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Chaouki Boulekdam^{1,2}, Abdeldjalil
Belkendil¹, Mohamed Zouidi¹,
Soumia Bendekkoum³, Aissa Lamri-
Zeggar⁵, Nadjat Chettih^{1,4}, Kaouther
Achouri¹, Houcine Bougrine¹, Amer
Zeghmar¹, Abdelkader Moudjari⁵

¹Centre de Recherche en Aménagement du
Territoire (CRAT), Campus Zouaghi Slimane,
Constantine, Algeria

²University Abdelhamid Mehri-Constantine 2,
LIRE Laboratory, Constantine, Algeria

³Constantine 3 University – Salah Boubnider,
Algeria

⁴Laboratory of Applied Mathematics and
Modeling, Department of Mathematics, Faculty
of Exact Sciences, University of Brothers
Mentouri Constantine 1, Constantine, Algeria.

⁵Ecole normale supérieure de Constantine
Algeria, Pôle universitaire de Constantine 3 Ali
mendjeli, Algeria

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¹Centre de Recherche en Aménagement du Territoire (CRAT), Campus Zouaghi Slimane, Constantine, Algeria

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⁴Laboratory of Applied Mathematics and Modeling, Department of Mathematics, Faculty of Exact Sciences, University of Brothers Mentouri Constantine1, Constantine, Algeria.

⁵Ecole normale supérieure de Constantine Algeria, Pôle universitaire de Constantine 3 Ali mendjeli, Algeria

Abstract: Disaster risk management is an increasingly critical national concern in Algeria, driven by the rising frequency and severity of climatic, technological, and biological threats. With the adoption of Law No. 24-04 on February 26, 2024, Algeria established a comprehensive legal framework to enhance disaster prevention, intervention, and resilience. Central to this framework is the ORSEC (Organisation de la Réponse de Sécurité Civile) plan, a vital emergency response system designed to address large-scale crises, including earthquakes, floods, wildfires, industrial accidents, and public health emergencies. The ORSEC plan aims to ensure a coordinated and efficient response by integrating multiple stakeholders, such as governmental agencies, emergency services, and private organisations. However, its implementation faces significant operational challenges, including delayed decision-making, poor inter-agency coordination, limited integration of real-time data, and reliance on traditional protocols and human expertise. These issues are compounded by the growing impacts of climate change, rapid urbanisation, and infrastructure vulnerabilities, which amplify the need for a robust and adaptive risk management strategy. To address these challenges, this research proposes EMHelp, an AI-powered decision-support system designed to enhance ORSEC planning and execution in Algeria. EMHelp leverages multi-risk databases, machine learning (ML), and deep learning (DL) techniques, alongside scenario-based simulations, to generate optimised response strategies. A human operator validates the best scenario, which is then translated into a real-time action plan. This approach aligns with Algeria's national legal mandates while introducing modern capabilities for predictive risk assessment, operational agility, and resource optimisation. By integrating AI-driven predictive models, EMHelp improves decision-making, enhances inter-agency collaboration, and mitigates risks more effectively. This study contributes to building a more resilient, intelligent, and responsive disaster management system for Algeria, addressing contemporary risk management needs and ensuring proactive, coordinated, and adaptive responses to crises.

Keywords: ORSEC; Law 24-04; Algeria; Disaster Risk Management; Artificial Intelligence; EMHelp; Emergency Response; Decision Support System.

1. Introduction

Disaster risk management has emerged as a critical pillar of sustainable development policies worldwide, particularly in countries vulnerable to both natural and technological hazards (Bang, 2024). The frequency and intensity of disasters earthquakes, floods, forest fires, pandemics, industrial accidents, and cyberattacks have highlighted the urgent need for structured, multisectoral, and anticipatory approaches to crisis management (Soyege et al., 2024). As climate change, urbanization, and geopolitical instability converge to

exacerbate vulnerabilities, national strategies must increasingly rely on integrated risk governance, multi-level coordination, and technological innovation (Abdillah et al., 2025). One of the most structured and emblematic frameworks historically developed for disaster response is the ORSEC Plan (Organization de la Réponse de Sécurité Civile) in France (Nahon & Michaloux, 2016). Far from being a simple list of emergency procedures, the ORSEC Plan represents a comprehensive, hierarchical, and modular coordination system, activated when local response capacities are overwhelmed (“catastrophes à moyens dépassés”) (Hallegatte et al., 2017). It defines a multi-tiered command architecture that distributes responsibilities among three main levels: the Crisis Management Headquarters, which oversees overall coordination; the Operational Command, which manages on-site interventions; and the Logistics Command, responsible for reinforcements and resource distribution (Azadehdel et al., 2012).

According to Law No. 24-04 of 26 February 2024 (Algeria, 2024), disaster risk prevention is a national priority fully funded by the state. The ORSEC framework also mobilizes five operational services, each with distinct but interdependent functions (Law No. 24-04 on Disaster Risk Prevention and Reduction, 1445): Public order and investigation, responsible for maintaining security, traffic control, and victim identification; Search and rescue, carried out by firefighters, emergency medical teams, and volunteers; Medical care and social assistance, coordinated through hospitals and emergency units; Transport and infrastructure, ensuring mobility and technical support; Communications and public relations, managing information dissemination and media coordination.

Since its creation in the 1950s, the ORSEC Plan has evolved into a multi-agency operational tool, providing both centralized decision-making capacity and decentralized operational flexibility (Prieur, 1985). The framework’s adaptability has inspired numerous countries, including Algeria, to design their own systems for disaster risk governance (Benouar, 2019). In this context, Algeria has taken a significant legal step forward with the adoption of Law No. 24-04 of February 26, 2024, establishing a comprehensive national strategy for disaster risk prevention, intervention, and resilience (Law No. 24-04 on Disaster Risk Prevention and Reduction, 1445). This legislation positions disaster management as a national priority integrated within the country’s sustainable development agenda (Article 4) and outlines a broad typology of risks seismic, geological, climatic, industrial, biological, radiological, cyber, and even biotechnological (Article 3) (Ramoul & Cimali, 2022). The law mandates the creation of multi-scale response structures, including General Disaster Prevention Plans, ORSEC Plans (at national, inter-wilaya, wilaya, municipal, and site-specific levels), and Specific Intervention Plans for industrial zones and critical infrastructure (Articles 65–74) (Tout et al., 2025).

Articles 1, 4, 7, and 8 of the 2024 law emphasize objectives such as the reduction of human and economic losses, enhanced early warning systems, and improved resilience of critical infrastructure (schools, hospitals, transportation networks). Moreover, the law highlights the role of science, innovation, and technology (Articles 5, 10–16, and 14), calling for the integration of artificial intelligence (AI), big data, and geographic information systems (GIS) to support decision-making, predictive analysis, and early warning mechanisms.

However, while the legal and institutional framework is robust and forward-looking, the practical implementation of intelligent technologies in both France and Algeria remains limited.

There is still a lack of fully integrated AI-based early warning systems, dynamic risk mapping using satellite and sensor data, and predictive analytics for resource optimization (Sari Mohammed, 2025). These tools, already emerging in international best practices, could drastically enhance responsiveness and efficiency in crisis management (Sudhi et al., 2025).

Furthermore, challenges persist ranging from inter-agency coordination gaps and bureaucratic inertia to low citizen participation and insufficient local resource mobilization (Zouaouid, 2025). Articles 85–87 of the Algerian law introduce penal sanctions for non-compliance, yet enforcement and institutional accountability remain critical issues (MENAFATF, 2023). Consequently, there is a strong rationale for reforming and

modernizing the ORSEC system through the integration of advanced computing and artificial intelligence. Such technologies can support: Real-time decision-making based on sensor data and predictive models; Crisis simulation and mapping for preparedness and adaptive planning; Citizen-centered alert platforms via mobile and social networks; Resource optimization algorithms for logistics and medical response.

This research therefore aims to evaluate the effectiveness of the ORSEC Plan within the Algerian institutional and legal context, identify current limitations, and propose a framework for integrating intelligent technologies and adaptive governance principles. The ultimate goal is to contribute to a resilient, proactive, and evidence-based national emergency management system, capable of addressing both current and emerging disaster risks.

2. Literature review

2.1. Disaster risk governance and national frameworks

Effective disaster response depends on a combination of legal preparedness, institutional coordination, and risk governance mechanisms (Tierney, 2012). Frameworks such as the Sendai Framework for Disaster Risk Reduction 2015–2030 emphasize the importance of multi-level planning, stakeholder engagement, and proactive investment in disaster prevention (UNDRR, 2015). Algeria's new legislation reflects these principles by integrating prevention, early warning, and public communication (Law 24-04, Articles 1–16).

However, comparative studies show that frameworks such as ORSEC, even in developed contexts like France, suffer from inter-agency friction, slow mobilization, and fragmented information systems (Karagiannis et al., 2017). These gaps are amplified in countries where digital and institutional infrastructure are still under development, leading to challenges in coordination and operational readiness.

At the international level, numerous studies stress that governance coherence linking local capacities with national frameworks is the foundation for effective disaster risk management (Raikes et al., 2021; Sigmund et al., 2022; Vu et al., 2025). In this sense, Algeria's Law 24-04 represents an important evolution by defining multi-level plans (national, inter-wilaya, wilaya, and communal) and aligning them with sustainable development objectives.

2.2. The role of technology and artificial intelligence in disaster management

Recent research demonstrates that AI-powered systems can significantly enhance disaster risk assessment, early warning, and operational decision-making. Machine learning algorithms have been used to predict floods, assess earthquake damage, and optimize evacuation routes (Ghaffarian et al., 2023). Likewise, GIS technologies have enabled high-resolution mapping of vulnerable areas, improving the speed and precision of emergency response (Han & Liu, 2025; Park, 2024).

Countries such as Japan and the United States have integrated real-time analytics, drones, and social media monitoring into emergency operation centers, allowing adaptive responses to evolving crises (Emmanuel K, 2025; Ongesa et al., 2025). Algeria's Law 24-04 (Articles 5 and 14) explicitly encourages the use of new technologies for prevention and coordination, though its implementation strategy remains underdeveloped (Tout et al., 2025).

A broader review of the literature on ORSEC and emergency management identifies recurrent themes:

- the need for interoperability in multi-agency systems,
- the role of intelligent decision support systems,
- the importance of structured governance models, and
- the integration of AI and GIS technologies into crisis management.

These topics are exemplified in the eight scientific studies summarized below, illustrating the diverse ways computer science and AI techniques have been proposed to enhance ORSEC-type frameworks.

Table 1. Categorization and Analysis of Existing Works on ORSEC and Emergency Management

Article authors	Title	Main Problem	Proposed Solution	Use of AI or Computer Science Techniques
(Elmhadhbi et al., 2022)	A Semantics-Based Common Operational Command System for Multi-agency Disaster Response	Lack of interoperability and coordination among emergency responders	POLARISC system using ontologies for semantic interoperability	Yes – ontologies and AI-driven decision-making
(Boudjellali et al., 2022)	An Intelligent Decision Support System Based on Collaboration and Case-Based Reasoning	Need for improved collaboration and decision-making in disaster management	Intelligent decision support system integrating case-based reasoning, ontology, and videoconferencing	Yes – AI-driven case-based reasoning and videoconferencing technology
(Foucher et al., 2018)	Catastrophe avec Nombreuses Victimes en Milieu Urbain	Challenges in managing mass casualties in urban settings	Development of crisis management tools like SAUVEE, CRISIS, and ORSAN terminal	Limited – suggests digital crisis management tools
(Quarantelli, 2000)	Disaster Planning, Emergency Management and Civil Protection: The Historical Development of Organized Efforts to Plan for and Respond to Disasters	Ineffective implementation of disaster planning	Shift from reactive to proactive strategies, community engagement, and improved coordination	No direct AI use – discusses technology in management
(Krogh & Røiseland, 2024)	Emergency management through enduring collaborative networks: Lessons on phases and levels	Difficulty in sustaining collaboration across emergency management phases	Strengthening intermediaries (voluntary organizations), systematic training, and improving network governance	No direct AI – focus on systematic learning
(Krogh & Røiseland, 2024)	Urban Governance of Disaster Response Capacity	Variability in governance models and lack of theoretical frameworks for local scalability	Hybrid governance models combining state, civic, and professional response	No direct AI – emphasizes governance models
(Nahon & Michaloux, 2016)	L'organisation de la réponse de la sécurité civile: Le Dispositif ORSEC	Complexity in coordinating emergency responses and mobilizing resources	ORSEC framework with general and specific provisions, sector-specific emergency plans	Limited – suggests standardization and digital crisis communication
(Naili & Telaidjia, 2022)	The Geomatization of the COVID-19 Care Offer for the ORSEC Plan in Algeria	Lack of real-time data for crisis management and resource allocation	GIS-based digital ORSEC system for real-time tracking of healthcare resources	Yes – GIS and digital mapping for real-time decision-making

2.3. Challenges in ORSEC implementation

Despite its structured nature, the ORSEC Plan has often been criticized for rigidity and limited adaptability to emerging disaster types (Larrue et al., 2016). During the COVID-19 pandemic, for instance, traditional ORSEC procedures were insufficient to manage the

complexity of a biological crisis requiring both health and civil security coordination (Filip et al., 2022). Similarly, recurrent forest fires and floods have exposed delays in resource mobilization and weaknesses in decentralized command structures (Vu et al., 2025).

In Algeria, such issues persist: although Articles 66–72 of Law 24-04 define multi-level ORSEC Plans, local authorities often lack the necessary technical expertise, funding, and access to real-time data. Furthermore, citizen engagement remains minimal, contradicting the participatory principles of Article 5 (Law No. 24-04 on Disaster Risk Prevention and Reduction, 1445) .

From a comparative governance perspective, the literature reveals that these limitations stem from institutional inertia, fragmented information sharing, and limited integration of scientific data into decision-making frameworks (Talbi, 2025) .

2.4. Opportunities for digital transformation in disaster response

The convergence of AI, remote sensing, cloud computing, and citizen-based sensing (via mobile technologies) is opening new frontiers for intelligent disaster management (Calle Müller et al., 2024) . Innovations such as digital twins, rescue simulations, and predictive alert systems have already been deployed in Europe and Asia (Bucaioni et al., 2026; Ghaffarian et al., 2023). These technologies enable:

- Dynamic allocation of emergency resources using predictive models.
- Automatic identification of high-risk zones through drone and satellite imagery.
- Real-time dashboards for crisis coordinators and responders.

2.5. General findings and research gap

The synthesis of the literature and empirical analyses points to four major insights:

- Governance coherence remains central to effective disaster management, but operational fragmentation hinders performance.
- AI and GIS technologies, while promising, are still underutilized within formal response mechanisms such as ORSEC.
- The existing frameworks exhibit rigidity and limited adaptability to multi-dimensional crises like pandemics or cyber-attacks.
- Digital transformation must be paired with institutional modernization, human capital investment, and inter-agency interoperability.

These findings underscore the need for a new paradigm of intelligent and adaptive governance that integrates AI-driven tools, predictive analytics, and participatory mechanisms within the ORSEC system particularly in Algeria’s evolving institutional and legal context.

3. Research methods

To address the increasing complexity and frequency of natural and anthropogenic disasters, this research proposes a hybrid methodological approach that combines system modeling, artificial intelligence (AI), and scenario-based simulation to improve decision-making within the ORSEC framework.

The proposed system called EMHelp (Emergency Management Help) (Figure 1) functions as an AI-assisted decision-support platform for managing multi-risk environments, including seismic, forest fire, flood, and geological hazards ... etc.

Unlike conventional ORSEC procedures that rely on static, pre-defined manuals, EMHelp introduces a dynamic, data-driven, and modular architecture capable of integrating real-time data, simulating multiple response scenarios, and assisting civil protection authorities in optimizing crisis response strategies.

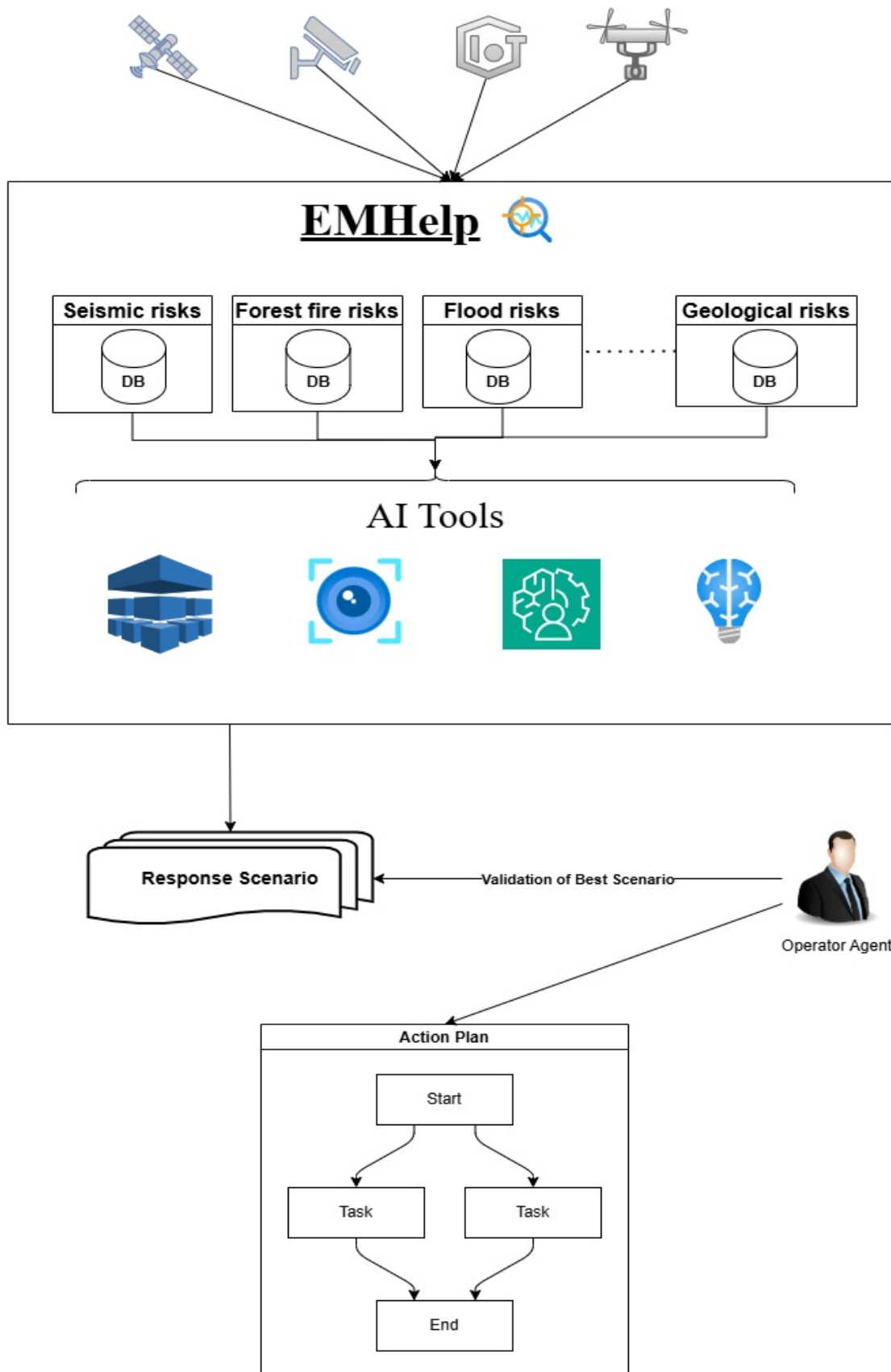


Figure 1. EMHelp Architecture

3.1. Architecture overview

The EMHelp architecture integrates multi-source data collected from satellites, drones, IoT sensors, CCTV systems, and institutional databases into specialized risk databases (DBs). Each database corresponds to a distinct disaster type, ensuring modularity, interoperability, and scalability:

- Seismic Risk DB
- Forest Fire Risk DB
- Flood Risk DB
- Geological Risk DB
- Technological/Cyber Risk DB (optional)
- ... etc.

All data are standardized and continuously updated to maintain temporal consistency and ensure interoperability across analytical modules. These databases serve as the foundation for real-time risk assessment and AI-based scenario generation.

3.2. AI-powered risk analysis and decision support

The core intelligence of EMHelp resides in its AI Tools Suite, which processes raw and structured data to perform predictive and diagnostic analyses. The suite integrates multiple AI techniques:

- Machine Learning and Deep Learning Models for pattern recognition, anomaly detection, and risk classification.
- Computer Vision Systems for real-time image interpretation from UAVs or surveillance cameras.
- Knowledge-Based and Ontology Systems for historical data interpretation and semantic reasoning.
- Multi-Agent Systems for scenario generation, evaluation, and prioritization.
- Optimization Algorithms to determine the most efficient allocation of resources and response strategies.

These modules work in coordination to simulate and rank potential response scenarios, each associated with an estimated level of risk, deployment time, cost, and feasibility.

3.3. Scenario evaluation and human-in-the-loop validation

A key feature of EMHelp is its human-centered validation process. While AI models generate multiple scenarios, final decision authority remains with the human Operator Agent a trained civil protection coordinator.

The Operator Agent is responsible for:

- Reviewing the feasibility and contextual appropriateness of AI-generated scenarios.
- Selecting the optimal response scenario according to available resources, geographical constraints, and legal requirements (Law 24-04, Articles 66–72).
- Approving or refining the proposed plan to ensure coherence with ORSEC coordination protocols.

This human-in-the-loop mechanism ensures ethical oversight, contextual intelligence, and institutional accountability, preserving the balance between automation and human expertise.

3.4. Action plan generation

Once the optimal scenario is validated, EMHelp automatically generates a structured Action Plan, formatted as an executable task workflow.

This plan specifies:

- Start and end points of operations.
- Sequential and parallel tasks.
- Roles, responsibilities, and timing.
- Dependencies between operational units.

The plan is exported to the ORSEC Command Dashboard, where it can be accessed by first responders, coordination cells, and sectoral operators (health, logistics, communication, etc.). This ensures a direct linkage between decision support and field execution.

3.5. Legal and institutional integration

EMHelp is designed to operate in full alignment with Algeria’s Law No. 24-04 of February 26, 2024, ensuring compatibility with institutional and operational structures. It supports:

- The multi-level ORSEC hierarchy (national, inter-wilaya, wilaya, communal).
- The defined responsibilities of public and private actors (Articles 89–90).
- The risk-specific prevention plans (Articles 20–58).
- The strategic alignment with sustainable development and resilience goals (Article 6).

By embedding legal compliance into its architecture, EMHelp acts not only as a technological tool but also as a policy-support instrument, bridging scientific innovation and governance mandates.

3.6. Methodological flow summary

The operational flow of EMHelp can be summarized as follows:

1. Data Acquisition → From satellites, UAVs, IoT sensors, and institutional systems.
2. Data Classification → Storage in risk-specific databases (seismic, flood, fire, etc.).
3. AI Analysis → Prediction, detection, and classification via machine learning and computer vision.
4. Scenario Generation → Simulation of multiple intelligent response plans.
5. Scenario Evaluation → Validation by human Operator Agent (human-in-the-loop).
6. Action Plan Generation → Automatic creation of structured workflows for ORSEC operations.
7. Adaptive Monitoring → Continuous feedback, learning, and re-planning based on new data.

3.7. EMHelp algorithm – ai-assisted disaster response planner

In this section, we will present a clear, modular algorithm that reflects the logic and flow of our EMHelp system one that integrates data acquisition, AI analysis, human validation, and action plan generation.

Below is a pseudo-code representing the logical and computational flow of EMHelp’s hybrid AI-human system:

Algorithm 1. EMHelp – AI-Assisted Disaster Response Planner

Input:

- Real-time data streams: *Satellite_Data, Sensor_Data, Drone_Images, Historical_DB*
- Risk Type: *Risk_Type* \in {*Seismic, Flood, Fire, Geological, Technological ...etc*}
- Resource availability: *Resources_DB*
- User constraints (e.g., region, time limits)

Output:

- *Action_Plan: Ordered and validated task list for ORSEC execution*

Step 0 – Initialization

Initialize system components
Load predefined risk models for each Risk_Type
Load ORSEC operational rules (from Law 24-04 articles 65-74)

Step 1 – Data Acquisition & Preprocessing

Collect live and historical data: D ←
Aggregate(Satellite_Data, Sensor_Data, Drone_Images, Historical_DB)
Clean and standardize D
Classify D into respective Risk_Database based on Risk_Type

Step 2 – Risk Analysis and Scenario Generation

For each Risk_Type:
Model ← *Load_AI_Model(Risk_Type)*

```

        Risk_Level ← Model.predict(D)
        Scenario_Set ←
Generate_Response_Scenarios(Risk_Level, Resources_DB)
    Rank Scenario_Set based on:
        - Estimated casualties prevented
        - Time to deploy
        - Cost and feasibility
# Step 3 - Human Operator Validation
    Display top N scenarios to Operator_Agent
    Operator selects Optimal_Scenario based on situational
context
    If no scenario accepted:
        Request re-run with adjusted constraints or
        fallback scenario
# Step 4 - Action Plan Generation
    Convert Optimal_Scenario into Action_Plan:
        - Define sequence of tasks
        - Assign resources and agents
        - Add timing and dependencies
    Export Action_Plan to Command Dashboard
# Step 5 - Monitoring and Adaptation
    While Disaster_Status ≠ 'Resolved':
        Monitor field data updates
        If environment changes significantly:
            Re-run Step 2 → Step 4 (adaptive replanning)
# Step 6 - Termination
    When emergency is resolved:
        Archive scenario data and feedback
        Log performance metrics
        Update AI models (learning loop)

```

4. Solutions and Results

The proposed EMHelp platform, powered by artificial intelligence and real-time data integration, is expected to deliver the following outcomes:

- **Improved Decision-Making Speed and Accuracy**
By automating scenario generation and analysis through AI, EMHelp reduces reliance on delayed human coordination. This will shorten response times during emergencies and improve the precision of the chosen response strategy.
- **Optimized Use of Resources**
Through predictive modeling and machine learning, the system can allocate personnel, equipment, and logistical support more effectively minimizing waste and prioritizing high-impact actions.
- **Real-Time Action Plan Generation**
Unlike traditional ORSEC plans, which may require manual adaptation, EMHelp will dynamically generate a tailored operational action plan, enabling fast task delegation and continuous updates as conditions evolve.
- **Legal and Institutional Alignment**
The system's design will remain fully compliant with Law No. 24-04, especially Articles 66–74 concerning multi-tiered ORSEC implementation and Articles 20–58 on risk-specific prevention measures. This ensures institutional applicability and readiness for governmental integration.
- **Scalability and Risk Type Flexibility**
EMHelp can be applied across multiple hazards earthquakes, floods, forest fires, and geological risks thanks to its modular architecture and risk-specific databases. Future extensions may include pandemics, cyber risks, and industrial incidents.

5. Discussion

5.1. From reactive response to intelligent governance

The adoption of the EMHelp system represents a significant paradigm shift from static, reactive emergency management to an intelligent, adaptive, and proactive governance model. In the Algerian context, where the implementation of the ORSEC framework has revealed multiple structural and procedural limitations, EMHelp introduces a scientifically grounded and technology-enhanced decision-support mechanism that directly addresses key operational weaknesses.

Specifically, EMHelp responds to the following shortcomings identified in existing ORSEC operations:

- **Slow decision-making (Article 66):**
The traditional ORSEC chain of command, while clear in its hierarchy, often results in delays during the critical initial hours of a disaster. EMHelp mitigates this through AI-driven predictive modeling and automated generation of alternative response scenarios, thus accelerating decision cycles.
- **Inter-agency coordination gaps:**
As documented in several studies, real-time interoperability between agencies police, firefighters, health services, civil protection, and logistics remains limited. EMHelp's centralized and interoperable data architecture fosters transparency, task synchronization, and shared situational awareness among all stakeholders.
- **Rigid and centralized response structures:**
The ORSEC Plan's hierarchical structure, effective in well-defined disasters, proves less agile in complex or cascading events such as pandemics or cyber-attacks. EMHelp overcomes this limitation by enabling dynamic scenario simulation and AI-based adaptation, ensuring flexibility and real-time recalibration of actions.
- **Weak public communication and awareness:**
In many municipalities, public alert systems remain underdeveloped. EMHelp can interface with citizen-based platforms and mobile early warning systems, supporting the requirements of Articles 10–13 of Law 24-04, which emphasize risk education and transparent public communication.
- **Underutilization of technology:**
The current ORSEC framework has yet to fully integrate AI, GIS, IoT, and big data analytics into its operational processes. EMHelp bridges this gap by making digital intelligence a central component of disaster risk reduction (DRR) and response.

5.2. Identified limitations of the ORSEC plan

Despite its long-standing importance in both France and Algeria, the ORSEC Plan continues to face systemic limitations that hinder its overall effectiveness:

- **Centralized and slow decision-making:**
Excessive hierarchical dependencies delay rapid operational decisions during emergencies.
- **Lack of real-time coordination:**
Inter-agency communication is not fully digitalized, causing overlaps and inefficiencies in resource deployment.
- **Limited resources and logistics:**
Remote or resource-constrained regions often face shortages of trained personnel and critical equipment.
- **Structural rigidity in emerging risks:**
ORSEC's reliance on predefined disaster types limits its adaptability to novel or compound crises such as pandemics, cascading climate events, or cyber hazards.
- **Inadequate public communication:**
Public alert systems exist but suffer from poor dissemination and low engagement, leading to weak community response.

- **Technological lag:**
Integration of AI, drones, and predictive models remains minimal, restricting proactive risk anticipation.
- **Dependence on critical infrastructure:**
The efficiency of ORSEC operations depends on functional roads, telecommunications, and energy networks, which may be compromised during disasters.
- **Limited local and community involvement:**
The top-down management style often excludes local governments and civil society, despite their vital role in community-level resilience.

5.3. EMHelp as a transformative solution

The proposed EMHelp system directly addresses many of these limitations, aligning with both national legislation (Law 24-04) and international standards such as the Sendai Framework for Disaster Risk Reduction (UNDRR, 2015), which advocates for the integration of science, technology, and innovation into risk governance.

Key transformations include:

- **Accelerated decision-making:**
Through predictive analytics, EMHelp shortens response time by automatically generating and ranking response scenarios based on real-time data.
- **Enhanced coordination:**
Its interoperable architecture links civil protection, health services, logistics, and security agencies through a unified digital interface.
- **Adaptive response capacity:**
Unlike static ORSEC protocols, EMHelp evolves with the crisis, using machine learning models to re-evaluate risk levels and adjust operational priorities dynamically.
- **Community-centered resilience:**
By integrating mobile apps and open communication channels, EMHelp enhances citizen participation, risk awareness, and public trust.
- **Policy support and strategic insight:**
The platform produces evidence-based metrics and analytics that assist policymakers in budget allocation, training needs assessment, and legal reform in disaster management.

5.4. Implementation challenges

While EMHelp offers substantial advantages, its deployment in the Algerian context may encounter several challenges:

- **Data availability and quality:**
Accurate predictions depend on comprehensive datasets, which may be limited in some regions lacking sensors or historical records.
- **Institutional resistance to change:**
Long-established ORSEC command hierarchies may exhibit reluctance to adopt AI-assisted or semi-automated systems.
- **Cybersecurity and reliability:**
As EMHelp centralizes sensitive operational data, robust cyber protection and fail-safe mechanisms are necessary to prevent system compromise during crises.
- **Human capacity and training:**
Effective use of EMHelp requires a new generation of emergency managers trained in AI literacy, data analysis, and digital governance.

5.5. Toward a more adaptive and resilient ORSEC system

To consolidate the progress initiated by Law 24-04, Algeria's disaster management framework must evolve toward an intelligent, decentralized, and participatory model. The integration of EMHelp provides a roadmap for this transformation by:

- Streamlining bureaucratic procedures and accelerating command flow;
- Establishing real-time coordination platforms linking national and local authorities;
- Investing in AI-based decision systems, risk modeling, and data infrastructure;
- Strengthening public engagement and community-based early warning systems;
- Empowering local authorities and NGOs as frontline actors in prevention and response.

By addressing these structural and technological barriers, the ORSEC Plan supported by EMHelp could evolve into a **more agile, inclusive, and data-driven framework**, capable of meeting the multifaceted challenges of **21st-century disaster governance**.

5.6. Anticipated impact

If successfully implemented, the EMHelp system is expected to:

- Enhance the operational efficiency and reactivity of ORSEC plans across all administrative levels;
- Promote a data-centric culture within Algerian emergency institutions;
- Improve resource optimization and inter-agency transparency;
- Provide decision-makers with real-time analytics to guide investment and policy reforms;
- Ultimately, strengthen national resilience and public safety, positioning Algeria as a regional model in intelligent disaster risk governance.

9. Conclusion

Disaster risk management in Algeria is entering a transformative phase with the adoption of Law No. 24-04 of February 26, 2024, which institutionalizes risk reduction as a pillar of sustainable development, aligning with the Sendai Framework (2015–2030). Despite the ORSEC system's structural foundation, operational challenges—slow decision-making, data interoperability gaps, and fragmented coordination—necessitate technological and governance modernization.

This research introduces EMHelp, an AI-augmented decision-support platform that integrates multi-source data, machine learning, and workflow automation to deliver scenario-based, human-validated action plans. EMHelp accelerates decision-making, optimizes resources, and enhances predictive capacity, shifting from reactive to proactive, data-driven governance fully aligned with Algerian law and global best practices.

To realize this vision, public authorities should integrate EMHelp via pilot programs in high-risk wilayas, establish a national open-data platform, invest in remote sensing/IoT infrastructure, and train personnel on AI tools. Researchers must develop hazard-specific models, incorporate Explainable AI for transparency, refine human-AI collaboration, and extend coverage to emerging risks (pandemics, urban fires, cyber threats per Articles 3, 57–58). International partners should foster North African/Sahel AI-DRR cooperation, align funding with Law 24-04, and promote South–South/North–South partnerships.

If deployed, EMHelp will catalyze a next-generation civil protection system, strengthening ORSEC efficiency, fostering data-centric culture, enabling evidence-based policy, and boosting community resilience. Future work includes real-world pilots, performance evaluations, and adaptive learning refinements. By bridging technology, governance, and expertise, EMHelp empowers Algeria to confront an unpredictable risk landscape with intelligence, agility, and resilience—safeguarding lives, infrastructure, and the environment.

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