

Comparison Analysis of the Integration of Early Warning Systems in the Nordic-Baltic Region

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ABSTRACT

This study examines the integration and effectiveness of Early Warning Systems (EWS) across the Nordic–Baltic Eight (NB8) countries, namely Denmark, Estonia, Finland, Iceland, Latvia, Lithuania, Norway, and Sweden. Through a mixed method exploratory design combining national technological data, hazard exposure profiles, and public trust indicators, the analysis reveals a high degree of technological convergence in hazard monitoring, data analytics, and multi-channel risk communication. Despite consistent exposure to major environmental hazards, particularly floods, significant disparities emerge in societal trust and coping capacity, indicating that technological robustness alone does not ensure societal resilience. The findings highlight a gap between institutional capabilities and public perception, with lower trust levels in several countries posing risks to warning compliance and crisis response effectiveness. While regional cooperation and adherence to international standards contribute to uniform EWS structures, uneven societal and infrastructural conditions limit the overall resilience potential. The study concludes that strengthening community engagement, improving risk communication credibility, and tailoring resilience strategies to national and sub national contexts are essential for enhancing the end-to-end performance of EWS in the NB8 region.

Keywords

Crisis, Resilience, Nordic-Baltic, Technology, Early Warning Systems.

INTRODUCTION

Effective crisis communication is among the primary elements of resilience within any societal unit or construct. In an era marked by transboundary and interconnected threats ranging from pandemics and natural disasters to cyberattacks and geopolitical tensions, the ability to detect, assess, and respond to emerging risks is critical. Early Warning Systems (EWS) serve as vital mechanisms for anticipating hazardous events and enabling timely interventions for risk mitigation. Some scholars emphasize that effective EWS should be both people-centred and end-to-end, coupling robust science with trusted communication and response capability (Basher, 2006; Glantz, 2009). By integrating sensors, data analytics, and communication infrastructures, EWS provides stakeholders with useful information about potential hazards and can be employed to minimize the impact of destructive events such as floods, epidemics, or infrastructure failures (UNDRR, 2025). Within the Preparedness Union Strategy launched by the European Commission in 2025, improving and harmonizing EWS is explicitly listed among 30 key actions to strengthen societal resilience across EU Member States, including actions on population preparedness and risk communication. Yet, due to differing national priorities, standards, and the EU’s multi-level governance, the effectiveness, interoperability, and practical employment of EWS vary substantially across countries. This variability can be observed in the Nordic–Baltic region, which faces a distinct compound-risk landscape. Firstly, climate change is intensifying hydro-meteorological events such as heavy rainfall, flooding, storms, wildfires, and rapid seasonal transitions (Bednar-Friedl et al., 2022; EEA, 2024). Recent assessments show the year 2023 as the warmest year on record, with heatwaves, floods, droughts and wildfires undermining socio-economic development across Europe (WMO, 2024). Second, the region’s high digitalization and critical-infrastructure interdependence increases the exposure to cyber and hybrid threats; recent EU threat-landscape reporting highlights continuous ransomware, rapid vulnerability exploitation, and ideologically-motivated hacktivist campaigns affecting public administration, transport (e.g. weather balloon attacks on Vilnius airport), and other essential sectors (ENISA, 2025; BBC, 2025). Third, closeness to ongoing geopolitical tensions around the Baltic

Sea comes with an increased information manipulation and interference risks; systematic analyses document Russian information influence operations targeting the NB8, attempting to diminish the general trust in institutions and complicating crisis communication (Sazonov et al., 2024). Collectively, these risk profiles demand multi-hazard, interoperable, and trusted early warning mechanisms that address both natural and human-induced hazards. The importance of studying the Nordic–Baltic region therefore can be explained through an analytical and practical level. On an analytical level, the region offers an advanced testbed of digitally enabled, governance-efficient societies where EWS can be integrated across meteorological, hydrological, public-health, cybersecurity, and strategic-communications domains (Basher, 2006; Glantz, 2009). On a practical level, the participation in EU and UN initiatives such as the Preparedness Union Strategy and the UN Early Warnings for All (EW4All) agenda, can be taken as a level of coordinated commitment to expand multi-hazard EWS coverage, strengthen observation and forecasting, upgrade warning dissemination, and enhance preparedness and response capabilities. At the same time, the media fragmentation and disinformation interfere in warning effectiveness as the statistical evidence from the NB8 shows active foreign interference, seeking to undermine trust in official governmental sources (Sazonov et al., 2024). The aim of this paper is to analyze the employment of Early Warning Systems across Nordic and Baltic countries, with particular attention to technological capacities and communication tools alongside the trust dynamics that shape the real-world effectiveness of hazard preparedness in the region.

Disaster Risk Reduction

In academic discourse, Disaster Risk Reduction (DRR) is known to have many different definitions. According to the United Nations Office for Disaster Risk Reduction (UNDRR), the Disaster Risk Reduction is aimed at preventing new disasters and reducing and managing current disasters, in order to strengthen resilience. Twigg (2015) argues that Disaster Risk Reduction can be widely understood as the creation and application of policies and strategies in order to reduce the disaster risks and vulnerabilities in society. Izumi et al. (2019) emphasizes that the strengthened cooperation between science and policy could improve the existing DRR framework. Moreover, Lee et al. (2018) proposes that when the scientific field and the executive technological field cooperate, it results in the fostering of technological innovation and the mitigation of disaster risk. As a result, newly emerged tools effectively aid in coping with hazards, some of the examples include the early warning systems, Earth observation or innovations in the building technology of infrastructure in order to enhance its resilience (Hu et al., 2018; Shaw et al., 2016). The Sendai Framework for Disaster Risk Reduction (SFDRR) of the United Nations promotes investments in technological innovations and research, which aims to diminish disaster risks and interdependence and to improve risk management processes. With the utilization of technologies in risk reduction, it should be noted that it has some limitations and challenges. In the UNDRR special report on the use of technology for disaster risk reduction (2025), it is stated that while technologies such as artificial intelligence (AI) and machine learning (ML) have granted significant progress in EWS, Earth observation and hazard analysis, the employment of these technologies alone cannot solve the DRR challenges. The effectiveness of these technologies depends on their integration with societal domains such as socioeconomics, culture, infrastructure and others. Furthermore, the design and the application of these technologies is not universal, leaving some regions lacking behind, not being able to use the existing tools due to financial, infrastructure or other constraints.

Crisis Communication

In academic literature the study of communication as a field of science is relatively recent. With the dawn of mass media communication tools (radio, television, world-wide-web, etc.), the relevance to study these phenomena grew (Simonson et al., 2019). It can be argued that communication is one of the key pillars in human civilization that empowered individuals and societies for collective knowledge by the transmission of information. In light of recent crises that challenged global societies, the role and impact of communication became more important. Barton (2001) argues the swift actions of crisis managers can reduce the possible harmful effects of a crisis, so the extent of damage would be minimized. Moreover, as the nature, origin and severity of the crises differ, it is important to identify and categorize the exact type of crisis, as it can be crucial to study its effects and to create adequate response mechanisms (Björck, 2016; Xue et al., 2022; Liu et al., 2025). One of the definitions of the crisis communication offered by Coombs (2010) suggests that crisis communication can be regarded as a strategic employment of words and actions during a disruptive event. The goal of strategic communication is to reach various objectives such as protecting the stakeholders, limiting the potential damage, shaping the perception and others. Furthermore, the emphasis on the difference between the terms crisis and crisis process is put.

Crisis communication is an integral part of the crisis process, which throughout its duration and different phases requires different communicative strategies and approaches. Academicians of the field (Roux-Dufort, 2007;

Coombs, 2014) point out crises rarely are linear in nature, and because of their complexity they require a multi-level response and analysis. The regenerative model can assist in best addressing the pre- and post-crisis phases, alongside the best fitting crisis communication strategy. The perception of a crisis is likely to shift throughout the duration of the crisis, which can impact the stages on the timeline or even trigger new events. The figure below (Figure 1) shows the regenerative crisis model which illustrates the fluidity of crises alongside the shift in the different phases of the crisis. The communication demands and strategies correspond to the different crisis phases.

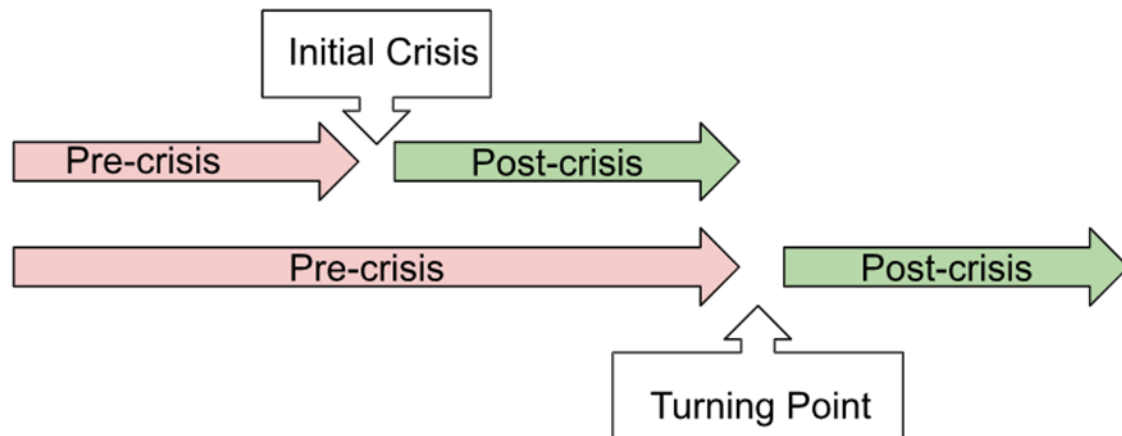


Figure 1. Regenerative crisis model (based on Coombs, 2017)

An integral part of crisis communication is crisis response strategies. These strategies can be categorized into three broad blocks: instructing information, adjusting information and reputation management (Sturges, 1994). The primary objective of instructing information is the physical protection of people during crisis events and managing the information. Some examples can include the warnings given when a health hazard appears (e.g. chemical release, floods, outbreak of fire, etc.). Adjusting information aims to provide psychological protection for people by combining the management of the information and the meaning behind it. For example, the expression of sympathy, counseling for trauma and others. These two strategies should be among the first ones to be used during a crisis event as they primarily focus on public welfare. Reputation management on the other hand is a strategy that focuses on the improvement of the reputation of an organization. According to Coombs (2015) the sub-strategies include the denial, diminish, rebuild and bolster. Crisis communication and crisis response strategies can be analyzed and evaluated by employing the Situational crisis communication theory (SCCT) by exploring the relationships between the public and organizational aspects. The three aforementioned crisis response strategies can be categorized by employing the SCCT from defensive to accommodative. The former focuses on the protection of the organization while the latter helps the crisis victims. As there are multiple types of crises, the SCCT defines three main categories for organizational crises: victim, accidental and intentional. Despite the clear differences between the typologies, the accurate identification of the crisis type can be challenging due to media manipulation (Coombs, 2019).

Another crucial element of crisis communication is the timing, in particular when communication about a crisis happens. Studies show that a crisis can be less damaging when an organization communicates in a timely manner (Arpan & Pompper, 2003). Stealing thunder can be defined as a highly proactive approach in releasing the news in the event of a crisis. It can be argued that the selection of post-crisis response strategies matters less if the crisis was communicated proactively and more if this is not the case (Claeys & Cauberghe, 2012). Despite the arguably positive outcome of stealing the thunder about a crisis, the reality can be different due to the fear of managers by acting too soon, hoping to resolve the matter internally, or legal constraints (Coombs, 2019).

Early Warning Systems

Humanity has long depended on the natural environment and resources, which are vulnerable to destruction and degradation. With the advancement and increasing complexity of human society and the corresponding growing impact of humans on the environment, the dependence on the natural environment steadily decreased, while the monitoring and the control of the natural environment rapidly grew. According to the World Meteorological Organization (WMO) half of all recorded disasters in the last 50 years were weather, climate and water related. Furthermore, the WMO states that the number of disasters has increased 5 times in a 50-year timespan.

In light of these developments and processes, accompanied by the growing need to protect ourselves from climate related hazards, protective measures in the form of Early-Warning Systems were developed over time. In general, there is no universal definition given for an Early-Warning-System (EWS), according to the United States Environmental Protection Agency, an Early warning system can be defined as an integrated system for monitoring, collecting data, analyzing, interpreting, and communicating monitored data, which can then be used to make decisions early enough to protect public health and the environment and to minimize unnecessary concern and inconvenience to the public (USEPA, 2005), whereas the United Nations International Strategy for Disaster Reduction (UNISDR) defines it as the capacities necessary to identify and analyze information in order to have an adequate and meaningful warning information, which in turn allows communities or individuals to prepare and act appropriately in a sufficient timeframe and minimizes the possible loss (UNISDR, 2012). According to the World Meteorological Organization, the employment of EWS's can reduce the potential damage up to 30 percent when the warning is communicated within 24 hours. Furthermore, the number of climate related disasters, which correspond to 50 percent of all recorded disasters, has increased over five times over a 50-year period between 1970 and 2019. Despite the global interest, investments and the proven value of EWS's, the implementation of them remains fractured, since it depends on the priorities of respective national governments. In order to be effective, the EWS has to provide information about possible hazardous events on time and through the different communication pathways to vulnerable communities. Additional challenges and difficulties arise when attempting to reach marginalized or distant communities (e.g. people without internet access). Islam et al. (2025) identifies the key success factors of EWS's precisely risk awareness, efficient technology, comprehensive communication, robust governance and community readiness.

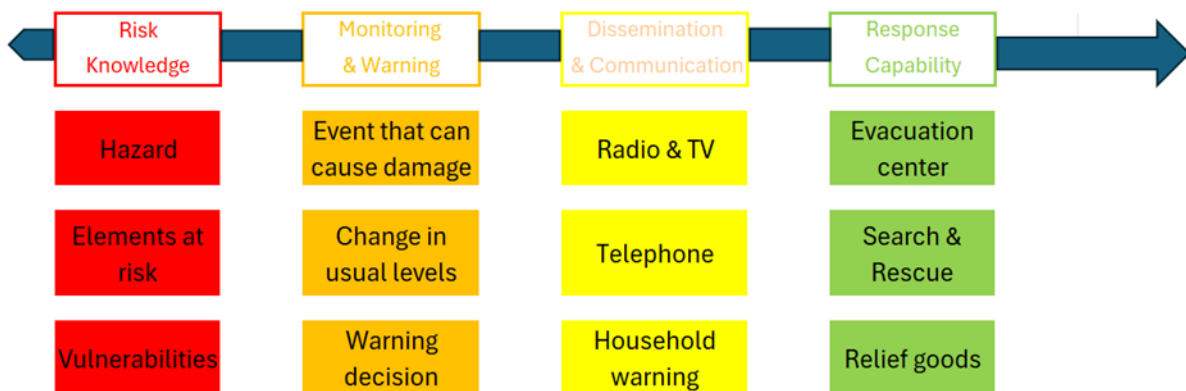


Figure 2. Integrated Warning System

The Nordic-Baltic Eight share a close cooperation on early warning and situational awareness to address both climate-driven hazards and hybrid threats in and around the Baltic Sea. The NB8 can be described as increasingly proactive and agile in regional security, reflecting an expanded reliance on shared surveillance through integrated monitoring, data-sharing, and cross-border preparedness and early warning architectures (Hallgren & Rhinard, 2025; Rokhideh et al., 2025). Among the key factors for high integrity of EWS in the region, the supranational cooperation through international organizations and institutions can be observed (e.g. NATO-aligned maritime and coastal surveillance which aims to protect critical infrastructure and supports hazard detection and warning across the Baltic coastline). The NB8 countries employ various technologies for early hazard and threat detection for national resilience building and cross-border regional coordination to counter hybrid threats (Hallgren & Rhinard, 2025).

To summarize, the Early Warning Systems serve as a vital tool for reducing the negative outcomes of natural hazards by accumulating, analyzing and sharing timely data and warnings. As the EWS are primarily used to inform about climate related events, the technology can be employed to distribute information warnings of different nature. Despite the potential benefits regarding the protection of society, the lack of standardization and differing national priorities, constrain the possible effectiveness of EWS.

METHODOLOGY

This study explores the integration of various technological tools within Early Warning Systems (EWS) across

the Nordic-Baltic Eight (NB8) countries, while also examining exposure to diverse risk profiles and hazard-related threats. A mixed-method empirical case study design was adopted for this exploratory research, enabling the analysis of both technical system characteristics and institutional-societal dynamics. Empirical datasets capturing technological capacities such as the use of satellite imagery, artificial intelligence applications, and other digital monitoring and analytics tools, were constructed using official national sources across the NB8 countries.

Conceptually, the study encompasses risk governance theory, which emphasizes that effective risk management stems from the interaction of scientific assessment, institutional decision-making, and the communication with society rather than from technical systems alone. From this perspective, early warning systems are a part of both social and technical governance arrangements that link hazard detection, organizational coordination, and public interpretation. As a result, assessing the effectiveness of EWS requires attention not only to technological performance but also to governance structures and mechanisms that mediate how warnings are generated, communicated, and acted upon. From a theoretical perspective, early warning systems function not merely as technical infrastructures, but as institutional communicative arrangements, whose effectiveness depends on the alignment between scientific knowledge and the relation between the public sector and citizens (Renn, 2017).

In addition to the technological indicators, the study incorporates public perception and institutional trust data, drawing on OECD indicators related to trust in national and local governments and perceptions of governmental capacity to protect citizens during large-scale emergencies. Institutional trust forms a central explanatory variable within both institutional trust theory and resilience governance frameworks, as it shapes the willingness of populations to accept authoritative guidance under conditions of uncertainty. Public trust is a critical determinant of EWS effectiveness because it influences whether individuals believe, interpret, and act upon warning messages. It directly affects compliance with evacuation orders, adoption of precautionary behaviours, and participation in preparedness initiatives (Russo, 2025).

Beyond shaping individual behaviour, trust also enhances the perceived legitimacy and acceptability of authorities' decisions, strengthening compliance with official risk communications (Hawkins, 2024). From a resilience governance perspective, trust can thus be understood as an enabling condition for collective action, learning, and adaptive capacity, rather than merely an attitudinal variable. In this view, resilience is not produced by technology alone, but by the alignment of institutional credibility, communication practices, and societal engagement.

This theoretical understanding aligns closely with global disaster risk reduction guidance under the Sendai Framework, which emphasizes that effective early warning systems must be people-centred and developed through participatory processes that foster trusted relationships between institutions and communities. Such processes are essential to ensure that warning messages are not only transmitted but also understood, perceived as legitimate, and translated into protective action (Risk-informed Early Action Partnership, 2025; Russo, 2025). Supporting this view, Pescaroli et al. (2025) demonstrate that trust in information sources constitutes a key factor in warning reception and protective action, highlighting that social and institutional conditions can be as decisive as technical capabilities in shaping early warning outcomes.

Sample: Nordic and Baltic countries, namely Denmark, Estonia, Finland, Iceland, Latvia, Lithuania, Norway, and Sweden.

Data collection: data was collected using official and media NB8 sources and OECD in February 2026.

Missing values: OECD data for Lithuania of 2023 was missing, no other sources could fill the hiatus. Therefore, absent values were left.

Data sources: OECD, INFORM Risk, Latvian Public Media, Ministry of the Interior of the Republic of Latvia, European Environmental Agency, LatViaNature, Lithuanian Radio and Television, Environmental Protection Department under the Lithuanian Ministry of Environment, National Crisis Management Centre of Lithuania, The Ministry of the Interior of the Republic of Lithuania, Satlas.dk, DENMARK'S NATIONAL SPACE STRATEGY, Nordic Co-operation, Keskkonnaportaal, Estonian Environmental Agency, ERR.ee, Stenbocki Maja (kriis.ee), National Cyber Security Centre Finland, Finnish Meteorological institute, Finnish Environment Institute, Lithuanian Hydrometeorological Service, SMHI.se, Statistics Sweden, Swedish Space Agency, SVT.se, Swedish Civil Defence and Resilience Agency, The Peace Research Institute Oslo, DSB.no, The Norwegian Mapping Authority, Norway's International Climate and Forest Initiative, Danmarks Meteorologiske Institut, Danish Geodata Agency, Veðurstofa Íslands - IMO, Náttúruverndarstofnun - EA.

RESULTS AND DISCUSSION

Table 1. The main hazards

Country	Denmark	Lithuania	Latvia	Estonia	Finland	Sweden	Norway	Iceland
Hazard 1	Coastal floods	River floods	Coastal floods	River floods	River floods	River floods	Coastal floods	Earthquake
Hazard 2	Agriculture droughts	Coastal floods	River floods	Coastal floods	Coastal floods	Coastal floods	River floods	Coastal floods

Table 2. Trust indicators

Measure / Country	Trust in national government (%) (OECD)	Trust in local government (%) (OECD)	Trust in civil services (%) (OECD)	Government preparedness to protect lives in large-scale emergency (%) (OECD)	Lack of coping capacity (0-10) (INFORM)
Denmark	44	47.28	44.13	66	1.0
Latvia	28.7	41.1	39.31	35	2.5
Estonia	37.8	46.33	48.87	46	1.5
Finland	47	55.54	62.35	82	1.7
Sweden	42.9	41.71	41.84	61	1.4
Norway	47.6	50.91	53.7	59	1.4
Iceland	36.4	41.89	63.98	50	1.8
Lithuania	42.5	-	-	-	2.4

Table 3. Cross-National Assessment of Hazard Monitoring and Warning Technologies

Category	Subcategory	DK	LT	LV	EE	FI	SE	NO	IS	Total
Technological hazard monitoring, data processing and analytics	Drones	+	+	+	+	+	+	+	+	8
	Satellite imaging	+	+	+	+	+	+	+	+	8
	Artificial intelligence (AI) tools	+	+	+	+	+	+	+	+	8
	Ground deformation sensors (e.g. GPS, InSAR)	+	+	+	+	+	+	+	+	8
	Interactive technologies (e.g. IoT)	+	+	+	+	+	+	+	+	8
	Machine learning models for hazard forecasting (e.g. floods, volcanic activity, etc.)	+	+	+	+	+	+	+	+	8
	Weather radars, river level and flood gauge systems, ocean buoys, seismic sensors	+	+	+	+	+	+	+	+	8
	Volcano monitoring (e.g. gas sensors, thermal cameras, tiltmeters, etc.)	_*	_*	_*	_*	_*	_*	+	+	2
	Air quality and heat index sensors	+	+	+	+	+	+	+	+	8
Information dissemination	SMS	+	+	+	+	+	+	+	+	8
	TV/Radio	+	+	+	+	+	+	+	+	8
	Public sirens systems	+	+	+	+	+	+	+	+	8
	Social media alert integration	+	+	+	+	+	+	+	+	8
Exposure to different types of risks	Natural-environmental (e.g. floods, heat waves, etc.)	+	+	+	+	+	+	+	+	8
	Hybrid	+	+	+	+	+	+	+	+	8
	Technological	+	+	+	+	+	+	+	+	8
	Chemical-biological	+	+	+	+	+	+	+	+	8
	Geopolitical-security	+	+	+	+	+	+	+	+	8
Responsible level of authority (preparedness and response)	National	+	+	+	+	+	+	+	+	8
	Local	+	+	+	+	+	+	+	+	8
Total	20	19	19	19	19	19	19	20	20	

The exploratory analysis of Early Warning Systems (EWS) within the Nordic-Baltic Eight (NB8) countries reveals a landscape characterized by strong technological convergence and developed institutional capacities. The relative uniformity observed in hazard monitoring practices, data analytics capabilities, and information-dissemination mechanisms indicates a shared regional commitment to integrating advanced technological solutions into disaster risk management. This convergence is notable given the differing historical, political, and socio-economic trajectories of the NB8 countries, suggesting that regional cooperation frameworks and international normative pressures, particularly those stemming from EU civil protection mechanisms, may play a harmonizing role in shaping national EWS architectures.

However, the finding that all countries exhibit comparable hazard exposure raises important considerations. While uniform exposure patterns might indicate shared climatic and environmental vulnerabilities, it may also reflect broad categorizations that obscure sub-national variations. For instance, the prominence of floods as a principal environmental hazard across all countries aligns with global assessments highlighting hydro meteorological events as increasing drivers of risk. Nevertheless, the similar exposure profiles should not overshadow country-specific geographic and infrastructural characteristics that may influence both hazard intensity and coping capacity.

The divergence between structural EWS development and societal perceptions presents a more complex picture. Despite robust systems, population trust levels, particularly in Latvia, indicate that technological sophistication does not automatically translate into perceived institutional reliability. This anomaly underscores the social dimension of resilience, in which trust, risk awareness, and communication effectiveness play determinants roles. As about half (48.4%) of NB8 citizens express trust in governments, it raises concerns regarding the potential distrust and negligence during crisis situations. Public trust has been widely recognized as a crucial determinant of compliance with official warnings, suggesting that societal resilience cannot rely solely on technological optimization.

The variation in coping capacity indicators further reinforces the need to consider resilience holistically. Denmark's strong coping indicators contrast with the more limited capacities observed in Latvia and Lithuania, highlighting uneven levels of community preparedness, infrastructure robustness, and institutional efficiency. These findings suggest that while the employment and integration of various technologies may be harmonized, the conditions which enable effective crisis response differ across the region.

Furthermore, the study's results align with global risk assessments that emphasize environmental threats as the dominant global challenge over the coming decade. Reports such as the 2025 Global Risk Report and the Global Assessment Report (GAR) on Disaster Risk Reduction highlight both the urgency of strengthening resilience and the substantial economic costs associated with intensifying climate-related hazards. The NB8 countries' advanced EWS positions them favorably in this context; however, the identified gaps in societal trust and coping capacity indicate that technological readiness alone is insufficient. A comprehensive resilience strategy must integrate community engagement, risk communication, and investment in structural mitigation measures.

Finally, the examined NB8 countries are either the member states of the European Union or part of the European Economic Area (EEA), which in turn results in closer and more coordinated socio-economic cooperation between the countries. One of the examples of such cooperation through collective resilience building and mutual assistance in disastrous events can be observed the rescEU or the EU Civil Protection Mechanism (UCPM). According to Parker et al. (2019) EU-level coordination requires legitimacy, shared norms, and professional trust. Integrated governance, rather than isolated systems, is vital to manage transboundary crises. Moreover, the effectiveness of national and EU civil protection systems depends not only on the formal structures and technical capacities, but on socio-historic culture and trust, demonstrating that effective crisis management is a socio-institutional governance challenge rather than a purely technical one.

To summarize, while the NB8 region demonstrates high levels of technological integration in EWS development, the broader resilience landscape remains uneven. Bridging the gap between technological capacity and societal acceptance emerges as a point of concern as it is crucial for societal protection. Enhancing public trust, addressing coping-capacity disparities, and tailoring risk-reduction strategies to national and sub-national contexts will be essential for strengthening regional resilience in the face of escalating environmental risks.

CONCLUSION

This paper examined the implementation of Early Warning Systems (EWS) across the Nordic–Baltic Eight (NB8) countries, finding strong similarities in the technological approaches of risk communication, namely hazard monitoring, data analytics, and dissemination features. This alignment, despite the different historical and socio-economic contexts, signals both the spread of international standards and the effectiveness of regional cooperation in shaping similar EWS frameworks. At the same time, exposure to major environmental hazards, in particular floods, points to a shared regional risk profile. The analysis also reveals that technological maturity alone does not determine societal resilience as the gap between systemic readiness and societal perception remains. This diversion has practical implications: the effectiveness of alerts depends not only on the performance but also on the credibility risk communication, the community engagement, and the perceived legitimacy of institutions. As an exploratory study, this work is constrained by the limitation of available indicators. Future research should incorporate sub-national differentiation, and behavioral metrics on alert receipt, comprehension, and protective action to better capture the end-to-end performance of EWS.

Overall, while the NB8 countries display notable technological harmonization and shared environmental risk exposure, resilience remains uneven due to differences in trust and coping capacity.

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