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Review article

The Role of Electronic Communications and the Media in Integrated Risk Management: The Case of a Public Warning System

Katarina Tomašević[1], Mihailo Jovanović[2]

[1] Ministry of Information and Telecommunications of the Republic of Serbia, Belgrade, Republic of Serbia,

[2] Office for Information Technologies and eGovernment, Republic of Serbia

Correspondence: katarina.tomasevic@mit.gov.rs.

Abstract

Effective risk management in modern society requires a comprehensive and integrated approach that includes coordination and cooperation among various government bodies, institutions, and other relevant stakeholders. In this context, electronic communications and the media play a particularly important role as key instruments for rapid, reliable, and wide-reaching public information in situations of heightened risk, emergencies, and crises. Timely and accurate information is one of the fundamental prerequisites for prevention, mitigation of the consequences of hazardous events, and the protection of citizens' lives and property. In addition to the public warning function, the media and electronic communications also have an important educational and preventive role through continuous public information, raising awareness of risks, and countering misinformation that may further affect safety in crisis situations. This paper focuses on the importance of institutional cooperation between the Ministry of the Interior and

the Ministry of Information and Telecommunications of the Republic of Serbia in establishing and operating a public warning system within the broader framework of integrated risk management. Special attention is given to the analysis of two specific mechanisms: the "Find Me" system, activated in cases of missing minors, and the early warning and public warning message system for impending or imminent threats via SMS and other electronic communications channels. Through these two examples, the paper points to the potential of modern communication technologies and the media to improve coordination among competent institutions, increase response effectiveness, and strengthen public trust in institutional protection mechanisms. The aim of the paper is to demonstrate that emergency alerting systems are not merely technical solutions, but an important element of public policy in the areas of security, prevention, and risk management, contributing to greater societal resilience in the face of contemporary challenges and threats.

Keywords

Emergencies; Find Me; SMS; CBS; Ministry of the Interior (MoI); Ministry of Information and Telecommunications (MIT); electronic communications; media

1. Introduction

In the context of increasingly pronounced global and local risks, crisis management has become a central challenge for contemporary societies. Accordingly, modern approaches to risk management increasingly rely on the integration of institutional mechanisms and the use of advanced information and communication technologies, which enable rapid and reliable public information.

The advancement of technologies—including the internet, social networks and digital media, geographic information systems (GIS), sensor technology, satellite communications, robotics, and the Internet of Things—can support the planning and implementation of disaster risk reduction measures. To ensure a strategic advantage, it is necessary to apply new communication technologies to facilitate reliable information exchange among all stakeholders involved in emergency management (Janković & Komazec, 2023, p. 126). In addition, these technologies can enhance an organization's capacity to identify and assess potential crisis situations before they escalate by enabling the analysis of large data volumes in order to detect causes, trends, and anom-

alies (Vuletić & Vukadinović, 2024, p. 112). Delays in public communication during crises may have significant adverse consequences for life, health, and property. Consequently, the development of effective public warning systems constitutes a priority for modern states. In this process, electronic communications and the media are essential, as they enable the rapid dissemination of verified information to broad audiences.

The Republic of Serbia is exposed to a range of risks and has been developing integrated mechanisms intended to strengthen prevention and enable timely response so as to avert or mitigate adverse consequences. This paper presents and analyzes a model of institutional cooperation between the Ministry of the Interior and the Ministry of Information and Telecommunications of the Republic of Serbia in the operation of a public emergency alerting system. The analysis relies on a qualitative approach with elements of a case study and uses analytical and descriptive methods, with particular emphasis on the role of electronic communications and the media.

2. Legal and Institutional Framework for Emergency Alerting and Risk Management

The legal framework is the foundation for establishing and operating risk management systems and public warning mechanisms, as it defines institutional competencies, operating procedures, and the rights and obligations of participants in the system. In the Republic of Serbia, this area is regulated through multiple legal acts which together form the normative basis for prevention and response in emergencies, as well as for organized and timely public information.

In this context, the Law on Disaster Risk Reduction and Emergency Management ("Official Gazette of the RS", No. 87/2018) is of particular importance, as it regulates the preparation, organization, and operation of the protection and rescue system, as well as the role of competent authorities in the event of natural and other disasters. This law establishes the basic principles of coordination and action in crisis situations, including the obligation of timely public notification. In addition, it regulates matters significant for disaster risk reduction, as well as prevention, strengthening resilience and preparedness of individuals and the community to respond in the event of such occurrences. Furthermore, the law covers the protection and rescue of people and material, cultural, and other assets, and defines the rights and obligations of various entities in the system, including government authorities, local self-government units, legal entities, and citizens.

It is particularly important that this law explicitly regulates the operation of the early warning, public notification, and alerting system, which represents one of the key mechanisms for timely public information in crisis situations. In this way, the role of communication channels and institutional mechanisms that enable the rapid transfer of information from competent authorities to citizens is legally grounded.

The law also defines the disaster risk reduction and emergency management system as an area of special interest for the Republic of Serbia and as an integral part of the national security system, thereby emphasizing its strategic importance and the need for coordinated action by all relevant stakeholders.

In addition to the above law, the Law on Electronic Communications ("Official Gazette of the RS", No. 35/2023) plays an important role, as it regulates, among other things, the functioning of electronic communications networks and services, as well as the conditions for using these systems for mass public warning. This law provides the basis for the technical implementation of systems enabling the delivery of public warning messages via SMS and other digital channels. Article 96 of the Law on Electronic Communications states that "providers of interpersonal communications services based on the use of numbering in a mobile public electronic communications network are obliged to enable end users to receive public warning messages of interest for protection and rescue free of charge, in accordance with the law regulating disaster risk reduction and emergency management." For this purpose, the law also recognizes other publicly available electronic communications services, provided that such a public warning system is equally effective in terms of coverage of a certain part of the territory or population and that end users receive public warning messages in a simple manner. This obligation is further extended when it is necessary to deliver notifications of importance for preserving and improving public health in accordance with the law regulating protection of the population from infectious diseases. The law prescribes that the delivery of such messages to end users is free of charge, and that the Government may determine additional cases of free-of-charge delivery of other public notifications to end users, of importance for achieving the public interest.

In addition, the Law on Public Information and the Media ("Official Gazette of the RS", Nos. 92/2023 and 51/2025) contributes to the legal regulation of communication with the public, emphasizing the importance of accurate, timely, and responsible information—especially in situations of public interest, such as emergencies and crises. In this sense, the media have an important role in conveying information originating from competent institutions. The Law on Public Information and the Media provides general provisions on reporting and highlights that everyone has the right to be truthfully, ful-

ly, and timely informed on matters of public importance. The Law on Electronic Media ("Official Gazette of the RS", Nos. 92/2023 and 51/2025) devotes significant attention to provisions strengthening the Regulator's oversight of media service providers in order to ensure professional and timely reporting, and pays special attention to the protection of minors in the media space.

Overall, the legal framework in the Republic of Serbia provides the normative prerequisites for the development of an integrated system for risk management and public emergency alerting. However, a key challenge remains consistent implementation, alongside the continued strengthening of institutional coordination and technical capacities.

Given the legal framework defining emergencies and the role of public warning as a core element of that system, it is necessary to outline the institutional framework, including the competent authorities, their roles, and coordination mechanisms. In this context, the institutional framework comprises the bodies and organizations responsible for planning, coordinating, and implementing measures in situations that require urgent public warning. Its effectiveness depends on clearly delineated competencies, established coordination procedures, and the timely exchange of information among institutions at the national, provincial, and local levels. Against this background, the need for stronger and more coordinated cooperation between the Ministry of the Interior and the Ministry of Information and Telecommunications has been identified.

In accordance with the Law on Ministries ("Official Gazette of the RS", Nos. 128/2020, 116/2022, 92/2023 – other law), the Ministry of the Interior (hereinafter: MoI) is the central state administration body whose primary task is the protection of citizens' lives and personal and property security, as well as safeguarding the legal order of the Republic of Serbia. Within its broad scope of work, the MoI performs operational duties including the prevention and detection of criminal offences, locating perpetrators, and maintaining public order and peace. It is also responsible for border security, foreigner control, and migration management. In addition, it carries out administrative and legal tasks such as issuing personal documents and maintaining citizens' records. It also manages fire protection systems, traffic safety, and weapons control. In modern conditions, the MoI is also engaged in electronic data management and international cooperation, giving it a key role in the national security system. Within the MoI, the Police Directorate and the Emergency Management Sector have a particularly important role in collecting and exchanging information, responding in emergencies, ensuring security and order, and supporting activation of the public warning system—especially in cases of missing persons and other situations requiring rapid and coordinated intervention.

Media and electronic communications services represent an important link between competent institutions and the public, enabling rapid and reliable transmission of information. The Ministry of Information and Telecommunications (hereinafter: MIT) performs state administration tasks aimed at regulating and developing public information, electronic communications, and the information society.

MIT plays a key role in ensuring the technical and regulatory conditions for the operation of electronic communications systems used for mass public warning. Through cooperation with other institutions, the ministry supports the use of modern communication channels (e.g., SMS and digital platforms), enabling rapid dissemination of information in crisis situations. In addition, as the body responsible for supervising the implementation of legislation in the field of information, MIT is positioned as a partner that can contribute—through multiple communication channels—to informing the public in emergency situations. As noted, "Rapid growth in the number of social media users, as well as the explosive growth in the volume of published information, leads to an increasing problem of fake news, which can have serious consequences for individuals and society, especially in emergencies. Moreover, the secondary effect of fake news can impact the loss of trust in reliable news sources" (Kovačević, 2024, p. 41). Accordingly, public communication in emergencies should be based on verified information disseminated through credible institutional and media channels.

In addition to national authorities, local self-government units also play an important role in the context of public emergency alerting, acting as the first line of response at the local level. They participate in organizing protection and rescue measures, coordinating local resources, and cooperating with national institutions in the process of informing and alerting the population. The institutional framework also includes other relevant institutions and entities, such as emergency services, healthcare institutions, public utility companies, telecommunications operators, media service providers, regulatory bodies, and others, which play an important role in information transmission and raising citizens' awareness of risks.

The effectiveness of the institutional framework largely depends on the level of coordination, clearly defined communication procedures, and the maturity of integrated information-exchange systems—factors of particular importance for the functioning of public emergency alerting and timely response in crisis situations. The remainder of this paper presents examples of public emergency alerting via electronic communications and the media following the successful cooperation of the two ministries (MoI and MIT) and other bodies and organizations of the Republic of Serbia.

3. Examples of Public Emergency Alerting Systems via Electronic Communications and the Media in the Republic of Serbia

Within the contemporary architecture of public emergency alerting, electronic communications and the media are operationalized through two distinct but functionally connected models: the "Find Me" system (based on the *Amber Alert* mechanism, originally developed in the United States in 1996) and a general emergency notification system via SMS.

The "Find Me" system was launched in the Republic of Serbia on 25 October 2023. Its purpose is to inform the public in cases involving missing minors in order to increase the likelihood of locating them during the critical initial period. The system was established through cooperation between the MoI and MIT, which signed a Cooperation Agreement concerning public warning in cases of missing minors. The agreement serves as the legal basis for the system and defines the roles of relevant stakeholders in the event of a missing minor, with the aim of ensuring an effective response. It was preceded by a Government Conclusion ("Official Gazette of the RS", No. 60/2023), which determines that transmitting notifications about reports of missing minors via publicly available electronic communications services is in the public interest and that communications service providers are obliged to enable end users to receive such notifications free of charge.

The system is based on the principle of urgency and on prioritizing the best interests of the minor. The basic premise for activating the system is that the disappearance of a minor represents a flagrant violation of fundamental human rights and an immediate threat to the child's physical and mental health. The agreement explicitly requires that personal data processing be carried out in accordance with national legislation and ratified international treaties, and that no measures be undertaken that could cause additional harm to the child.

The central instrument of cooperation is a joint electronic platform owned by MIT through which the MoI initiates public emergency alerting. Since MIT had previously established a national contact center system for children's online safety, designed to connect a large number of users from different domains, it was assessed that this system was suitable for upgrading and implementing a system intended to inform the public about missing minors (the "Find Me" system). Technically, the contact-center software consists of mutually integrated CRM segments (Customer Relationship Management—user database) that enable linking all system users with information across the chain of resolving safety-related issues. For full implementation of the

"Find Me" system, it was necessary to enable direct connectivity for a large number of external users via the system application (three mobile operators, around 500 TV and radio media outlets at national and local levels, 50 users related to airports, motorways and railway/bus stations, etc.). After system testing and training of key users, the "Find Me" application was established, and by signing the Cooperation Agreement between the two ministries, the system was officially put into operation.

3.1. How the "Find Me" System Operates

The MoI reports a missing minor by registering an authorized internal user/agent from the relevant police directorate within the system and opening a new case. The case file includes data on the missing person, as well as on the police directorate that generated the case. Information is entered into the system through pre-defined forms on the platform, which take into account formatting requirements or character limits for individual fields. Entering data for SMS and motorway signage is subject to character limits (160 characters for SMS messages and 114 for motorway signs).

After the missing minor is reported at a police station and the police assess whether the criteria are met (the child's age, disability, or suspected life-threatening circumstances), the MoI generates a notification on the electronic platform. The notification contains standardized data: a current photo, personal description, description of clothing and footwear, time and place of disappearance, and the 192 contact number (Figure 1.).

Figure 1. Notification appearance

MIT retrieves the data from the platform and immediately activates the network of media service providers and mobile operators. Based on the created case (Figure 2.), an automatic email notification is sent to the "Find Me" user group, containing the unique case ID, case name, and case link, so that each group member can download the material intended for them (e.g., radio stations download audio material, TV stations material with an image, mobile operators the text content of the future message, etc.).

Detalji predmeta	
Naziv	Test 17.06.2024. Test 17.06.2024.
Tip predmeta	Pronađi me
Status	Potvrđeno
Zadužen	TEST PRONADI ME 30.4.
Vreme poslednje promene	17.06.2024. 15.26.22
Prioritet	Visoki
Vreme sledeće eskalacije	18.06.2024. 15.05.52

Pregled predmeta

Figure 2. Created case

The agreement precisely regulates the frequency of publishing information in order to maintain a high level of public vigilance without causing information desensitization. Obligations are divided by communication channel:

- Television and radio stations:

In the first eight hours after activation, the notice is broadcast every 30 minutes. After that, the frequency changes to every 60 minutes. The overall period of intensive notification lasts 48 hours. This schedule is prescribed by the Rulebook on the Emergency Public Notification of a Missing Minor ("Official Gazette of the RS", No. 43/2024), adopted by the Council of the Regulatory Authority for Electronic Media. This bylaw specifies the technical standards and the manner in which media outlets are required to act in order to ensure maximum visibility of the information with minimal disruption to programming. Under the Rulebook, media outlets are obliged to publish the information in an unaltered form, exactly as delivered by the competent ministry. A key feature concerns the publication format. For television stations, the notice is displayed visually via a static image or video covering the entire screen, accompanied by text. In addition, an audio recording of the text is mandatory so that the information is accessible to blind and visually

impaired persons. For radio stations, the information is broadcast exclusively in audio format, through clear and intelligible reading of the delivered text.

This framework reduces reliance on discretionary editorial decisions by establishing defined obligations for the dissemination of official information in cases of missing minors.

- Mobile operators:

All mobile operators in the territory of the Republic of Serbia are obliged to forward a one-time SMS message containing the data from the notice to their users within the shortest possible time.

One of the most important aspects of the Agreement is the regulation of the termination of information broadcasting. The system is deactivated in two cases: when the minor is found, or upon expiry of the statutory 48-hour period. As soon as the MoI confirms that the child has been found, the information is posted on the platform, after which MIT, the media, and operators are obliged to immediately stop broadcasting and permanently delete all personal data and photos of the minor. This mechanism is designed to prevent secondary victimization of the child and to enable an undisturbed return to private and social life without a lasting digital trace of the traumatic event.

Since its establishment, the "Find Me" system has been activated several times. From a technical perspective, it has demonstrated full functionality and effectiveness.

3.2. Public Warning System for Emergencies

The public warning platform is an integrated early warning system for cases of natural disasters or large-scale technical-technological accidents, with the primary goal of protecting human life and health, material assets, and the environment. The purpose of the system is to ensure timely and comprehensive public awareness so that protective measures can be implemented effectively, achieved through a multimodal approach to distributing information. This process includes sending one-time public warning messages via mobile operators in affected areas, broadcasting notifications via television and radio stations, informing the public through infrastructure companies responsible for roads, and publishing official recommendations on the websites of the Ministry of the Interior and other competent authorities.

The essential function of this subsystem is to support rapid operational response within a defined territory by generating a public warning message containing key information, which is then distributed to a network of approximately 600 external users. This group consists primarily of organizations whose activities complement those within the "Find Me" framework, enabling coordination among stakeholders in national security and civil protection and providing additional functionalities compared to the aforementioned platform. Whereas the "Find Me" system is intended for cases of missing minors, the public warning system has broader scope and may be used for different types of emergencies, including floods, storms, flash floods, earthquakes, fires, and other hazards assessed by the MoI as requiring public warning. The system is designed to enable geographically targeted warning for affected areas rather than nationwide dissemination, thereby supporting timely delivery and prioritization of information for populations at risk (Figure 3.). Information is also transmitted electronically to local and regional television and radio stations to facilitate timely public communication. Unlike the "Find Me" system, media service providers are not required to repeat urgent information at prescribed intervals; rather, they are expected to align dissemination with their programming in view of the nature of the event and the affected territory. Following user training for internal and external stakeholders, the system entered production on 15 September 2024 and has been activated on multiple occasions.

Figure 3. Outline of the warning system's operation

4. Further Development Directions

Future directions for developing the national public warning system are aimed at implementing *Cell Broadcast Service* (hereinafter: CBS), a technologically superior solution compared to existing distribution channels. Unlike conventional SMS technology, which operates on a point-to-point basis and requires individual delivery to each user, CBS uses a point-to-area broadcasting principle. This enables simultaneous delivery of public warning messages to millions of users within a defined geographic area within seconds, completely eliminating the risk of network congestion. During critical events, when mobile infrastructure often collapses due to overload, CBS ensures warning message delivery via a dedicated radio channel physically separated from regular voice and data traffic.

The introduction of CBS will also support precise geographic targeting, where messages are activated only on base stations covering the specific affected area, preventing unnecessary panic among citizens outside the risk zone. These messages also have display priority on device screens and are accompanied by distinctive audio-visual signals that can cut through a phone's "silent" mode.

It is important to emphasize that implementing the CBS system does not imply abolishing the SMS service; instead, the establishment of a hybrid public warning model is planned. By retaining SMS as a secondary channel, system inclusiveness is ensured, allowing users with older generations of mobile devices that do not support the CBS standard to continue receiving public warning messages without interruption. This two-layer approach guarantees maximu population coverage and system resilience to various technical challenges. With parallel warning channels (SMS and CBS), the Republic of Serbia will join only a few European countries that have both methods of public warning (Figure 4.).

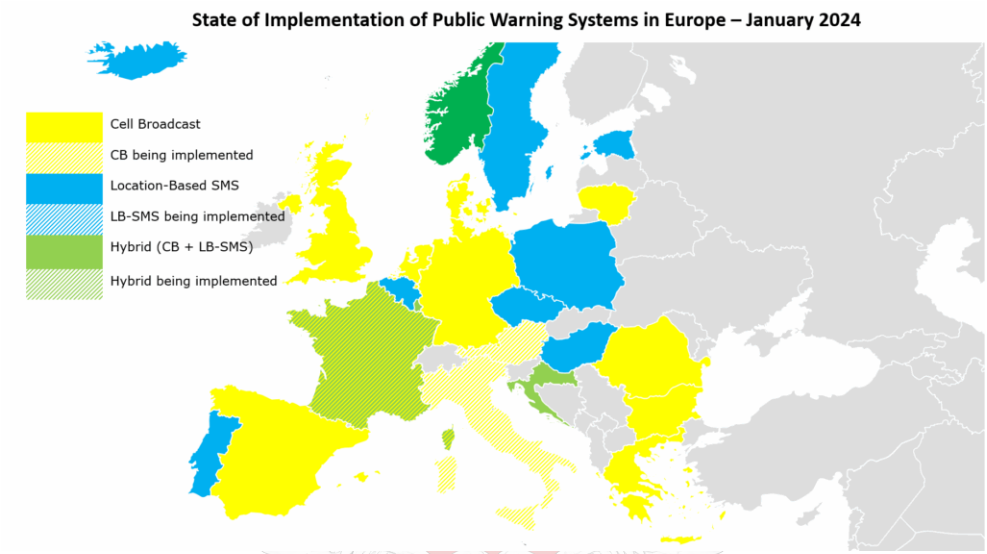

Figure 4. State of implementation of public warning systems in Europe

By integrating these solutions, the "Emergencies" system is raised to the level of advanced European standards such as *EU-Alert*, achieving full alignment with international risk management protocols. The Technical Specification for Emergency Communications, adopted by the European Telecommunications Standards Institute (ETSI) within the EMTEL technical committee for emergency communications, addresses technical requirements and mechanisms for a public warning system based on Cell Broadcast technology (European Telecommunications Standards Institute, 2023). Its application is aligned with Directive (EU) 2018/1972, which prescribes the obligation to establish public warning systems in Member States (European Union, 2018). The ultimate goal of this modernization is a transition to a digitalized, multimedia, highly reliable public warning system that combines the speed of modern technology with the comprehensiveness of traditional communication channels.

The European Emergency Number Association (*European Emergency Number Association*, hereinafter: EENA), which aims to improve emergency response in the European Union, emphasizes that technical solutions should be guided by the principle of technological neutrality, leaving Member States to decide whether to implement cell broadcast (CBS) and/or location-based SMS messaging. In view of the respective advantages and limitations, EENA indicates that using both technologies may provide the most comprehensive approach. In addition, EENA does not support the use of smartphone applications as a replacement for mobile broadcasting and/or location-based SMS,

primarily because applications require downloads and high penetration is difficult to achieve solely through voluntary uptake (Vivier, 2022).

EENA anticipates that public warning systems in the near future will communicate directly with smart devices in homes. According to EENA documents, the future of public warning lies in connecting state platforms with IoT infrastructure, where an emergency message could automatically switch on lights in tunnels, stop trains, or activate audible alarms in smart buildings—reducing the human factor in the response chain to a minimum (Vivier, 2022, pp. 14–16).

5. Conclusion

The establishment of the "Find Me" system and the public warning platform for emergencies illustrates the relevance of coordinated institutional action and modern communication technologies for citizen protection in the digital environment. By defining protocols through the Cooperation Agreement between the MoI and MIT, the Republic of Serbia developed a structured approach to public communication in specific critical events, with implications for the timeliness of response and the broader security framework related to the protection of minors, the population, and property.

Further development of this national system is inseparably linked to the full establishment of the single European emergency number 112, which requires continuous and intensive interdepartmental cooperation. This model is firmly grounded in the Law on Electronic Communications, which imposes on service providers the imperative to enable free access to emergency services from any device. While MIT, through this regulation, ensures technical enablement and implementation of advanced functions such as AML (*Advanced Mobile Location*) for precise caller location, the MoI assumes the key operational role in incident management and coordination of field response.

Based on the results and experience achieved so far in implementing these systems, the planned implementation of CBS technology represents the natural next step in the evolution of the national public warning system. With the introduction of this solution, the system moves from an exclusively reactive to a proactive mode, enabling mass broadcasting of warnings that are immune to network congestion and capable of reaching users within a specific geographic area in real time. According to the Strategy for the Development of the Electronic Communications System ("Official Gazette of the RS", No. 70/2024), CBS implementation was initially planned for 2025, but for economic reasons it was postponed until the end of 2026. Introducing

CBS technology does not imply discontinuing SMS messaging in emergencies. The strategic decision by the MoI and MIT to retain SMS as a secondary channel ensures the necessary inclusiveness for owners of older devices, thereby maximizing population coverage.

This multisector approach, which translates legal provisions into technical and operational mechanisms, is aligned with European standards such as EU-Alert and with EENA recommendations. In addition, continued investment in electronic communications infrastructure and the strengthening of cooperation with media actors remain important for developing a robust public warning system capable of responding to complex contemporary security risks.

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