Exercise Evaluation Creating Knowledge to Improve Information Resilience

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Abstract: Carrying out and evaluating exercises is typically seen as a very pragmatic means to improve performance of various security related organizations. In this research, we question this traditional perception of exercising and broaden the perspective to look at the evaluation of exercises as an integral part of the preparedness related knowledge management. This study utilizes as its theoretical framework a systemic model for information resilience created in the context of national preparedness by the Academy of Finland project IRWIN (Information Resilience in a Wicked Environment). The findings of the EU project INEGMA-E[2] are used as study material to unveil the specific features of evaluation systematics in reflection to information resilience. Exercises are understood as systems and evaluation as a process that captures the influencing factors of this system. In connection to information resilience, exercise evaluation concepts need to consider e.g. individual agency and group decision making features, while reflecting them with the development goals of the exercise system. Improvement of exercise evaluation as a process enhances the creation of validated knowledge for systemic development of preparedness at all levels. Exercise evaluation can also contribute to improving information resilience in connection to preparedness related governance and decision making.

1 INTRODUCTION

In the complex and deeply interconnected safety and security environments of today, new approaches to enhance cooperation between the many different civil protection professionals are needed. Yet, appropriate management of performance of very complex professional networks can only be done with accurate, timely and reliable information. Exercises can be excellent means of providing data for creation of validated knowledge. Evaluation of exercises is a crucial element to guide validation of this knowledge.

Carrying out of civil protection exercises (CPE) or their evaluation should not, however, be conducted in a vacuum. To be meaningful, this activity should have clear apprehensible connections to wider societal targets. In Finland CPEs are often programmed in the context of preparedness activity outlined by the Emergency Powers Act (EPA), which sets demands for the different government branches develop and maintain their preparedness in case of times of crises. Preparedness thus covers both proactive actions that help prevent and mitigate crises, and actions during crises – whether or not directed by enforcement of the EPA regulated specific powers.

National Preparedness in Finland is directed by the Government Resolution on Societal Security (Lonka 2016, Lonka 2013) that sets the general guidance for preparedness work at the different levels of administration. Exercises are a crucial element of preparedness work. Yet, the way the resolution does not provide guidelines for carrying out exercises and further, the gathering and analysis of knowledge gained from them. This article intends to increase understanding on how knowledge created by the Civil Protection Exercises could more efficiently feed in the knowledge base of national preparedness planning. The issue is central from the point of view of improvement of the national security related knowledge management. This is a specific challenge as national security affects many stakeholders with divergent interests and perspectives, as no individual actor has the resources or information to alone

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address preparedness on a societal level (Rantamäki et al. 2023).

The concept of information resilience in the wicked environment created by the Academy of Finland project Information Resilience in a Wicked Environment (IRWIN 2020-2023) is utilized as a theoretical framework for this study. In project IRWIN information resilience is approached as a holistic concept that is strongly embedded in the structures, processes, institutions and collective agency of the democratic system. The project has contributed considerably to widening the earlier, rather technical definition of information resilience as documented in Uusikylä et al. (2024) and Rantamäki (2024): in the field of public policy, information resilience is often defined as the capacity of individuals, communities, and societies to withstand misinformation, disinformation, and other forms of information manipulation and recover from them.

The concept can, however, be seen as being wider than only resisting the false information and mitigating its effects. An important aspect is that information resilience includes the ability to operate amid in-formation uncertainty and imperfection. This sets a societal target to create robust information infrastructures that enable people to access, evaluate, and use information effectively. In the context of the IRWIN project this constructs a central governance perspective for understanding information resilience as a systemic phenomenon which becomes formed in interaction between actors in an uncertain and fluctuating environment. (Rantamäki & Jalonen 2022.) According to Rantamäki (2024) information resilience appears in interaction, during uncertainty and is characterized by systemicity.

The IRWIN project approaches the issue of robustness of information resilience from two perspectives: 1) the ability of the governance and regulatory system to embrace complexity and create adaptive, agile, and collaborative forms of interaction and participation, and 2) the role of citizens as agents in enhancing or hampering information resilience. The main research question of the project was how to redesign systems of governance and regulation, participation of citizens, and protection of the knowledge society by understanding information resilience as a critical element for national preparedness in a complex environment.

Exercises are traditionally seen as a tool to practice individuals and organizations to carry out their civil protection tasks resourcefully (Beerens 2021, Beerens et al. 2021). Thus, evaluation of exercises often focuses rather narrowly on listing findings of necessary improvements from the point of view of a specific organization (Borell and Ericsson 2013, Heath 1998). More seldom is the evaluation process seen to tackle wider aspects of improving knowledge management, organizational learning, and communication in wider civil protection networks (Wybo 2008).

This article studies exercise evaluation concepts, as investigated and elaborated in the EU project INEGMA-E^2 (International Network of Evaluators & Guideline for a Methodological Approach in Exercise Evaluation). The study looks at the potential that exercise evaluation has to feed in and improve information resilience in connection to national preparedness and related to its governance and decision making. The research question that this article intends to answer: How can civil protection exercise evaluation enhance the creation of validated knowledge on disaster management to improve information resilience in the context of national preparedness?

The findings of the INEGMA-E^2 project are used as study material on the usefulness and improvement needs of civil protection exercise evaluation. Thus, this research is not empirical but a theoretical study combining the findings of the two projects. The synthesis is structured in line with the theoretical framework provided by IRWIN project in the fields of governance and regulation, individuals' collective agency and com-batting mis- and disinformation (see Uusikylä et al. 2024).

2 METHOD

The goal of this research is to deepen understanding on how civil protection exercise evaluation can enhance the creation of validated knowledge on disaster management and thus improve information resilience in the context of national preparedness. It uses the findings of the two recent projects: INEGMA-E^2 and IRWIN which complete each other. INEGMA-E^2 project serves with findings on how evaluation of exercises can be improved to produce applicable knowledge for systemic improvement of organizational performance. The IRWIN project adopts a systemic view on information resilience that enables a shift from a descriptive to an explanatory analysis of crisis preparedness (Uusikylä et al. 2024). Combination of these two approaches provides an integrated view on systemic knowledge gathering of functional preparedness performance, i.e. the exercise evaluation process. This knowledge feeds in to replenishing the theoretical framework of in-formation resilience in the context of national

preparedness. In this integral picture the exercise-based knowledge elements offer an enabling factor for explanatory analysis of crisis preparedness which the IRWIN project targeted for.

Figure 1 presents the theoretical framework of the study. In this illustration the original systemic categories of information resilience in the context of national security as created by the causal loop diagram technique (CLD) for analytic purposes of the IRWIN project have been reduced to four for the sake of the analytical simplicity (Uusikylä et al. 2024). The theoretical framework of the IRWIN project provides a theory base which is used to reflect the findings of the INEGMA-E^2 project. The method is theoretical deductive.

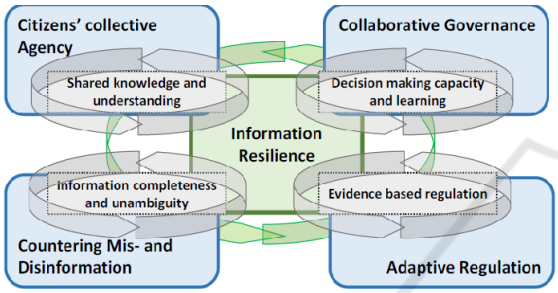

Figure 1: The theoretical framework of the study. Based on systems model for in-formation resilience in the context of national security (modified by authors from Uusikylä et al. 2024).

In the framework of the IRWIN project (Figure 1), the four fields cover different aspects which create building blocks for information resilience in the contexts of the collective agency of individuals, governance and regulatory activities, and countering malicious information actions. The theoretical background of these concepts will be presented in the next chapter.

3 THEORETICAL APPROACH

The theoretical approach of this work (Figure 1) is based on the framework created in the Academy of Finland project IRWIN. It provides a conceptual model to understand the role of information resilience as a part of national preparedness and security of supply in a wicked and complex environment. The framework adopts a systemic view of information resilience enabling a shift from a descriptive to an explanatory analysis of crisis preparedness (Uusikylä et al. 2024).

Information resilience is a systemic phenomenon manifesting itself in the interaction between actors in an uncertain environment. The logic of emergence suggests that the interaction between actors generates information resilience and influences their interactions. Information resilience strengthens information-related agency and reduces information-related vulnerabilities, such as the effects of misinformation and disinformation. On the other hand, information resilience can be defined as the capacity of individuals, communities, and societies to withstand and recover from misinformation, disinformation, and other forms of information manipulation. The concept also encompasses the ability to operate amid information uncertainty and imperfection. Establishing information resilience involves the development of cognitive skills, critical thinking, and information literacy. Moreover, a robust information infrastructure that enables actors to access, evaluate, and use information effectively is critical. (Rantamäki et al. 2023, Rantamäki 2024)

Collective agency of citizens plays a central role in tackling the preparedness for unprecedented crises. In this perspective individuals are not just users of information but also active agents who participate in solving issues (Bifulco 2013). Collective agency is based on the perceived collective efficacy of individuals, which is shared belief in collective capabilities to execute actions (Bandura, 2002).

Collaborative governance is closely connected to the concept of complexity in the sphere of governance. It illustrates how parts of a system can self-organize and create seemingly coordinated and adaptive behaviour even without centralized government or leadership (Klijn 2008). Complexity thinking includes a wide set of concepts that can be used to explore the dynamics of socio-economic systems (Cilliers 1998, Byrne & Callaghan 2014). The complexity leadership theory (CLT) developed in organizational context underlines the point that the adaptive space of leadership is created when the informal and formal side of knowledge confront.

Adaptive regulation includes all aspects which enable good quality characteristics of regulation. These can be defined according to EU Impact Assessment Guidelines as so-called SMART qualities: regulation should be specific, measurable, achievable, realistic and time dependent. A comprehensive and holistic approach to regulatory development facing complex networks and societal demands is crucial in the context of national crisis preparedness (Lonka 2016).

Diverse viewpoints including those of citizens and practitioners are vital for developing robust regulation and operational practices for national preparedness (Santonen & Paasonen 2017). The

regulatory burden, i.e., costs and responsibilities, should be shared and not accumulated in governmental agencies (Baldwin et al. 2012). These aspects underline the importance of whole-of-society participating in sharing the burden of crisis and crisis preparedness guided by the regulation.

Counteracting mis- and disinformation is a very important activity in relation to the information resilience in the context of national preparedness. Social media in to-day's world is a central channel for distributing misinformation and disinformation and it is also a key instrument for influencing all societal activity including politics (Norri-Sederholm et al. 2020). A central part of the modern national security is the capability of public authorities to detect and counter disinformation and other intentional efforts to maliciously influence the flow of information. Information resilience in this context refers to the notion that during a crisis as well citizens as various stakeholders of different critical activities must receive and understand the central governmental information quickly and accurately. That is a prerequisite for them to behave accordingly in their private sphere and in various societal and public activities during times of crises.

4 THE CONTEXT OF CIVIL PROTECTION EXERCISES

In the INEGMA-E^2 project the evaluation of civil protection exercises has been viewed as a ground to train and validate tactics and strategies, to identify strengths and shortcomings and to stimulate exchange on best-practices. All in all, these provide an opportunity for learning and development.

The three pillars of the INEGMA-E^2 project were: 1) To develop an adequate and versatile evaluation methodology, addressing the different types of existing exercises. 2) To explore existing tools, software solutions and technical tools alike, which can facilitate data collection throughout an exercise process. 3) To create an international pool of evaluators, who meet a certain skill set that is defined and trained during the project. (Bruns et al. 2022)

Systematically interconnecting evaluation methods, tools and available evaluators can importantly contribute to a continuous improvement of the outcomes of European civil protection exercises (Heinonen et al. 2024). It is central to understand these elements from a holistic view because civil protection exercises create a European system that includes many national and regional systems of systems and sub-systems (Heath, 1998; Heinonen et al. 2024). Exercise evaluation should have a wider scope and be seen as an instrument for quality assurance, validation, accountability, and knowledge gathering in the field of civil protection.

This chapter presents key findings of the INEGMA-E^2 project in connection to the need for development of the evaluation of exercises in a systemic manner. These findings are then reflected with the theoretical framework of the IRWIN project. The INEGMA-E^2 project analysis was structured according to the exercise evaluation focus divided in three entities which are systems, structures, and processes (Ruoslahti & Lonka 2024). These three categories are used as a basis for identifying the key activities which are central goals for practical exercise evaluation efforts.

Firstly, exercise evaluation targets at capturing the influencing factors of a system. System in this context refers to the man-made or natural formations present in the exercise situation. Such system-influencing factors may include, for example, project management, exercise preparation, the scenarios, on-site security, or cultural factors. All these factors can be influenced by practical organizers or administrative level planners of the exercise and its goals. Possible flaws in project management can lead to the exercise objectives being lost in the preparation phase, while poorly prepared and designed locations can harm the realization of exercise targets in field. In such situations the failure of the exercise results can be seen as due to the flaws in the conditions of the operational environment. (Bruns et al., 2022).

A second category to focus on in the evaluation are structures referring to devices and mechanisms by which the exercise system is operated and managed (Ruoslahti & Lonka 2025). The focus of exercise evaluation in this category lay in the structures designed for response management, while evaluation may measure and analyse resolution strategies as well as possible alternative measures (Döring & Bortz, p. 1009). The organizational structure of an exercise determines widely the information flows between system parts and sub-systems. In centralized structures decisions would flow top-down, while in decentralized structures, decision-making becomes distributed among various levels of the exercise organization. Structures may either lead to a defined chain of command, or in other case allow every actor to have a high level of personal agency (Ruoslahti & Lonka 2025).

The organizational processes as evaluation foci refer to how structures are managed. They cover the activities which establish the goals of the exercise

from the point of view of a specific participating organization and guide the analysis of how operations and human interactions are carried out to manage the exercise scenario. In the context of exercise evaluation, factors such as communication and cooperation in realizing exercise scenarios can be used to scrutinize the exercise system. In the process approach communication contributes to three phases of value creation (1) input, (2) throughput and (3) output (Vos and Schoemaker 2004). Evaluation within an exercise system, consider its structures and processes in relation to the requirements of the exercise scenario. Looking at civil protection exercises through this lens can help systematize the evaluation of how these three concepts become addressed across the exercise and its different scenarios (Table 1).

Table 1: Input, throughput, and output communication in the context of civil protection exercises (modified by authors from Vos and Schoemaker 2004).

Input communication	Throughput communication	Output communication
Reading materials (e.g., planning documents) Observation Interview Survey ←	Analysis of data Communication between evaluators FEEDBACK	After event hot wash up Evaluation report ←

As seen in Table 1, the notion of input – throughput – output – feedback can help make sense evaluation foci. In an exercise context these can be seen to form a process cycle of interrelated activities. Civil protection exercises and their evaluation projects gather teams of diverse expertise to achieve common goals that demonstrate a need to actively manage communication in all these three phases of knowledge development in the context of civil protection exercises (Canonico et al. 2013).

Inputs may be resources, and outputs learning, knowledge creation processes, and ideas (Mitchell & Boyle 2010), while throughput are the interactions between the exercise actors (Pinho et al. 2014). Evolving input, throughput and output communication can engage various stakeholders and civil protection experts in knowledge sharing and adapting participation strategies over time.

5 RESULTS

The added value of this research is that it connects the concept of civil protection exercise evaluation into a framework of creating and enhancing information resilience. The common factor between these two seemingly remote approaches is systemic knowledge creation. The systemicity in exercise evaluation refers to evaluation as a process. This process ideally combines parts of individual exercises (sub-systems) to one analytical entity (a system). Furthermore, it can enhance selected data sets from individual exercises so that they could be compared between e.g. different exercise types or over time (Ruoslahti & Lonka 2024). Information resilience is a concept that particularly underlines the fact that resilience in connection to the information dimension of crises requires active networked cooperation and interaction be-tween different systems. In addition, the study of Rantamäki (2024) emphasises the importance of creating an operating culture that accepts information uncertainty, maintains systemic trust, and proactively strengthens information-related capabilities in the context of crises and preparedness.

For this study we chose the specific elements of the IRWIN project-based systems model to assist analysis of exercise evaluation features which support or resist creation of information resilience. These elements are: 1) shared knowledge and understanding; 2) decision making capacity and learning; 3) evidence-based regulation; 4) countering mis- and disinformation. These elements function in different manners for different types of exercises and in connection to different types of exercise evaluation concepts. The collective agency of individuals and countering mis- and disinformation plays a key role in study of the exercise organization processes. Governance and regulation related elements, on the other hand, are central for more systemic analysis of information flows in connection to the civil protection exercises.

Shared knowledge and understanding are clearly prerequisites for exercise process to fulfil its tasks. These are connected to how individuals create collective agency which is central for different task forces at the exercise to carry out their organizational and group related duties. Human interaction, communication and collaboration are key activities in successfully fulfilling the tasks related to the exercise scenario. For the process analysis of exercise evaluation, understanding the rationale behind individual actions and decision making that concerns shared actions becomes central. For this evaluation

focus e.g. individual and group interviews are important means of gathering information.

The governance and regulation related elements of the framework, i.e., decision making capacity and learning as well as enhancing evidence-based regulation, are elements that enable successful exercise processes and interconnect the exercise process to the meta-level expectations and targets of the exercise as a system of systems. The findings in relation to these elements feed into different administrative levels and reveal the development needs on organizational level and on leadership matters. These aspects have not been part of the INEGMA-E^2 project, the focus of which was more in the civil protection exercises concentrating on development of exercise activities of individual civil protection professional organizations. Evaluation of wider interconnected systems like the EU MODEX exercise system, which involve larger variety of different stakeholders, could benefit from this approach.

Countering mis- and disinformation will probably gain more attention in the future as many aspects of exercise processes, including their evaluation, become increasingly dependent on digital tools and database solutions, which may increase systemic vulnerabilities if providing effective channels for malicious information that may influence the exercise process.

Exercise evaluation findings should also, in the future, provide more information on aspects of cyber and information security. As digital elements become a more integral part of exercise scenarios the creation of information safety and security sensitive exercise scenarios will be an important challenge. Evaluation findings can become more useful in enhancing systemic improvements in the context of information resilience.

6 DISCUSSION

The three exercise evaluation concepts: system, structures, and processes influence each other and form a tight coupling with many interdependencies (Vos 2017). There are complex interactions between people, technologies, and processes as well as with governance systems at the different levels behind and inside the exercise organizations (Lonka and Wybo 2005). These create complex leadership systems but also socio-technical ones combining human activities with information technologies (Wybo and Lonka 2002).

When we study information resilience in connection to exercise evaluation, the application of systemic approaches to evaluation tasks becomes central. It makes a difference, whether an exercise is studied as an adaptive system or a strictly formalized activity. The latter approach easily leads to the results which can only reveal findings already written down in the exercise plan (Wybo 2008). At the same time, it may strongly diminish the sphere of individual agency and innovativeness in the exercise situation.

We claim that understanding the exercise as a system opens avenues for wider applicability of evaluation findings. The concept of information resilience supports the analysis of exercise evaluation findings in connection to networks of participants and stakeholders, improvement of their knowledge exchange and mutual learning and in developing exercise processes as individual cases or as combined cases over time (Ruoslahti & Lonka 2025, Yin 1984).

The real challenge for exercise evaluation lies in the actual planning of the exercises. According to Wybo (2008) the simulation, which an exercise is, might assist in enhancing the learning from the extraordinary situations – which crises are. There are, however, important obstacles for this learning. "… in some contexts, all members of the organization are invited to integrate safety within their professional identity. During degraded situations, experts tend to consider adaptations and innovations as a 'normal way' to use their skills and experience when they must cope within a risky situation. By doing so, they will be reluctant to talk about it and this 'expertise in action' will not be shared and learned by other players." The question remains, how to enable adaptive reactions at the exercise situations and how to be able effectively use these experiences as lessons learned in the evaluation process.

For the lessons learned in connection to collaborative governance and adaptive regulation, the system guiding the exercise scenario work as well as evaluation concepts play a central role. Again, the planning phase of the exercise becomes crucial, and it would be preferable to involve as many stakeholders to the exercise planning as possible (Lonka and Wybo 2005). If we target the exercise evaluation to provide useful feedback for governance and regulation, we need to involve appropriate stakeholders to both scenario and exercise planning process. In some sense exercise planning and evaluation are similar processes as stakeholder hearings in drafting laws, where a participatory approach can bring along crucial information for implementation (Keinänen et al. 2024).

7 CONCLUSIONS

This article has discussed on how evaluation of civil protection exercises can be used to enhance the creation of validated knowledge for improving information resilience in the context of national preparedness. Information resilience is understood as a holistic concept that is strongly embedded in the structures, processes, institutions, and collective agency of the democratic system (Uusikylä et al. 2024). The specific value of the concept of information resilience in the scope of this research is that it helps to focus on characteristics of knowledge and its formation in uncertain and fluctuating environment and in interaction between groups and individuals (Rantamäki & Jalonen 2022, Rantamäki et al. 2023).

When analysing civil protection exercise evaluation from aspects of systems, structures and processes we can discern the specific role of creation, use and flow of knowledge and information in each of them. At the systems level the evaluation attention is focused on exercise administrative level like project management, exercise preparation, scenarios, on-site security decisions and general cultural factors. The critical actors at this level are practical organizers and administrative level planners setting the goals for the exercise and refining the exercise plans. The role of information and knowledge is clearly very similar as in general governance work in planning, organization and decision making.

At the structures level the evaluation focuses on devices and mechanisms by which the exercise system is operated and managed. Examples of these are response management, resolution strategies and decisions on possible alternative measures to solve the situations in the field. At this level the exercise evaluation concepts need especially to consider individual agency, group decision making and mechanisms targeting to fulfil the systemic goals of the exercise.

On an organization level, evaluation focuses on how structures are managed. This includes activities which establish the goals of the exercise from the point of view of a specific participating organization and guide the analysis on how operations and human interactions are carried out to manage the exercise scenario. The organizational structure of an exercise determines widely the information flows between system parts and sub-systems. In the context of the exercise evaluation at this level, factors such as communication and cooperation in realizing the exercise scenario become central.

The key finding of this study is that the concept of information resilience can serve as a useful guideline in creating the analytical frameworks for civil protection exercise evaluation. It is obvious that the information revealed by the exercise evaluation can and should be utilized also wider than only for the feedback and improvement of the organizations whose activities have been the primary focus of an exercise. Civil protection activity is not only operational work but does have bearing to the wider perspectives of the societal and even national preparedness. We should improve the usefulness of exercise evaluation process to better provide such preparedness related information.

Further study is recommended with actual interaction data to help validate the effectiveness of the discussed features for further practical implementation and to examine potential for stronger real-world impacts.

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