and down-scaling—through interpretation and negotiation. These processes were triggered by uncertainty, requiring actors to interpret evolving developments and align actions based on shared, and sometimes contested, understandings.

Collaboration was central to the sensemaking process. Within NOST, organizations pooled information, interpreted cues, and synchronized action through daily meetings. These interactions involved ongoing negotiation of meaning as actors interpreted

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uncertain developments. Here, legal expertise could resolve overlapping responsibilities, while ad-hoc or bilateral meetings at operational levels enabled more flexible adjustments. Through collaborative sensemaking processes, stakeholders continuously constructed and revised shared understandings of the evolving crisis, which guided how response modules were scaled throughout the pandemic. Additionally, smaller informal groups of police, health-sector staff, Home Guard, and Defence representatives frequently met to align expectations and clarify responsibilities, discussing questions such as "*What exactly are the soldiers supposed to do?*" or "*How many days should they be deployed?*" (Respondent, The Army). Such collaborative sensemaking allowed military personnel to be added, relieved, or moved around, thereby enabling modularized scaling through the reallocation and adjustment of capacity across modules. This included both upscaling and downscaling of personnel in response to shifting demands. For instance, sensemaking processes led to military personnel being shifted between border control and vaccination support in December 2021, illustrating reallocation and rebalancing across response modules. In January 2022, this shift was reversed—vaccination support was scaled down while border control was scaled up. These processes made modularized scaling possible but also revealed tensions. At the national level, sensemaking in NOST sometimes became gridlocked, especially in disputes over personnel allocations. As one Defence Command officer noted, resource negotiations risked becoming zero-sum struggles that slowed reconfiguration:

> *...They're going with this 1:10 approach [i.e., one police officer to 10 soldiers], and the Armed Forces are gradually running out of the people we had on standby. So, the negotiation was happening—practically with my boss in my ear—and as I recall, the police did eventually give in.*
>
> (Respondent, The Defence Command)

This illustrates how sensemaking could become contested, as actors held competing interpretations of resource needs, thereby slowing the reconfiguration of response modules. When national forums stalled, local actors often compensated by negotiating directly, producing joint sensemaking and more flexible solutions, such as downscaling testing modules or withdrawing military personnel where appropriate. In such cases, sensemaking in smaller groups translated strategic intent into workable local action. Nevertheless, sensemaking was persistently challenged by civilian reluctance to scale down modules, highlighting how ambiguity and competing interpretations can constrain coordinated action under conditions of uncertainty. The hotline exemplifies this dynamic, as actors feared renewed infection spikes, prolonging military support despite visible falling demand. A DEMA respondent illustrates how fears of renewed infection surges, combined with the political reluctance to close citizen access points, shaped sensemaking processes and obstructed downscaling efforts:

> *It's natural that politicians don't want to close down a hotline—it's the citizens' access point to the authorities. Even if only a few are calling, no one knows if the virus would come back or mutate. Better to keep it running until wehaved a clear overview, rather than risk shutting it down and needing to reopen.*
>
> (Respondent, DEMA)

This illustrates how decisions were guided not by clear signals but by interpretations of uncertain future developments, where resurging infection rates seemed plausible to some, prompting the maintenance of capacity rather than risking premature closure. While collaborative sensemaking enabled modularized scaling by aligning expectations and reconfiguring modules through the joint interpretation of cues, it also revealed organizational hesitancy and resource competition, complicating timely downscaling. Compared to improvisation, sensemaking was a slower process, oriented more toward reconfiguration than sheer upscaling.

4.4 | Learning: Downscaling and Crossing Sectoral Divides

Learning refers to embedding change over time through processes of testing, evaluating, and adjusting responses. In this study, it may take the form of single-loop learning, which refines existing routines, or double-loop learning, which questions underlying assumptions and structures. In this study, both variants of learning were evident both within and across organizations, especially supporting the downscaling of response modules and, at times, enabling cross-sectoral adjustments that reconfigured modules more fundamentally.

Single-loop learning took place both within individual organizations and across them. Intra-organizational learning helped to identify possible adjustments but proved insufficient for modularized scaling unless shared and collectively understood in collaborative forums (e.g., NOST). Here, collaborative structures were occasionally insufficient to translate learning processes into effective modularized scaling. For example, the Defence Command repeatedly raised the need for clear exit strategies when deploying soldiers. A respondent from the Defence Command provides an example of this when commenting on the recurring issue of relieving soldiers: "*We're the ones who can provide manpower for many tasks, so there needs to be an exit strategy. Like: 'When is the military supposed to be relieved of this task?'*" (Respondent, The Defence Command). While the military quickly learned this lesson, challenges arose when conveying it to collaborating partners, meaning that it was only incorporated into joint practices late in the pandemic. Another example of single-loop learning occurred when politicians decided to establish a national test capacity in the first place. Military organizations provided knowledge on traffic flows at prototype test centres, which were later upscaled to the national level and eventually bolstered by soldiers who conducted tests and directed traffic. Thus, single-loop learning improved the efficiency and scaling of existing modules, particularly by increasing testing capacity and standardizing deployment practices.

Double-loop learning, though rarer, proved decisive for modularized scaling. A striking case was the hotline module, where the Home Guard had to abandon its traditional short-term deployment model. Instead, temporary contracts were created to sustain long-term operations, representing a shift from

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flexible volunteer staffing to more stable arrangements, thereby enabling the maintenance and stabilization of the module. This arrangement later served as a template for vaccination support. This example shows how questioning and altering underlying organizational assumptions—specifically the reliance on short-term deployments—produced a more permanent restructuring of the module. Likewise, double-loop learning about the health sector's limited operational capacity led to the Defence taking the lead in structuring the contact-tracing hotline, while the mink outbreak required the Defence's logistical expertise to supplement the Danish Veterinary and Food Administration's technical skills:

> *It has a scale that requires planning and coordination capacity that simply doesn't exist within the Danish Veterinary and Food Administration. They could handle the technical issues, but all the logistics—vehicles, inspections, and everything else—that required the Defence to take the lead."*
>
> (Respondent, The Defence Command)

Unlike single-loop learning, these changes altered underlying assumptions about roles and organizational arrangements, rather than refining existing practices. Together, these examples show how learning processes shaped modularized scaling by enabling both the expansion and stabilization of response modules (single-loop learning) and the restructuring of modules to support sustained or reallocated capacity (double-loop learning). However, while these examples demonstrate that collaborative learning could cross sectoral boundaries and generate entirely new module designs, the lack of structural support for systematic learning repeatedly constrained scaling. Respondents emphasized that time pressure and shifting collaborative constellations often acted as barriers, and without mechanisms to translate intra-organizational lessons into inter-organizational change, opportunities for scaling were frequently lost.

5 | Discussion

This study has examined how collaborative processes have prompted crisis response to adapt by facilitating modularized scaling in distinct but complementary ways. Together, these processes highlight how modularized scaling unfolds across different time horizons, balancing immediate action, ongoing interpretation, and longer-term adaptation. In doing so, the study contributes to the field of crisis management in two noticeable ways.

First, the study answers the call made by Ansell et al. (2024) to refine response strategies to turbulent developments by linking modularization and scaling to collaborative processes capable of producing robust governance through improvisation, sensemaking, and learning. Improvisation was a crucial enabler of rapid upscaling under conditions of urgency, where actors created immediate responses to the ensuing crisis by drawing on organizational memory, real-time information, and communication, thereby enabling the swift mobilization and expansion of response modules. Yet extant research has predominantly connected improvisation to mostly positive outcomes (Frykmer et al. 2018). This study nuances this by showing how improvised action lacked long-term strategic foresight, often complicating eventual downscaling or reconfiguration. These adjustments were left to ongoing sensemaking and learning. As turbulence endured, continuous joint sensemaking enabled modules to be reconfigured by shifting, shedding, and adding resources. Yet sensemaking processes shaped by contentious perspectives, political sensitivities, and organizational hesitancy revealed that a dominant narrative could limit the interpretation of information, thereby hampering flexible downscaling in some instances. While this tracks with previous research (see, e.g., Wolbers and Boersma 2013), the interconnectedness of the crisis response further shows how such contestation constrained scaling across modules. In this case, the Danish Defence was restricted in supporting other modules when resources were tied down to, for example, testing capacities. Moynihan (2009a) points out how learning during a crisis works best when both structure (e.g., procedures) and culture (e.g., trust and shared understandings) are supported and developed together. When this was the case, learning produced more enduring adjustments and occasionally generated new module designs, as it enabled actors to reflect on and revise underlying practices and organizational arrangements, rather than merely responding to immediate demands or interpreting unfolding events. However, barriers in terms of structures supporting learning and the absence of shared understandings limited its scope. From the perspective of organization studies (see, e.g., Holmqvist 2003), the case illustrates how organizations lacked the absorptive capacity needed to internalize knowledge across organizational boundaries. More concretely, challenges arose when intra-organizational lessons failed to translate across sectors, resulting in lost opportunities for scaling. In this regard, modularized scaling extends existing concepts such as resilience, adaptive governance, and networked collaboration by specifying how adaptive processes—such as learning, sensemaking, and improvisation—translate into concrete changes in response capacity through the scaling of discrete modules organizational boundaries.

Second, the study contributes to the field of crisis management by filling a gap in civil–military collaboration in domestic crises. In so doing, it advances the literature in three significant ways. The study adds nuance to existing research on differences in civil–military organizational cultures in crisis management (Franke 2006; Hedlund and Alvinius 2024; Khorram-Manesh et al. 2022; Winslow 2002). While these were clearly visible and constituted an obvious nuisance to collaborating partners, they rarely hindered modularized scaling directly. Rather, the study finds indications that civilian values and traditions could enable speed in civil–military responses that the military might not otherwise have enacted. This is especially illustrated by the willingness of the Police—and to a lesser extent DEMA—to act quickly, leaving little time for military planning.

The study also reveals the importance of civilian organizations maintaining the overarching responsibility while military organizations implement and contribute specific expertise on, for example, crisis management or logistics. This finding confirms previous studies identifying both the benefits and drawbacks to such hierarchies (Bollen and Kalkman 2022). As

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civilian organizations develop a sense of ownership over military resources, flexible redeployment becomes constrained due to their reluctance to release them. On the other hand, expert organizations setting clear directions and frames for collaboration can trigger speed in modularized scaling by providing clear directions. The study echoes previous findings (Gibson-Fall 2021; Ratchev and Tagarev 2018), which highlight the demand for formalized collaboration to clarify roles and define the duration of support, thereby maximizing advantages while minimizing drawbacks.

More broadly, these findings contribute to ongoing debates on the role of the military in domestic crisis management. On the one hand, they confirm research suggesting that military organizations can be used as efficient and flexible governance instruments (Martínez and Bueno 2024; Pérez et al. 2024). On the other hand, examples such as the culling of minks reiterate previous findings that military actors may encroach upon and potentially substitute for civilian organizations when responsibilities become unclear (Gibson-Fall 2021; Malešič 2015). At the same time, the findings suggest that civil-military collaboration is not only influenced by military expansion but also by civilian reluctance to assume responsibility or relinquish military support, effectively locking military actors into sustained crisis-response roles.

Finally, the study shows that civil–military differences can be overcome by mutual professional respect, interdependency, and sheer urgency. Mutual respect prompted collaborating partners to overlook cultural differences, while interdependency entailed repeated and frequent collaboration. This led to improved sensemaking, in turn easing modularized scaling by aligning expectations and familiarizing routines. The urgency of the crisis brought collaborators together and spurred solution-oriented collaboration, which facilitated the scaling of crisis-response modules. Noticeably, however, this trait also led military organizations to overextend, suggesting that a context-sensitive capacity to adapt governance forms to shifting constraints and demands requires guidelines and agreements that enable flexibility while placing responsibilities (cf. Eriksson and McConnell 2011; Quarantelli 1997; Rosenthal et al. 2001).

6 | Conclusion

This article has examined how collaboration shaped the adaptive processes of improvisation, sensemaking, and learning, each contributing differently to modularized scaling in the Danish pandemic response. It has revealed how these processes both enabled and hindered scaling in distinct ways. Improvisation facilitated rapid upscaling but lacked strategic foresight, complicating later adjustments. Sensemaking supported ongoing adaptation through resource reallocation, although downscaling efforts were often slowed by organizational hesitancy. Learning contributed to more durable changes and the development of new module designs, but its impact was constrained by limited structural support and the weak cross-sectoral transfer of lessons. Together, these findings illustrate how adaptive processes operate across different time horizons of crisis management and highlight the importance of collaborative capacity when scaling responses to turbulent events.

Some limitations of the study are worth noting. Modularized scaling is introduced as a novel analytical lens, yet it builds on foundational concepts such as modularity, scaling, and adaptive processes, which themselves are defined and applied in diverse ways across the literature. This conceptual plurality may limit precision and comparability, suggesting that further theoretical refinement could strengthen and consolidate the concept. Additionally, the study distinguishes between improvisation, sensemaking, and learning for analytical clarity, but these processes often overlap or interact in practice. Treating them individually risks obscuring their interconnections, but this choice was made to provide a broad overview of how each process may enable or hinder modularized scaling rather than to analyse their dynamic interplay in depth. In so doing, the study inevitably sacrifices some empirical richness that could have been gained by exploring each process more fully. Moreover, scaling was assessed through narrative accounts rather than formal metrics, such as staffing or financial data, which limits the precision of measurement. Finally, as a single-case study, the findings are context-specific; however, the Danish case offers valuable insight into the complexities of domestic crisis governance and helps to fill a notable gap in research on European civil–military collaboration.

Future research should aim to develop clearer conceptual and empirical frameworks for modularized scaling, including operational definitions and measurable indicators. Further research might also explore how improvisation, sensemaking, and learning interact in real time, mutually shaping and constraining each other during modularized scaling processes. While this study has explored civil–military collaboration as an illustrative case spanning multiple modules, future research could also investigate whether other forms of collaboration encounter different drivers and barriers to modularized scaling. Finally, incorporating quantitative measures alongside qualitative insights would offer a more comprehensive understanding of how crisis response systems evolve and adapt over time.

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Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

This study is based on confidential qualitative interviews and related internal documents that cannot be shared due to privacy and consent restrictions. Further information is available from the corresponding author.

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Supporting Information

Additional supporting information can be found online in the Supporting Information section.

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