EVALUATION OF ABS + TECHNOLOGICAL SOLUTIONS

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15.10.2020.	0.2	Original version of the document
04.12.2020.	0.3	Document supplemented by the results of the public survey and Finland's experience with the use of mobile app
21.12.2020.	1.0	Customer comments embedded

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1. EXECUTIVE SUMMARY

Article 110 of Directive (EU) 2018/1972 of the European Parliament and of the Council of 11 December 2018 on the establishment of the European Electronic Communications Code states that "By 21 June 2022, Member States shall ensure that, when public warning systems regarding imminent or developing major emergencies and disasters are in place, public warnings are transmitted by providers of mobile number-based interpersonal communications services to the end-users concerned".

In compliance with the requirements of the Directive, an information system "Early Warning System plus" or ABS + is being developed in Latvia, which is intended for warning the public, both by identifying assessing potential or existing emergency situations impacts on society, as well as eliminating the impact of these situations.

The State Fire and Rescue Service (hereinafter - SFRS) conducts a feasibility study on an early warning solution most suitable for Latvia, using the services of mobile network operators (hereinafter - MNO), which includes assessment of three public warning technological solutions - Cell Broadcast (CB), Location Based SMS (LB- SMS) and mobile app. Result of this assessment will be used as a basis for deciding on the most appropriate public warning solution for Latvia, as well as for the development of the ABS + architecture.

The scope of the study

Within the framework of this study, the consultants conducted a survey of the MNO network and mobile devices, identified public opinion regarding possibilities to receive warning messages on mobile phones, evaluated CB, LB-SMS and mobile application solutions according to several criteria:

1. Compliance of the solution with the needs of public warning, incl. coverage of the technological solution and ability to reach the end users of the mobile network operators (notification speed, notification areas, technological capability of mobile devices to receive warning messages, notification of roaming customers and people with special needs, language support, usability, security, simplicity of solution architecture, broader communication possibilities);
2. Compliance of the solution with regulatory enactments;
3. Solution costs and implementation deadlines

Public opinion

The results of the public e-survey conducted during this study showed that **99.75% of respondents would like to receive warning messages on mobile phones**, especially when the threat is extreme or significant, as well as when the threat is imminent or expected in the near future. 54% of respondents indicated that they would also like to receive informative messages. 83% of respondents noted that they would expect warning messages on mobile phones from SFRS, and 50% respondents indicated that they would expect warning messages from other State authorities.

40% of respondents indicated that they often use mobile phones during the day in vibrating or silent mode. 2/3 of the respondents (70%) during the day use their mobile phones in normal mode (with the sound on). This indicates a high risk that the warning message will not be noticed quickly enough, even if it is received during the day.

Only 47% of respondents use mobile phones in the normal mode (with the sound on) during the day. A possible reaction to a message received on a mobile phone would be: during the day 85% of respondents will read the message within 30 minutes, at night 86% of respondents will not read the message until the morning.

Mobile operator network and end-user mobile devices

According to the information provided by the MNO, the coverage of the **mobile communication network in Latvia is very high, exceeding 99% of the territory of** Latvia in the case of each technological solution variant (CB, LB-SMS, mobile application). The actual reach of mobile network users is affected by the barriers that electromagnetic waves have to overcome in order to reach a particular user's mobile phone. Smart devices account for 74% and their share continues to grow. However, this figure is still not enough to use the mobile app as the primary channel for alerting the public. According to the MNO, most mobile phones available on the market have CB functionality, but it is not known whether it is enabled. With the introduction of ABS + the situation for 2022 should be modeled due to rapidly evolving mobile device market.

Currently, 97% of smartphones use Android OS or iOS. The average time of using one phone in Latvia is a little over two years. For all new iPhones, CB functionality is turned on by default. Also, for smartphones with Android 11 OS, the CB functionality is turned on. This means that in the coming **years there will be a mass transition to mobile devices with CB functionality turned on without the involvement of end users.**

Public warning process

In order to assess the compliance of the technological solutions with the requirements of the Directive and the needs of the IFRS, the consultants defined the desired public warning process, which must be supported by the chosen ABS + solution. This includes recording an emergency event, assessing the impact of the emergency event on the public, deciding to warn the public, defining the warning message and identifying the recipients (geographical area), sending the warning message and analyzing the process results.

Assessment of CB, LB-SMS and mobile application solutions

During the assessment of the solutions, it was concluded that cell broadcasting (CB) technology is the most suitable solution for the public warning system in Latvia.

The table below summarizes the consultants' findings on the strengths and weaknesses of the 3 solutions in the context of public warning needs.

	CB	LB-SMS	Mobile app
Strong sides	1. Reporting rate 2. Ability to reach LV guests 3. Architectural simplicity 4. Users of new Android OS and iOS terminals don't have to take additional action to turn on CB 5. If some MNO network does not work, other MNO will report to the population	1. Unlimited support for mobile equipment 2. Increased warning, communication capabilities	1. Extensive warning, communication capabilities 2. Opportunities to reach certain groups of society 3. Reporting rate
Weak sides	1. Limited communication capabilities (one-way communication) 2. Reports on message delivery are not available 3. Users of old Android OS equipment must take additional steps to turn on CB	1. Reporting rate 2. MNO Infrastructure Load 3. Complexity (keeping the list of active subscribers) 4. Security threats - potentially spoofing of SMS messages.	1. Need for the Internet 2. Limited mobile support (not applicable on button phone) 3. Complex to end-users

Assessing the compliance of the solutions with the requirements of regulatory enactments, it can be concluded that **there are no restrictions in the national level regulation for the implementation of any of the solutions**. In accordance with the provisions of the Directive, the consultants identified the need to supplement the following regulatory documents: Electronic Communications Law, Civil Protection and Disaster Management Law, Law on Emergency Situation and State of Exception, Cabinet Regulation No. 440 "Procedures for Establishing, Operating and Financing the National Early Warning System", General Authorisation Regulations in the Field of Electronic Communications and Cabinet Regulation No. 360 "Regulations Regarding Conformity Assessment, Making Available on the Market, Installation and Use of Radio Equipment".

Summarizing the experience of public warning system implementation in the Netherlands, Lithuania, Finland, Austria, Sweden and Poland, as well as conducting an initial survey of public warning system suppliers and interviewing Latvian MNOs, the following findings were obtained regarding possible implementation costs and deadlines:

1. Based on supplier prices, the implementation and maintenance costs of CB and LB-SMS are comparable (consultants did not have the opportunity to compare infrastructure costs). The cost of implementing a mobile application is 10 times lower than other solutions and its maintenance is 2-3 times cheaper;
2. National approaches to the implementation of public warning systems differ significantly, taking into account the countries' history, cooperation with MSOs, the level of technological development during the implementation of the system, etc. Countries indicated the following costs:

- CB: implementation costs from EUR 6 100 000 to EUR 15 000 000, maintenance from EUR 400 000 to EUR 1 000 000 per year;
- LB-SMS: implementation costs unknown, maintenance costs EUR 2 500 000 per year. Implementation of CB and LB-SMS takes on average 8-9 months (after concluding the procurement contract). It takes 2-3 months to implement the mobile app (including translating the user interface).

The main arguments for choosing the CB solution:

- CB provides fast, efficient, secure and guaranteed communication with public to all mobile device users with acceptable and future-proof accessibility indicators.
- CB main advantages over LB-SMS:

- Standard mobile services are used for LB-SMS, which may be unavailable in case of an emergency (CB uses a special data transmission protocol for the transmission of messages, which works regardless of the availability of mobile communications network)
- LB-SMS sends individual messages to specific subscribers; thus, it requires significantly more time to send messages and increases the load on the mobile network;
- The use of LB-SMS requires the maintenance of a list of active subscribers, which significantly complicates the structure / integration of the system and creates potential risks of unavailability of the solution and violation of personal privacy;
- Recipients of LB-SMS messages need to register in a specific mobile operator's network, as opposed to CB, which provides messages to all mobile device users without registration in the network (including customers of foreign and other operators who are physically located in the mobile coverage area);
- The CB solution is more secure because LB-SMS involves the risk of message spoofing.

- CB main advantages compared to mobile application:
  - The mobile application requires an internet connection that may not be available in the event of an emergency, nor may it be available to all mobile device users (e.g., roaming customers outside the European Union);
  - Mobile application may not be installed or technically available on end-user device (smartphones in Latvia are ~ 74% of users);
- The relative shortcomings of CB are acceptable and could be solved in the future:
  - Insufficient end-user reach due to non-enabled CB message reception settings can be solved in cooperation with mobile device manufacturers and mobile network operators (in the case of LB-SMS this problem does not exist, because virtually all users can receive SMS);
  - Feedback communication can be provided through other channels - SMS, mobile application, web browser, etc.
- From the cost point of view, the costs of CB and LB-SMS solutions are almost equal.

2. INTRODUCTION

2.1. Context

Based on the order from the State Fire and Rescue Service Republic of Latvia (hereinafter "SFRS"), the "Corporate Consulting" within project of the European Commission Civil Protection Mechanism "Study on Early Warning Systems Based on Telecommunications Technologies, ECHO/SUB/2019/TRACK1/808194" carries out a feasibility study on most appropriate early warning solution for Latvia using mobile operator services (hereinafter - ABS +), which includes an evaluation of three public warning technological solutions (cell broadcasting, location-based SMS, mobile application) and the necessary development of operational processes, research, analysis and technical documentation for ABS + establishment (hereinafter - Project).

These activities will at the same time contribute to the implementation of the following requirements of international policy planning documents:

1. Compliance with the requirements of the first paragraph of Article 110 of Directive (EU) 2018/1972 of the European Parliament and of the Council of 11 December 2018 on the establishment of the European Electronic Communications Code (hereinafter - Directive);
2. Decision No 1313/2013/EU of the European Parliament and of the Council of 17 December 2013 on a Union Civil Protection Mechanism compliance with Article 3, first paragraph a.;
3. The implementation of point 18 subpoint (g) of the Sendai Framework for Disaster Risk Reduction 2015-2030;
4. As stated in the conclusion of the European Commission working document "Towards Better Protection of Citizens against Disaster Risks: Strengthening Early Warning Systems in Europe" of 14 December 2007, Member States need to introduce early warning systems based on mobile network operator technologies.

2.2. Purpose of the document

This document includes an evaluation of three public warning technological solutions, which will be used as a basis for deciding on the most appropriate public warning solution for Latvia's needs using mobile communication networks (hereinafter - ABS +). The further development of the ABS + architecture and technical specification will be based on the findings and proposals provided in this document.

2.3. Intended audience of this document

The survey is targeted by a number of institutions and the general public:

- SFRS as manager of the ABS + system,
- The Ministry of Interior, as an industry policy planner and holder of the ABS + system,
- other national regulatory authorities which may initiate public warning,
- the public as beneficiaries of warning statements (hereinafter referred to as "warnings").

2.4. Assumptions and limitations

1. The evaluation shall be carried out with a view to selecting the most appropriate public warning system within the framework of the early warning system.
2. The evaluation focuses on the compliance of technological solutions with the requirements of the Directive and the needs of the SFRS. This does not include market research or an assessment of the options for the specific solutions of the producers concerned.

2.5. Terms and abbreviations

Table 1. Terms and abbreviations.

Term, abbreviation	Explanation
ABS +	"Early warning system plus" (*latvian - "Agrīnās brīdināšanas sistēma plus"*). Information system ensuring public warnings in Latvia
Emergency event	An event in which the public needs emergency assistance from the state (operational services). Emergency events may vary in impact on the general public. In the event of an emergency event with a significant impact on public safety, the State warns the public about the emergency event and the necessary action.
Exceptional situation	A special legal regime during which the Cabinet of Ministers has the right to restrict the rights and freedoms of state administration and local government institutions, natural and legal persons, as well as to impose additional obligations on them in accordance with the procedures and to the extent specified by law. Law "On Emergency Situation and State of Exception"
Warning	Information on the emergency event and the necessary action
CAP	Common Alerting Protocol
CPDML	Civil Protection and Disaster Management Law CPDML

Term, abbreviation	Explanation
CB	Cell Broadcasting (English-*Cell broadcast*)
CBC	*Cell Broadcast Center*. Part of the PWS solution integrated with mobile operator mobile communications equipment providing warning messages
CBE	*Cell Broadcast Entity*. Part of the PWS solution enabling dispatchers to prepare warning messages and initiate their transmission
Directive	Directive (EU) 2018/1972 of the European Parliament and of the Council of 11 December 2018 establishing the European Electronic Communications Code
EEN	European Emergency *Number Association*
ECM	Electronic Communications Merchant
ETSI	European Telecommunications Standards Institute
MoI	Ministry of the Interior
MoI IC	The Information Centre of the Ministry of the Interior
LB-SMS	Location-based text message (English - *Location-based SMS*)
LEGMC	State limited Liability Company "Latvian Environment, Geology and Meteorology Centre"
LMT	SIA "Latvijas Mobilais telefons"
MBS	Mobile base station
Regulation No. 440	Republic of Latvia Cabinet Regulation No. 440 Adopted 8 August 2017 "Procedures for Establishing, Operating and Financing the National Early Warning System"
MNO	Mobile network operator
OTT	*Over-the-top*
OMD	Operational Management Division of SFRS
PMECN	Public mobile electronic communications network
Project	Scope of the "Study on Early Warning Systems Based on Telecommunications Technologies, ECHO/SUB/2019/TRACK1/808194"
PWS	Public warning system. A set of procedures and solutions enabling public authorities to warn the public to direct or threatening emergency situations and disasters through a variety of communication channels, including mobile facilities, web solutions (social networks, etc.), radio, television, sirens, specialized communication equipment, etc.
System	Public warning system ABS +
SLA	Service Level Agreement, Service Quality Indicators agreed by the Parties before the service is provided/received
PUC	Public Utilities Commission
SASL	State Administration Structure Law
SFRS, Customer	State Fire and Rescue Service

3. CONTEXT AND SCOPE OF ABS + DEPLOYMENT

3.1. The context of the early warning system and the public warning system

Article 110 of Directive (EU) 2018/1972 of the European Parliament and of the Council of 11 December 2018 on the establishment of the European Electronic Communications Code states that "By 21 June 2022, Member States shall ensure that, when public warning systems regarding imminent or developing major emergencies and disasters are in place, public warnings are transmitted by providers of mobile number-based interpersonal communications services to the end-users concerned"[1]. The Directive also allows warnings to be sent to the public via other channels (e.g., mobile applications), ensuring that they comply with requirements stated above. The assessment of the effectiveness of the various notification channels is conducted using appropriate BEREC guidelines[2].

The term "emergency situation" appears in the Law "On Emergency Situation and State of Exception", during which the Cabinet of Ministers has the right to limit the rights and freedoms of State administrative and local government authorities, natural persons and legal persons in accordance with the procedures and to the extent specified by the Law, as well as to impose additional duties on them. In the context of the Directive, it can be understood that the emergency situation does not directly address the emergency situation, but all situations where the public needs emergency assistance from the State (operational services). Therefore, it is further assumed that **the emergency and emergency situation are not equivalent terms.** In order not to confuse both terms, the term **"emergency event"** is used in the document below, whose impact on society can reach a significant level that makes it necessary to inform the public.

Thus, in the Directive and the relevant BEREC guidelines, the Public Warning System (PWS) is described as a system (set of procedures and solutions) through which **public authorities can warn the public about immediate or threatening emergency situations/events and disasters through different communication channels**, including - mobile devices, web solutions (social networks, etc.), radio, television, sirens, specialized public addressing systems, etc.

[1] https://eur-lex.europa.eu/legal-content/LV/TXT/HTML/? uri = CELEX: 32018L1972 & from = EN #d1e9543-36-1

[2] BEREC Guidelines on how to assess the effectiveness of public consultation systems transmitted by different means, https://berec.europa.eu/eng/document_register/subject_matter/berec/download/0/9286-berec-guidelines-on-how-to-assess-the-ef_0.pdf

The concept of an early warning system (*EWS*) is used internationally to identify a set of processes aimed at minimizing the impact of all types of risks to public, with predicting their probability and providing timely and relevant information in a systematic manner[3].

The basic elements of the EWS are:

1. **Risk knowledge** is formed by organizations responsible for risk management in a certain area, identifying risks and their impact on society, conducting risk assessments (regularly and at risk), organizing public information campaigns on potential risks, risk communication channels and risk action plan;
2. **Monitoring and warning service** includes monitoring infrastructure, information gathering and analysis activities, identification of critical indicators. Modern technologies make it possible to collect data from a variety of monitoring sources, including citizens' smartphone sensors;
3. **Response Capability** includes centralized knowledge, plans, risk management instructions, as well as training of responsible authorities and the public;
4. **Dissemination and Communication** is a critical and strategic element of the EWS, based on safe and disaster-tolerant technologies, and provides timely, targeted public awareness and, where possible, communication to provide effective support to victims.

Figure 1. based on the structure of the UN Early Warning System, illustrates the link between the two concepts.

[3]Early Warning Systems (EWS) are complex processes aimed at reducing the impact of natural hazards by providing timely and relevant information in a systematic way. United Nations, 2018, https://www.undp.org/content/dam/rbec/docs/UNDP%20Brochure%20Early%20Warning%20Systems.pdf

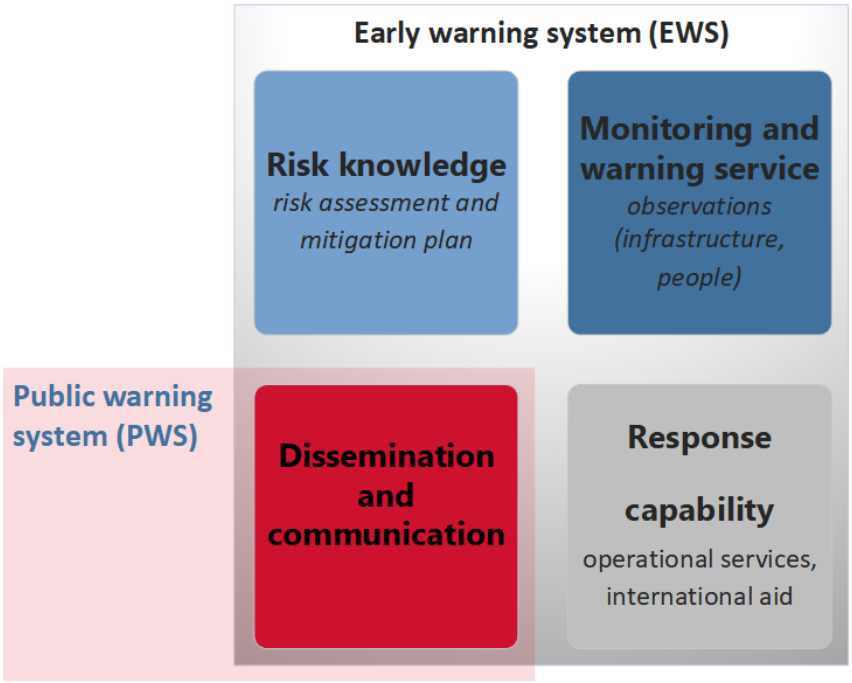

Figure 1. Demarcation of the Early Warning System and the Public Warning System.

The concept of an early warning system is broader – it also includes notification part, which is the task of the public warning system.

Taking into account that in Latvia public warning is provided within the framework of early warning system, then in the context of this document the term early warning system plus (ABS +) means public warning system (within the meaning of the Directive) and are used synonymously.

3.2. Existing public warning system

Public warning in Latvia takes place within the framework of the State's early warning system as specified in Civil Protection and Disaster Management Law. Cabinet Regulation No. 440 of 8 August 2017 "Procedures for Establishing, Operating and Financing the National Early Warning System" defines the elements of the national early warning system as follows:

- alarm sirens placed in republic cities, municipality towns and municipality parishes that are controlled and turned on from the central control panel (164 sirens);
- alarm and public address equipment of State and local government authorities;
- electronic mass media (e.g., radio, television);
- broadcasters and electronic communications merchants that ensure the electronic communications network;

- other engineering solutions that can provide early warning (the meteorological observation network established by the State limited Liability Company "Latvian Environment, Geology and Meteorology Center" with 33 stationary stations; hydrological observation network with 79 observation stations; warning services of the operational services and the Latvian National Armed Forces)[4].

The SFRS informs that the operation of the National Early Warning System alarm sirens is based on 5 consecutive steps:

1. The decision regarding the activation of the state early warning system shall be made by the SFRS if information has been received from state and local government institutions in accordance with their competence, as well as from natural or legal persons regarding a disaster or disaster threats;
2. prior to the activation of the alarm sirens, the SFRS shall, in accordance with the concluded interdepartmental agreements, send to the electronic mass media information regarding the disaster or its threats and information about necessary action of the public;
3. Upon receiving a response from the electronic mass media regarding their readiness to transmit the warning information, the SFRS shall turn on the alarm sirens in the chosen territory and keep sirens turned on for a least three minutes;
4. Simultaneously with the activation of the alarm sirens, the electronic mass media shall announce the information provided by the SFRS regarding the disaster or its threat and the actions necessary to be taken by the population;
5. Residents shall switch on equipment that ensures the receipt of information transmitted by electronic mass media (radio, television).

The involvement of mobile operators in informing the public is currently not regular procedure. Currently each public warning notification initiative must be negotiated with each mobile network operator separately, within mutual agreement between the State and the mobile network operators.

3.3. Purpose of implementing the ABS + solution

Article 110 of Directive (EU) 2018/1972 of the European Parliament and of the Council of 11 December 2018 on the establishment of the European Electronic Communications Code states that "By 21 June

[4]Information report on the CB system and other possible notification systems, their implementation and maintenance costs http://tap.mk.gov.lv/lv/mk/tap/?pid=40489470

2022, Member States shall ensure that, when public warning systems regarding imminent or developing major emergencies and disasters are in place, public warnings are transmitted by providers of mobile number-based interpersonal communications services to the end-users concerned".

On the other hand, paragraph 2 of this Article provides that "Notwithstanding paragraph 1, Member States may determine that public warnings be transmitted through publicly available electronic communications services other than those referred to in paragraph 1, and other than broadcasting services, or through a mobile application relying on an internet access service, provided that the effectiveness of the public warning system is equivalent in terms of coverage and capacity to reach end-users, including those only temporarily present in the area concerned, taking utmost account of BEREC guidelines. Public warnings shall be easy for end-users to receive". The capacity of the existing public warning system is not sufficient to meet the requirements of the Directive. **The purpose of implementing ABS + is to provide an effective public warning for direct and threatening emergency events by sending warning messages to mobile phones**.

In July 2020, the Ministry of the Interior prepared and submitted a report on the "Cell Broadcasting System and other possible notification systems, their implementation and maintenance costs" at the meeting of the Secretaries of State, which stipulates that in order for the Ministry of the Interior to take a decision on the technological solution to use for the implementation of the Public Warning System (ABS +), an assessment should be carried out of the following technological solutions:

1. Cell Broadcasting (hereinafter - CB),
2. Location-based SMS (hereinafter - LB-SMS),
3. Mobile app.

3.4. ABS + public warning process

In order to assess the compliance of the technological solutions with the requirements of the Directive and the needs of the SFRS, we will determine the desired public warning process, which will have to be supported by the chosen ABS + solution – see Figure 2 .

The process may be initiated by any emergency event having a significant impact on the public. An emergency event can be identified by the public, operational services, rescue workers, international organizations and others.

The range of emergency events for which public warning may be initiated may be identified in different ways. For example, a warning message may be sent in the context of the following emergency events:

- Traffic (*Transport alert*): closure of national borders, road accident, road repairs, public transport restrictions;
- Meteorological and geophysical conditions (*Geophysical and Meteorological alert*): storm, flooding, extreme temperatures, earthquake;
- Terrorism (*Terrorism alert*): terrorist attack, radiological, explosive, biological, chemical equipment;
- Hazardous materials (*Hazmat alert*): leakage of gas, petroleum products, chemicals;
- Aviation (*Aviation alert*): aircraft accident, emergency landing, aerodrome closure, airfield fire, aircraft incident, flight delay;
- Health (*Health alert*): public health, quarantine, outbreak;
- Security (*Security alert*): armed collision, bank robbery, threat of explosion, population unrest, hostage situation, police activity, military operation, violent crime, detection of suspicious objects, migrant flow across the border;
- Strikes (*Labor alert*): sectoral strikes;
- Infrastructure (*Infrastructure alert*): fuel leakage, water/sewer leakage and damage, telecommunications/electrical supply interruption;
- Fire (*Fire alert*): explosion, forest fire, fire in multi- story building, industrial fire, fire in vehicle;
- Structural *alert*: breakdown of bridge, tunnel, building, construction, unsafe structures;
- Advisory *alert*: recommendations on food security, public health, travel, population protests, military training, public measures.
- Others: for example, evacuations.

The national civil protection plan shall identify the following hazards which may make it necessary to notify the public of emergency events:

- Natural disasters (geophysical):

  a) Earthquakes;

b) Landslides;

- Natural disasters (hydrological):
  a) Floods and floods;
  b) Wind flows;
- Natural disasters (meteorological):
  a) Torrential rains (long rains, thunderstorms) and hail;
  b) Storms (wind gusts), sudden wind gusts;
  c) Tornadoes;
- Natural disasters (climatological):
  a) Strong frost, snow, putter, icing, wet snow;
  b) Heat;
  c) Icing;
  d) Drought;
  e) Forest and peat bog fires;
- Natural disasters (biological):
  a) Epidemics: pandemic influenza;
  b) Epizootic diseases;
  c) Epiphytotia;
- Technogenic (anthropogenic) disasters:
  a) Leakage of hazardous chemicals at the site;
  b) Accidents in the transport infrastructure of the oil pipeline;
  c) Emergency in the natural gas supply system;
  d) The accident of radioactive substances at the site;
  e) Incidents of biological substances;
  f) Fires will be built;

g) Ruptures of dams and other hydrotechnical structures - a cascade of Daugava hydroelectric power plants;

h) Accidents or accidents in port and sea hydrotechnical engineering structures;

i) Damage to distribution electricity networks and damage to transmission grids;

j) Collapse of structures;

k) Ship leakage of hazardous chemicals;

l) Running the ship on the bank;

m) Collision of ships;

n) Passenger ship disaster;

o) Accident of road transport;

p) Aircraft accident;

q) Railway transport disaster;

r) Public riots;

s) Terrorist acts;

t) Internal riots.

At the discretion of the consultants, when introducing an ABS + solution for public warning, there should be ensured at least the following possibilities:

- implementation the process reflected in Figure 2.
- quickly distribute the warning message to the public in the network of all mobile network operators in Latvia (up to 10 min);
- a warning should be delivered to the public in a certain (chosen) notification region, during a specified period of time, in different languages;
- to deliver a warning to people from other countries who are in the territory of Latvia (tourists etc.);
- unambiguously identify the sender of the warning message;
- ensure that the warning signal is distinguishable and recognizable, and that it is saved in end-users device;

- to create a report of the results of the dissemination of the warning message (including. number of notified persons, time of notification, territory of notification etc.).

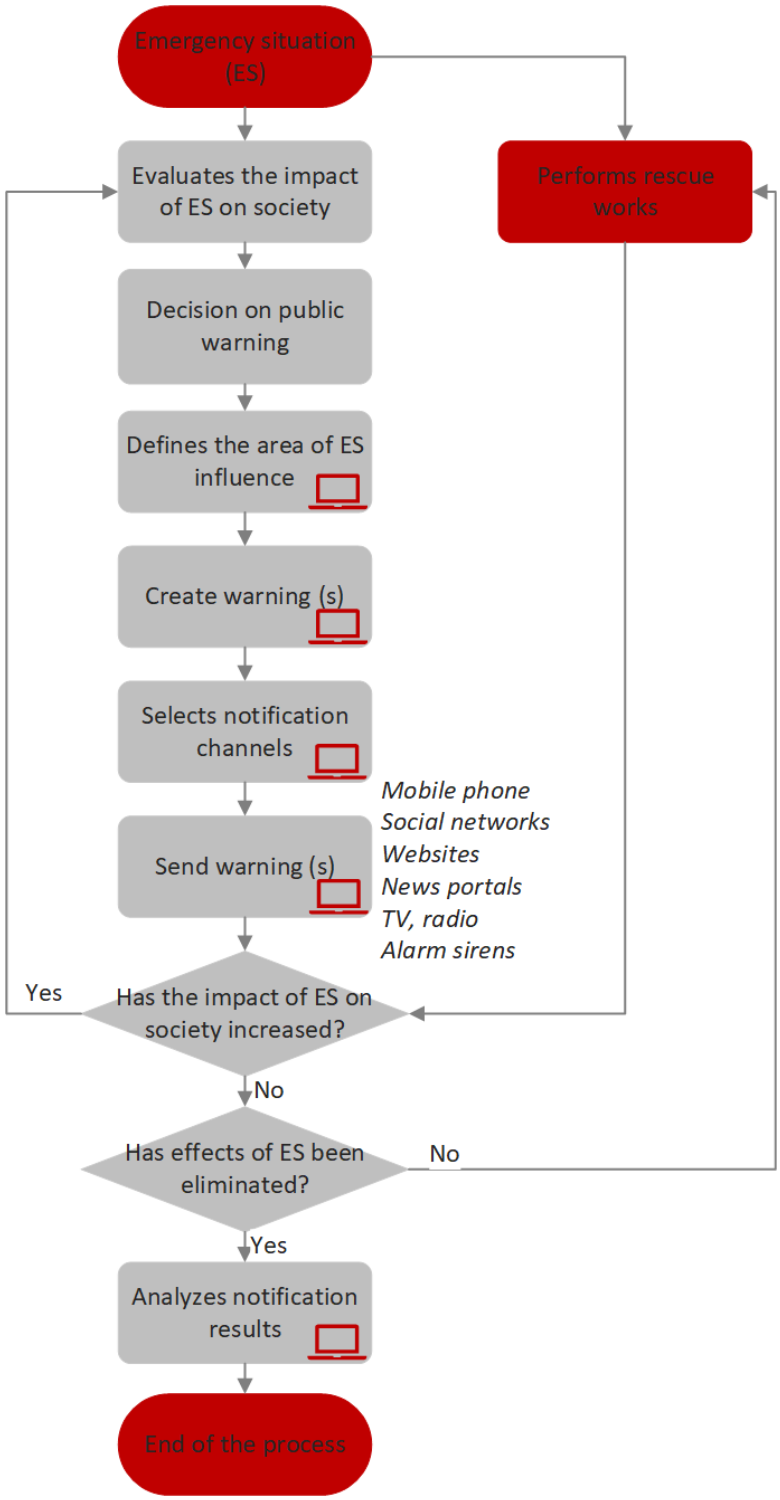

Figure 2. ABS + public warning process.

4. OVERVIEW OF ABS + SOLUTIONS AND DESCRIPTION OF LATVIAN MOBILE NETWORK

4.1. Cell Broadcast Solution (Cell Broadcast)

Technology

The cell broadcasting system is part of the GSM (2G), UMTS (3G), LTE (4G) mobile networks standard (also included in a generation of 5G mobile standards). The BEREC guidelines state that the use of cell broadcasting system is similar to a text message (SMS) solution, but the difference is that when is that when using mobile network operator towers, the message is sent from a point to a defined geographical area (zone), or in accordance with the principle of one-to-many.

Warning dissemination process

The BEREC guidelines state that a cell broadcasting message is sent at predefined intervals until it is no longer necessary. Thus, people who later enter the affected area (or have been in this area but not in mobile network coverage) could also be warned via cell broadcasting. Each warning message has its own unique serial number. The mobile device memorizes the serial number of the cell broadcast message, so the cell broadcast message appears only once on each mobile device, but the end user has the option to open as many times as necessary. Cell broadcast messages can be received on mobile devices that are properly configured and geographically located in the specified receiving area of the message. Cell broadcasting messages are automatically displayed on the user's mobile phone screen and typically have a special sound tone and vibration. It is important to note that a cell broadcast solution does not require database of end-user phone numbers.

Data flow

The BEREC guidelines explain that a cell broadcasting message from a cell broadcasting centre is sent only once to each cell and is transmitted from each cell to all connected mobile devices. The network load generated by the warning message is very low, so cell message transmission works well during network congestion[56]. Contrary to SMS, the cell broadcasting does not allow two-way communication.

[6]BEREC guidelines on how to assess the effectiveness of public betting systems transmitted by different means https://berec.europa.eu/eng/document_register/subject_matter/berec/regulatory_best_practices/guidelines/8913-berec-guidelines-on-how-to-assess-the-effectiveness-of-public-warning-systems-transmitted-by-different-means

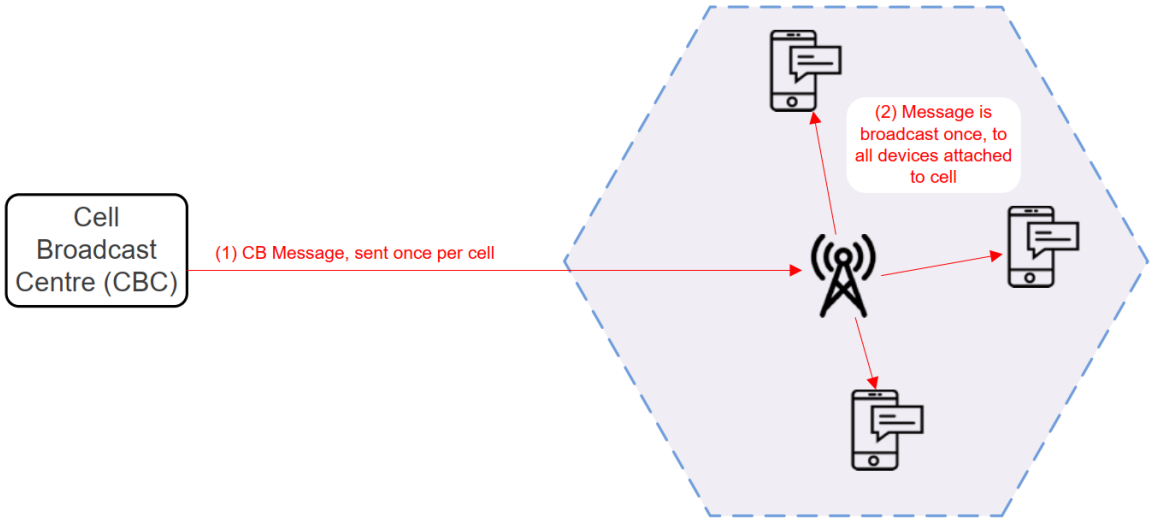

Figure 3. Cell broadcasting data flow.

Source: BEREC, 2019

Identified shortcomings

- Because a cell broadcast solution broadcasts one message to many devices, it is not possible to determine in real time how many users have received sent messages.
- Limited possibilities for feedback from the public (end-users do not have the possibility to respond directly to the received message).
- Users have the option to turn off option for receiving cell broadcast messages manually in their mobile phones.
- Warning messages sent while the user's mobile phone is switched off will not be received upon switching phone back on[7].

Countries where solution is implemented

Chile, Greece, Lithuania, Israel, Netherlands, Canada, New Zealand.

End-users device ability to receive warning messages

The answer to the question "How many mobile devices can receive CB notifications?" has 2 parts:

1. Does the mobile device technologically support the receipt of CB messages?

[7] https://publicwarning.eu/

2. Is CB functionality enabled on the mobile device?

Ability for the mobile device to receipt CB messages are influenced by several factors:

- whether the mobile device is intended for the EU market,
- if not, in which country and in which factory the equipment (model) was manufactured,
- device release time (year and month).

The directive stipulates that only smartphones with CB functionality will be able to be marketed in EU countries. Assessing the situation in Latvia, it should be noted that a significant part of Latvians buys smartphones online, i.e., without checking whether the device complies with the requirements of the said directive (for example, when buying on AliExpress or Ebay platforms). According to the information provided by the Latvian MNO, the number of terminal equipment used by customers and the variety of models can be measured in several thousand units, which requires a disproportionate investment of resources for statistically correct research. Also, the analysis of the sample of the most popular devices does not give an idea of how large a part of the Latvian population has equipment with the possibility to receive CB notifications, because only a third of the population uses Top 15 equipment.

The average time of using one phone in Latvia is a little over two years. The implementation of the ABS + solution will take place in 2022. Therefore, it would be reasonable to model the situation when CB technology would be introduced in Latvia.

For all new iPhones, CB functionality is turned on by default. For smartphones with Android OS with Android 11, CB functionality is also turned on (as of September 2020). In practice, Android 11 can currently be installed on many smartphones manufactured in 2019, starting with the Samsung S10 model. The transition of existing smartphones to Android 11 will take place in 2020-2021. per year. All new phones, logically, will be with Android 11 with CB functionality turned on. This means that in the next 5 years there will be a mass transition to terminals with CB functionality turned on without the involvement of equipment users.

As the experience and practice of other countries shows, there is great potential to achieve a very high proportion of smartphones with CB functionality enabled. For example, in the Netherlands, about 90% of smartphones have CB functionality enabled. In order to achieve at least such statistic in Latvia, it would be necessary to take at least the following measures:

1. To make amendments to the regulatory framework, stipulating that starting from a certain date, mobile devices sold in the Latvian market must be with enabled cell broadcast

functionality in accordance with the EU-ALERT standard (ETSI TS 102 900) (Cell Broadcast). These amendments should be made to Cabinet Regulation No. 360 "Regulations Regarding Conformity Assessment, Making Available on the Market, Installation and Use of Radio Equipment";

2. Communication and cooperation with Apple and Google to ensure that CB functionality is enabled remotely, such as with the latest operating system updates;
3. Mobile device users should be informed about the possibilities of enabling CB functionality for certain smartphone models;
4. Periodically, on specified, pre-announced dates, send a test CB message to all mobile network users. If such a message is not received, the user is invited to familiarize himself with the instructions provided on the SFRS website on how to proceed to enable CB functionality.

The above measures are objectively necessary to achieve a high proportion of CB-enabled smartphones, and it is currently not appropriate to assess the proportion of existing CB-enabled smartphones until any of these measures have been implemented.

4.1.1. Cell Broadcast solution implementation experience in Lithuania

Information on the Lithuanian experience of the implementation of the cell broadcasting solution was obtained in a video conference held on September 17, 2020, with the participation of representatives of the Fire and Rescue Department of the Lithuanian Ministry of the Interior.

General description of the solution

Since 2012, in addition to the alarm siren and speaker solution, a cell broadcast solution has been used in Lithuania. Although the two solutions are not integrated and operate separately, they generally form the Lithuanian public alert system. Unrelated to cell broadcasting solution, the responsible authorities have the possibility of directly suspending television and radio broadcasting in order to transmit warning messages.

In Lithuania, each local government has access to a platform for sending warning messages, the local government may, accordingly, send out warning messages within its territory using a cell broadcast solution. If more than 3 municipalities are affected, warning messages then are sent on a national level. The Fire and Rescue Department of the Lithuanian Ministry of Interior (hereinafter referred to as "LT SFRS") is informed of the local governments' desire to send out warning statements. LT SFRS does not have the right to refuse for municipalities to send warning messages to public, but the event

in question must threatening or significant to society. Most commonly, warning messages are sent for severe wind, floods and traffic accidents that cause major traffic jams. Notifications are also sent for military exercises and, for example, for action to be taken in the event of an imminent threat, such as a fire. Test alert notifications are sent twice a year.

In the event of an alarm siren being activated, cell broadcasting statements about the reason for the activation of the alarm sirens are also sent to the population. Warning messages are sent in three languages, Lithuanian, English and Russian. The message display language depends on the end user's phone settings.

The rescue manager may request the sending of warning messages via a cell broadcasting solution by contacting the 112 dispatchers.

LT-SFRS representatives indicate that it is not possible to obtain accurate information on how many end-users receive sent warning messages. It is only possible to see from which cells the message has been sent successfully. For this reason, population control groups have been established with specific mobile phone models they use. This control group has to provide information to the LT-SFRS if a warning message has been received. Based on population surveys, LT-SFRS indicated that 30-50% of Lithuanians have received warning messages. In general, the Lithuanian population is satisfied with the possibility to receive warning messages on mobile phones.

A special web page (https://www.lt72.lt/) was created in Lithuania, which contains information about the cell broadcast solution, as well as instructions on how to activate the cell broadcasting function in various mobile phone models.

Funding

With regard to the operation of cell broadcasting, all costs are borne by the State. The cell broadcasting solution belongs to the Republic of Lithuania, and when implementing the solution, the state purchased all the necessary equipment, including equipment for mobile network operators. In 2012, the implementation of the project required approximately 4.3 million EUR, while the annual maintenance costs are approximately 200 000 EUR.

As regards the SLA indicators, LT SFRS has established the SLA criteria for operating the system with the cell broadcast solution provider (NT Service), the system must be capable of operating 90% of the working time, and the system must not be available for more than 1 hour. The SLA contracts with mobile network operators are concluded by NT Service.

Technological description

In general, the cell broadcasting system has two parts - the core part of the system (servers, etc.) and the CB center is under the control of LT-SFRS.

- User Interface - Esri ArcGIS software (interactive maps with the ability to see the cell destination, set cell broadcast areas, enter broadcast messages, schedule message sending times, etc.).
- "HB Viewer for Messaging" - the main program for preparing messages (text message and mobile operator cell information) and sending them to Celltick CBC software.
- Celltick CBC software - gateway with different interfaces to mobile network operator 2G, 3G and 4G networks.
- MS servers and MS SQL, SUN Solaris.
- All servers involved in the operation of the solution belong to LT SFRS.
- Not all mobile operators are required to install the same software, but the mobile operator's equipment must comply with ETSI TS 123 041 / 3GPP TS 23.041 and other 3GPP standards.
- In the event of a power outage, the warning system is able to operate in an autonomous mode for up to 8 hours and it is monitored in 24/7 mode.
- Existing equipment is not compatible with the 5G protocol.

To enable CB function on end-user phones, the Lithuanian state contacted Apple, Google and mobile-phone manufacturers that use the Android operating system.

The software available to the dispatcher allows to create any areas / zones on the map of Lithuania, and the system sends messages to the cells in that area. It is possible to set the frequency of repeating warning messages as needed, and it is possible to schedule notification sending. In addition, if the warning message has already been received once, the message will not be displayed a second time.

4.1.2. Cell Broadcast solution implementation experience in the Netherlands

Information on the Dutch experience with the implementation of the CB solution was obtained during video conference on 18 September 2020, interviewing Matthijs Geilenkirchen (Ministry of Justice and Security Officer in charge of maintaining NL-Alert) and John Tacken (consultant for NL-Alert).

General description of the solution

The public warning system used in the Netherlands, using cell broadcasting technology (NL - Alert), was introduced in 2012 and is managed by the Dutch Ministry of Justice and Security. According to the Dutch Ministry of Justice and Security, the main reason for choosing the cell broadcasting technology was to set up a national public alert system that would allow all Dutch citizens to be notified within 3 minutes. In addition, it was mentioned as an important factor that the system should be simple and robust, because, for example, in the event of a single operator failure, the transmission of cell broadcast messages will not be affected. As another important factor in favor of cell broadcasting, it was mentioned that information on end-users was not collected.

Twice a year, a test warning messages are sent in the Netherlands and based on a survey of 2,000 Dutch people conducted in June 2020, it was concluded that around 90% of the people in the Netherlands have received test warning messages. Citizens' surveys are the only way to get feedback from the public. By introducing a cell broadcasting system in 2012, only 9% of the Dutch population were able to receive cell broadcasting messages. On averages, 50-100 warning messages are sent during the year. At national level, warning messages have been sent only 2 times so far (not including test messages).

According to the Dutch Ministry of Justice and Security, Dutch citizens also inform their neighbors and family members when they receive alerts, thus ensuring the widest possible public awareness of the threat through public involvement.

There are 25 warning regions in the Netherlands and there is a possibility of sending out cell broadcasting messages at both regional and national levels.

Warning messages are sent by the 112 dispatcher centre contacted by the responsible rescue manager requesting the sending of warning messages.

Funding

The total costs of implementing the Cell Broadcasting solution in 2012 were as follows:

- EUR 12 million for mobile network operators (EUR 4 million per operator),
- EUR 1 million on the kernel of the warning system (Brokers), which provides for the preparation of warning messages, area selection, selecting of notification channels, sending messages, etc.;
- EUR 2 million for public education campaigns.

The total annual costs of leasing and maintenance of the system are EUR 1 million, of which EUR 700 000 relate to the costs of the system (broker) and EUR 300 000 for technical maintenance, including solving technical problems.

The Dutch State paid the initial costs of mobile network operators related to the adaptation of the infrastructure to provide the function of cell broadcasting. Currently, in the Netherlands, the sending of warning messages using cell broadcasting, according to law is an obligation to mobile network operators, so the State does not compensate mobile network operators for the costs of providing the function of cell broadcasting.

As regards the SLA criteria, they are set out in agreements between the Dutch State and the mobile network operators. There are different SLAs with each mobile operator.

Technological description

Apple and individual mobile-phone makers that use the Android operating system were contacted to activate a cell-broadcast function on end-user phones. As stated by the Dutch Ministry of Justice and Security, starting with version 11 of the Android operating system, cell broadcasting will already be incorporated into the software, so it will no longer be necessary to address each mobile phone manufacturer individually. The current cell broadcasting solution was developed and implemented by One2Many (bought by Everbridge in 2020).

Cell broadcast centers are installed in the infrastructure of mobile operators and each mobile operator has 2 cell broadcast centers. In general, cell broadcasting centers from different manufacturers are used. The decision on which manufacturer's cell broadcasting center to install was taken by the mobile operators themselves, so additional integration work had to be done in order for Brokers to be able to connect to these cell broadcasting centers of different manufacturers. The solution also uses the CAP protocol.

4.2. Location-based SMS solution (LB-SMS)

Technology

Location-based SMS is an SMS message sent to devices connected to a mobile network located in a specific geographical area. In order to achieve this, there are two possible solutions where information on the location of end-users is collected and maintained by mobile network operators or by a merchant who ensures the operation of the established public warning system. Accordingly, the mobile operator or merchant providing the public warning system must constantly maintain and

update the mobile device database or user list in the particular notification area. The BEREC guidelines explain that it is normally necessary to establish a Mobile Location Centre to obtain a list of users in a given area.

Warning dissemination process

The BEREC guidelines state that, in order to successfully send a warning message to a mobile phone, it is necessary to provide a telephone number database in a specific area, managed by the mobile network operator, which contains the mobile phone numbers of customers in that particular territorial area.

This option provides location-based SMS services that allow mobile network operator to identify the location of customers' phones in that area. When creating a list of customer phone numbers in the affected area, LB-SMS allows to contact these end-users also after the event by sending additional messages to recipients who received the initial warning message. Unlike cell broadcasting, receiving LB-SMS doesn't require configuring of mobile phone.

Data flow

As stated in the BEREC Guidelines, an additional difference between CB and LB-SMS is that in the mobile network, the LB-SMS message must be delivered separately to each user, as the SMS standards do not provide for "one-to-many" message delivery options. In addition, mobile network operators can only send LB-SMS to their customers / subscribers.

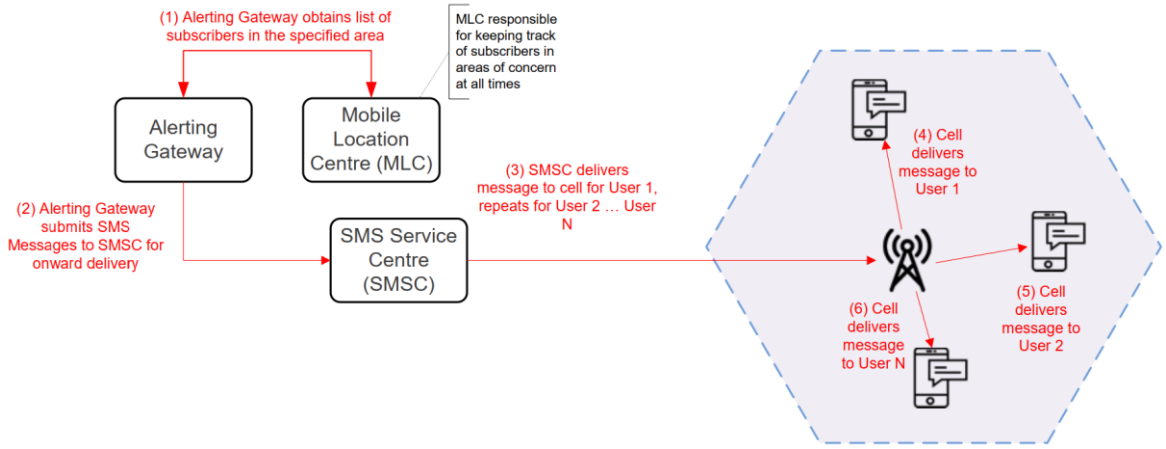

Figure 4. Location-based SMS solution data flow.

Source: BEREC, 2019

Identified shortcomings

- In the case of LB-SMS ABS +, the MNO can only notify its customers / subscribers, if one of the MNO towers stops working, the customers of this MNO will not receive a warning message (SMS) in the area, as opposed to the CB solution where other MNO towers can send a warning message.
- As indicated in the BEREC Guidelines, there is currently no standardized method for Mobile Location Centers to track mobile devices as they move through the mobile network, and there is a potential for some level of inaccuracy.
- LB-SMS warning messages will not generate notification sounds or ring tones and vibrations that are different from a normal SMS message, so end users may not notice the warning messages when mixed with a normal text message.
- Depending on the number of mobile phones in the area, the delivery time for location-based SMS alert messages can take up to several hours.
- With the introduction of LB-SMS and the establishment of LBAS, the methods used by the Mobile Location Center to track the movement of mobile devices over the network are not standardized and are subject to some inaccuracy.
- It is potentially possible to spoof LB-SMS messages if appropriate security devices (SMS firewalls, etc.) are not used.

Countries where solution is implemented

Austria, Australia, Belgium, Denmark, Iceland, Norway, Romania, Sweden, Poland.

4.2.1. LB-SMS solution implementation experience in Poland

Information on Poland's experience with the implementation of the LB-SMS solution was obtained by receiving written responses from the Polish Government Security Center.

General description of the solution

On 12 December 2018, Poland initiated the use of the LB-SMS solution, before carrying out a 6-month pilot project for testing. The development of the solution is still ongoing. The solution allows to highlight the hazard area on the map that needs to be notified. The coverage of the solution 100% covers the territory of Poland in total, 4 mobile operators are involved in ensuring the operation of

the solution. Warning SMS will be received by people with mobile phones at the designated notification are, including roaming foreigners who will receive notifications in English.

Upon receipt of the warning information, the Polish Government Security Centre sends warning message to be distributed to mobile network operators, which have to send warning messages to their customers / subscribers. The time between sending the message from the Polish Government Security Center and sending the message to public takes up to 30 minutes.

Most frequently, warning messages about weather conditions are sent.

Technological description

Operational continuity is provided by the dispatchers which monitors potential hazards 24/7.

When a software failure occurs, it can be started from another location, if communication channel with mobile network operators is available. For security reasons, each message is digitally signed and a unique ID is provided for verification. The Government Security Center does not process personal data from end-users SIM cards and does not store user databases. This warning system is not compatible with other systems.

4.2.2. LB-SMS solution implementation experience in Sweden

Information about Sweden's experience in implementing the LB-SMS solution was obtained on 24 September 2020 during videoconference by interviewing Marcusson Håkan (warning system architect) and Maria Lundström (warning system IT administrator) from the Swedish Civil Emergency Agency.

General description of the solution

In 2013, a decision was taken in Sweden that it was necessary to introduce a reverse 112 system. For this reason, a public survey was conducted to identify which public warning solution citizens would like, either a cell broadcasting solution or an SMS. Given that cell broadcasting functionality was not widespread in 2013, a decision was made to use an SMS solution to send warnings to the public. SMS was also technically easier to implement during the period considered. Given that the legislative framework initially did not exist to fully implement the location-based SMS solution, it was necessary to give individual consent from citizens that their location would be determined. Accordingly, only from 2017, when the legislative framework was put in place, was a fully operating LB-SMS solution was launched. Given the relatively large territory of Sweden, it is also planned to introduce a public warning system based on cell broadcasting solutions.

Given that the LB-SMS solution is subject to spoofing, warning messages are only sent together with simultaneous statements on radio and TV.

On average, warning messages are sent 40-50 times (within the regions) and are mainly linked to fires and gas leaks. At national level, no warning messages have been sent until now. Also test messages are not sent. This is mainly due to the relatively low throughput capacity of the system. For example, it took 3 hours to send 150,000 SMS messages in the Malmö area.

Warning messages are sent only in Swedish. The main advantage of LB-SMS was the possibility for the end user to reply to the received text message.

Funding

The costs of maintenance of the system are EUR 2,5 million per year, including compensation for mobile network operators of EUR 1,2 million (approximately EUR 300 thousand per each mobile network operator). Mobile network operators were also compensated for the necessary solution implementation costs.

Technological description

In Sweden, the LB-SMS solution was supplied by Unified Messaging Systems (bought by Everbridge in 2018). All mobile network operators have the same technological solution installed. Depending on the notifiable area, it is up to the mobile network operators themselves to decide from which towers to send warning messages.

The SLA criteria depend on the number of people in a given region. One of the criteria for the SLA is the ability to reach 95% of subscribers (up to 50,000 subscribers) within 5 minutes.

4.3. Mobile Application Solution

Technology

As stated in the BEREC guidelines, the mobile app works on user devices that have installed it and the mobile app communicates with the OTT application server. Due to the specificities of the IP network, each mobile device should be contacted separately because it is not possible to transmit warning messages to all mobile devices at the same time as in the case of cell broadcasting. When a warning message is received from the alert gateway for a specific area, the OTT application server then sends warning notification messages.

Warning dissemination process

On the basis of the BEREC guidelines, there are potentially two possible options described in Table 2.

Table 2. Mobile Application Process Implementation Variations.

Description of the options	Comment
Option 1: Send an alert message to all connected devices, regardless of location. Each mobile device "decides" or displays a warning message, depending on the location of the device.	No real-time user location information is required, but network resources will be consumed to send warning messages to all devices, even if they do not display a warning message. It should be noted that, depending on mobile device, there might be potential errors in determining the user's location.
Option 2: Maintain a real-time user database, so a warning message is sent only to mobile devices located in the selected area.	This approach reduces the total number of warnings sent because messages are not sent to devices outside the notification area. However, setting the location of real-time users increases network capacity as well as additional aspects related to user privacy.

Source: BEREC, 2019

Data flow

The following is a description of the sequence of events on the mobile device where a public warning mobile application is installed, based on the information set out in the BEREC guidelines.

Table 3. Mobile Application Warning Sending Data Flow Description

Step No.	Description	Comment
0	Registration with mobile or fixed network	
1	Registration with OTT application server	Mobile devices that have an early warning mobile application installed will register with the OTT application server to notify their IP addresses and ensure that the device can be reached from the OTT application

Step No.	Description	Comment
		server. User credentials, settings and cryptography certificates can also be exchanged at this stage.
2	For option 2 only: Mobile device continuously informs the OTT application server about its location	The OTT application server maintains the current user database and location information. When a user moves within a mobile network, the early warning application installed on the phone will contact the OTT application server at specified intervals by informing the user location that is updated in the user database system. User location information is determined by the global navigation satellite system built into the machine, not by the mobile network information.
3	Alerting Event	The alert gateway shall, upon request from the competent authority, notify the OTT application server of the need to send a warning message to all users in the particular notification area.
4a	For option 1 only: Select the recipient of a warning message	The OTT application server does not select individual users, but sends a warning message to all users.
4b	For option 2 only:	The OTT application server retrieves a list of users in that area from the user location database. Warning messages are sent only to users in the affected area.
5	Delivery of warning message	A warning message is received when using a mobile/fixed data transmission network that installs an early warning application.
6	For option 1 only	Each device shall autonomously check that it is currently in the appropriate notification area and shall only display the warning message.
7	Approval (optional)	The device confirms the receipt of an alert message.

Source: BEREC, 2019

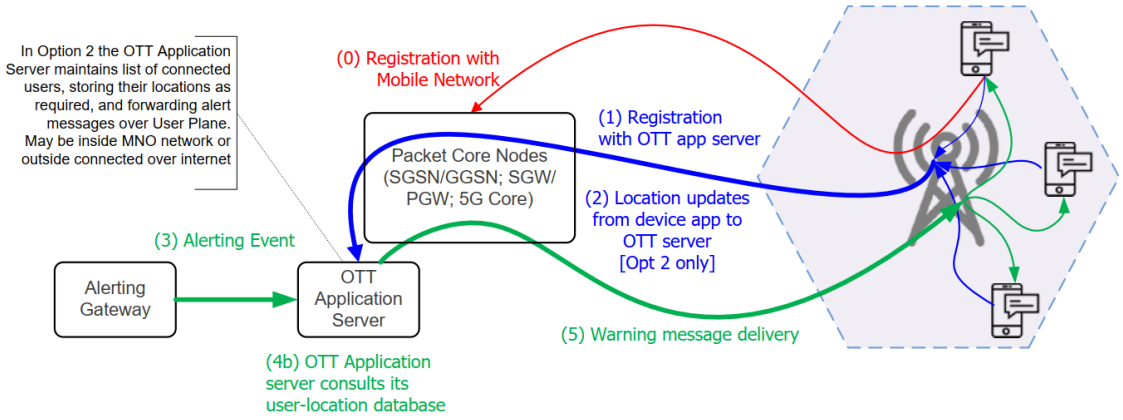

Figure 5. Operation of an early warning application using a mobile network.

Source: BEREC, 2019

Identified shortcomings

- The app can only be installed on smartphones.
- Potentially only a small portion of the population voluntarily installs these kinds of mobile apps. By comparison, the mobile app "Stop Covid" on 03.08.20. was downloaded 110 000 times, representing only 5.8% of Latvia's population.
- There is limited scope for reporting foreigners entering the country if they do not install an application.
- A public awareness campaign is needed on the need to download the app.
- Potential cyber-attacks aimed at hacking the app.

Countries where solution is implemented

Finland, Germany, Switzerland, Austria.

4.4. Mobile app deployment experience

4.4.1. Mobile app solution experience in Austria

Information on the Austrian experience with the introduction of a mobile app was obtained using the information published on the home page of the Austrian Federal Ministry of Interior (https://www.bmi.gv.at/204/katwarn/start.aspx), as well as during video conference on 21 September

2020, with representatives (TURM solutions GmbH) from warning application KATWARN used in Austria and Germany.

During this project, no answers were received from the Austrian representatives to our written questions, as well as the opportunity to discuss the experience of implementing the mobile application in a video conference was declined.

General description of the solution

KATWARN Österreich is a system that transmits information and warnings from various public authorities to citizens' mobile phones and other devices on which this application is installed based on the location of end users. In this way, KATWARN Österreich complements the existing capabilities of Austrian warning systems - sirens, loudspeakers and mass media. The application developed by KATWARN is also used in Germany.

Warning messages are sent for a variety of events, such as natural disasters, weather conditions, industrial accidents, search for missing people, etc. In the application, it is possible to mark areas (by specifying the postal code) for which the user would like to receive warning messages, such as schools, homes, etc.

Although KATWARN Österreich's main message transmission channel is a mobile application, other information channels can be used, such as public transport information boards, urban video screens, etc.

Alerts are classified in four categories:

- Information on potential hazards (safety-related information at the initial stage of the event);
- Warning (information about the action required);
- Alarm (need to seek protection);
- The threat situation is over.

Funding

During the video conference, representatives OF TURM solutions Gmb indicated the potential costs of the KATWARN system. License costs for system use for the 10-year period are EUR 200 000. Installation and configuration costs are around EUR 50 000, and additional costs associated with system translation work might be present. The annual costs of maintenance of the system are EUR 50 000.

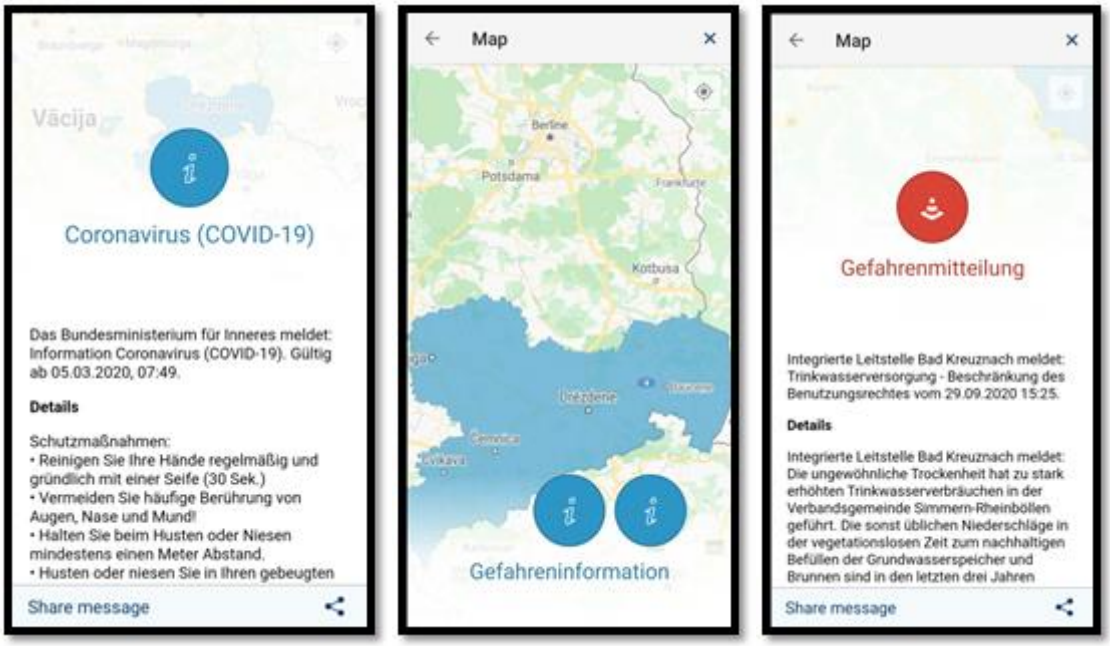

Figure 6. Screenshot of the KATWARN app.

4.4.2. Mobile app solution experience in Finland

Information on Finland's experience with the introduction of the mobile application was obtained using the information published on the Finnish Emergency Response Centre's website (https://112.fi/en/erc-services), as well as by organizing a videoconference with Mikko Jäskeläinen, representative of the Finnish Ministry of Interior, and Henri Viljasjärvi, representative of the company Digita. During the video conference, representatives from Finland indicated that alarm sirens, radio, television as well as the mobile app 112 Suomi were used to warn the public in Finland.

General description of the solution

112 Suomi is a mobile app primarily designed to make emergency calls and find people in emergency situations. In case of emergency calls, the user's location will only be determined when the call is made. In addition, the application is used to send warnings to the public. Within 3 years of the launch of 112 Suomi, 37 public warning messages have been sent.

The application contains a number of telephone numbers of various on-call services (Maritime Search and Rescue Service, Toxicology Information Center, etc.), as well as the ability to check the coordinates of the location. The app is available in Finnish, Swedish and English.

The app was created in collaboration from Finland's Emergency Response Centre Agency with Finnish company Digia. The app can be downloaded for free at Android and Apple app stores. Windows and Yolla phones can also download the app for free, but the app version will no longer be updated for these devices, and warning messages can only be received on Android or iOS phones.

The app has been running for about 3 years and has been downloaded around 1.7 million times (Finnish population – 5.5 million). No public awareness campaigns were conducted to promote the application. It should be noted that representatives of the Finnish side do not have information on how many users actually use the application. It should be noted that the application source code belongs to its developer company Digia.

The application is able to determine the user's location using a satellite-based geographic location. On the basis of user location information, the Finnish Emergency Response Centre may send out warning messages in a designated area. User location is based on information from WiFi network and mobile network base stations. The GPS location is available only if another application uses a GPS service on the phone. In order to enable the Finnish Emergency Response Centre to determine the location of the user for warnings, users in the application must give their consent that their location will also be determined when the application is not in use. Note that if the phone is set to silent, warning messages will appear without a beep. On the other hand, if the phone is set up in flight mode, no notifications will be received.

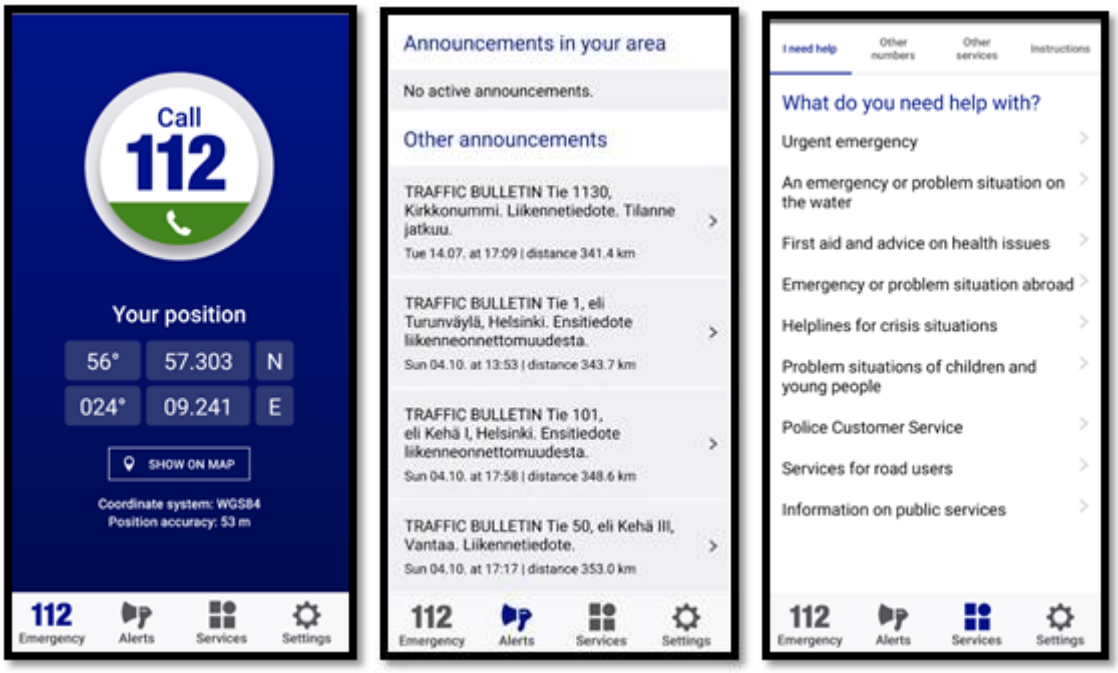

Figure 7. Screenshot of 112 Suomi app.

According to the Finnish side, a mobile application will be used to ensure compliance with the first paragraph of Article 110 of Directive (EU) 2018/1972 of the European Parliament and of the Council of 11 December 2018 establishing a European Electronic Communications Code (hereinafter the Directive). CB or LB-SMS solution). During the feasibility study, the Finnish side concluded that the implementation of the CB solution would be too expensive, as the infrastructure of Finnish mobile network operators cannot currently provide the CB function, and it would be difficult to ensure that cell broadcasting function is activated in end-user devices. On the other hand, the fact that the message must be free of charge (mobile application requires an internet connection) is not considered a potential limitation, as about 97% of the Finnish population have smartphones with a data connection. Tourists could potentially be informed via SMS, but this decision has not yet been taken.

Work is currently underway to improve the mobile app by providing additional functionality. Integration with the IS of other institutions using the CAP protocol, automatic translation of notifications (because the alert notification must be sent in at least Finnish and Swedish, and there may be 3 other languages depending on the affected region), possibility to use notification templates are planned. The setting is to be able to deliver alert messages to end users within 7 minutes. Alert notifications will be sent out after the new functionality is implemented, along with a link to a website where you can verify the authenticity of the alert message. Prototypes of the new application are currently being developed, in the development of which 3 companies are involved.

Representatives of the Finnish side did not disclose the costs of developing and maintaining a mobile application but indicated that this solution is cheaper than CB or LB-SMS.

4.5. Comparative overview of solutions

In order to facilitate comparison of the technological solutions of the LB-SMS, CB and Mobile application described previously, Table 4 summarizes the capabilities of these solutions in a structured way.

Table 4. Comparative review of the solutions.

Inherent features	LB-SMS	CB	Mobile app
Type of mobile phone that may receive a warning message	Featurephoness and smartphones	Featurephones and smartphones	Smart phones
Options for receiving a message after	Can receive the message after device is turned on.	A message previously sent will not be received after the	Can receive the message after device is turned on.

Inherent features	LB-SMS	CB	Mobile app
switching on the phone		device is switched on. Notifications will be received only if the device is switched on.	
User engagement to review warning messages	Not required	User must activate cell broadcasting function if it is not already activated by default.	User needs to download mobile app.
Length of notification	160 symbols for Latin letters or 70 symbols in Latvian	93 symbols. Up to 15 multiple "page" messages are available,	Depends on the solution developed, but the options are much wider.
Location dependency for receiving a message	The message is sent to the phone numbers that are included in the notification list. This list is based on the users in specific cells.	The message is received by mobile devices in specified area (if the cell broadcast function is turned on in them)	Depending on the application's functionality (e.g., GPS locations)
Two-way communication capabilities	Users can both receive and reply to messages	Users cannot respond directly to the message, but they can respond using the phone number or URLs included in the message.	Depending on the application's functionality (can potentially reply to received message)
Display a message	Display as standard SMS.	The message can pop-up above all apps with a different warning tone.	Depending on the solution developed.
Public awareness	Widespread technology, well-understood by public	In many countries, most people aren't familiar with CBS technology	A public education campaign is needed to promote app downloads.
Distribution of a warning on the network of all mobile operators in Latvia within 3-10 min	There is potentially a potential for SMS "congestion" (*SMS congestion*)	Yes, if the public concerned has phones supporting CB	Yes, if the relevant part of the public has applications installed.
Clear identification of sender	Exposed to the risk of spoofing SMS	Yes	Yes
Different warning tone	No	Yes	Yes
Distribution of a warning message on the network of all	Possible SMS congestion	Yes, if the population has phones supporting CB	Yes, if the population has applications

Inherent features	LB-SMS	CB	Mobile app
mobile operators in Latvia within 3-10 min			installed in their phones

4.6. Overview of Latvia's mobile communication network

According to data collected by Public Utilities Commission (PUC) on the electronic communications sector, in 2019 the number of mobile network operator (hereinafter - MNO) service users continued to increase. In 2019, the number of connections has increased by 5%, reaching 2.85 million (the total number of active SIM cards). More detailed information is presented in the table below.

Table 5. Indicators for services in the electronic communications sector 2018-2019.

Service Indicators	2018	2019	Change, %
Number of connections * (active SIM cards) total at the end of the year	2 709 337	2 849 424	+5%
Number of voice telephony services connections * * at the end of the year	2 070 180	2 071 814	+0,1%
Total call minutes (million)	6 547	4 425	-32%
Number of domestic calls * * * minutes (million)	6 178	4 219	-32%
Number of international call minutes (million)	213	191	-10%
Number of SMS messages sent (million)	1 756	1 206	-31%

* Connections that have a voice telephony service, a text messaging service, an Internet service, a television program distribution service, or an inter-device (M2M) communication service.

** Connections for which voice telephony service is provided with or without Internet service.

*** Domestic calls, except for calls to special numbers.

Data source: PUC, 2020

Figure 8 gives an overview of the distribution of the number of Latvian MNO connections in 2019, based on data compiled by PUC.

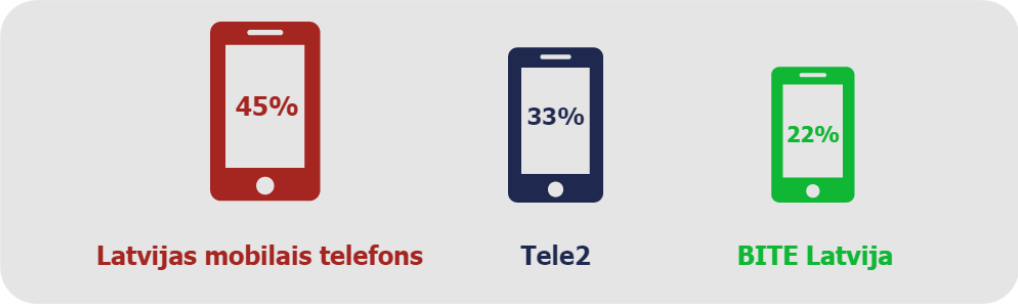

Figure 8. Distribution of connections between mobile network operators, 2019.

Data source: PUC, 2020

As part of this project, the consultants surveyed the MNO's operating in Latvia about the geographic coverage of mobile networks in order to understand the potential reach of the population in the case of CB, LB-SMS or mobile application technological solutions.

According to the information provided by the MNO, it is concluded that mobile network coverage is very high in Latvia, exceeding 99% of the territory of Latvia. In addition, it should be noted that the coverage rate exceeds 99% for each variant of the technological solution (CB, LB-SMS, APP). Therefore, it can be argued that **the Latvian cellular network is a very suitable solution for sending ABS + warning messages, in terms of its geographical coverage.** It should be noted that the reach of users of the mobile network may be affected by the obstacles that electromagnetic waves that needs to be overcome in order to reach a particular user's mobile device, such as very thick walls of the building, roofs etc.

The **percentage of smartphones (with active SIM cards) has reached 74% and continues to grow** as shown in Figure 9. 22% of users still use featurephones without the ability to install and use mobile apps. This means that if the State chooses **a mobile app as a technological solution for sending warning messages to public, at least 22% of the population would not receive warning messages**. All MNO acknowledges that although the proportion of these users will continue to fall over the coming years, it is not expected to fall below 10%-15% over the next 3 years. This is an essential argument for selecting a variant of CB or LB-SMS as the default technological solution for public warning.

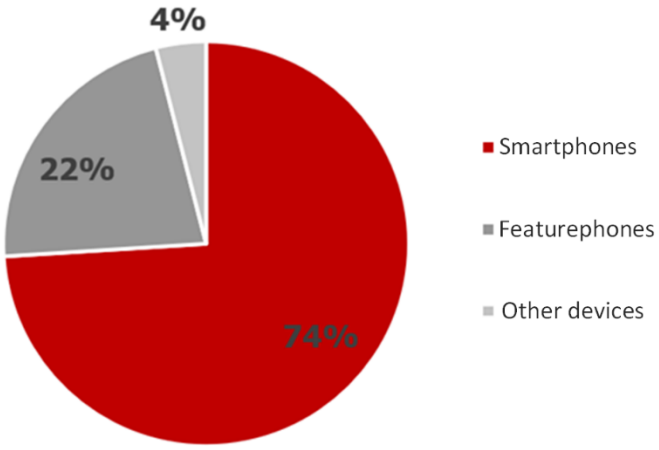

Figure 9. Types of mobile phones,%, 2019

Data source: LMT, Bite, Tele2, 2020

Figure 10 shows the distribution of mobile devices by their operating system. Devices with Android operating systems are the most popular – 79% of all devices, in second place are devices with iOS operating systems (devices produced by Apple) with a 17% share. Other operating systems represents only 4%. Consequently, it can be argued that a significant majority of 96% (Android and iOS combined) are well-established operating systems on the market and that when changing to newer device the user should not face serious or difficult problems when starting to use smartphone and/or mobile app.

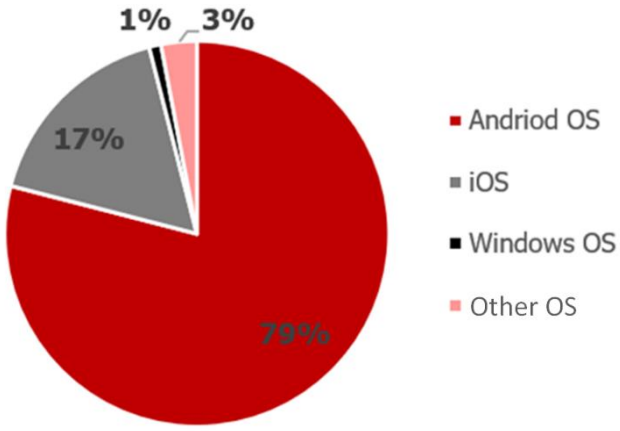

Figure 10. Distribution of mobile devices by operating system,%, 2019.

Data source: LMT, Bite, Tele2, 2020

As it can be seen in the Figure 11 which shows the distribution of mobile devices by their manufacturer, **the most popular devices are Samsung, Huawei and Apple, which together account for nearly 75% of the entire market for smart devices**.

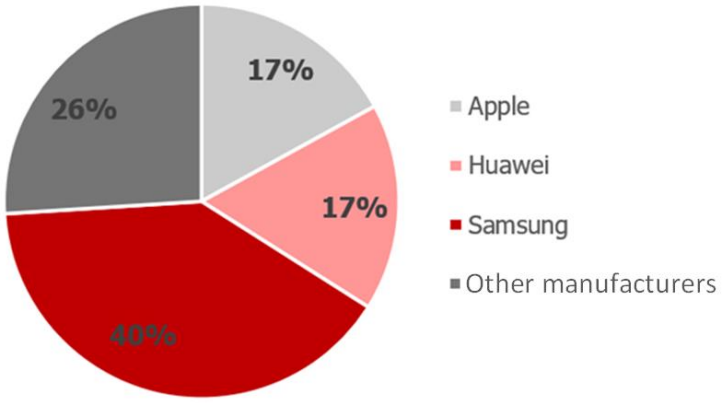

Figure 11. Distribution of smart devices by manufacturer,%, 2019.

Data source: LMT, Bite, Tele2, 2020

All mobile devices with active SIM cards that are connected to a cellular network will be able to receive warning messages in the form of an SMS. Information on mobile smart device manufacturers and models on the Latvian market is gathered at a sufficiently high level of detail, but there is no data available on the availability of CB functionality in these models, as well as there is a lack of information on whether users need to change settings on mobile devices to enable CB functionality. MNO acknowledges that they do not have remote capabilities to perform installation or setting changes on user devices. It should be noted that in recent years, mobile device manufacturers have provided CB functionality, and moreover in the form that this functionality is available by default on distributed mobile devices. Referring to tests performed by one mobile operator, it can be concluded that most, but not all, mobile devices have CB functionality enabled.

When assessing MNO networks' readiness to send warning messages to the public, it should be noted that without developing the MNO network infrastructure**, the number of people that can be reached by warning messages may vary significantly within a given time (3-10 min)**. The option of CB solution would allow all mobile users to be reached within a few minutes. In the case of the LB-SMS solution, the number of SMS messages that the MNO can send out within a minute is limited. It would take several hours for all mobile network subscribers to be notified by 1 SMS message (160 characters without the use of special characters and symbols other than 7bit symbols). In the case of a longer warning message, it may take several days to send the SMS message to all users. In the case

of the mobile application solution, it may take a few minutes to send the warning message if it consists of text and small image.

5. PUBLIC SURVEY

As part of this assessment, a public survey was conducted in order to find out the public's opinion on warning the public in emergency cases. The 18 questions included in the questionnaire (see Annex 1) were agreed and approved by the SFRS. The public survey was conducted from October 12, 2020 till December 3, 2020. The public survey could be completed in electronic format and its dissemination was provided by the SFRS through social networks and media.

5.1. Information about respondents

Overall**, 1205 respondents** participated in the public survey, of which **58%** were **women** and 42% were men. The age distribution of the survey participants is shown in Figure 12.

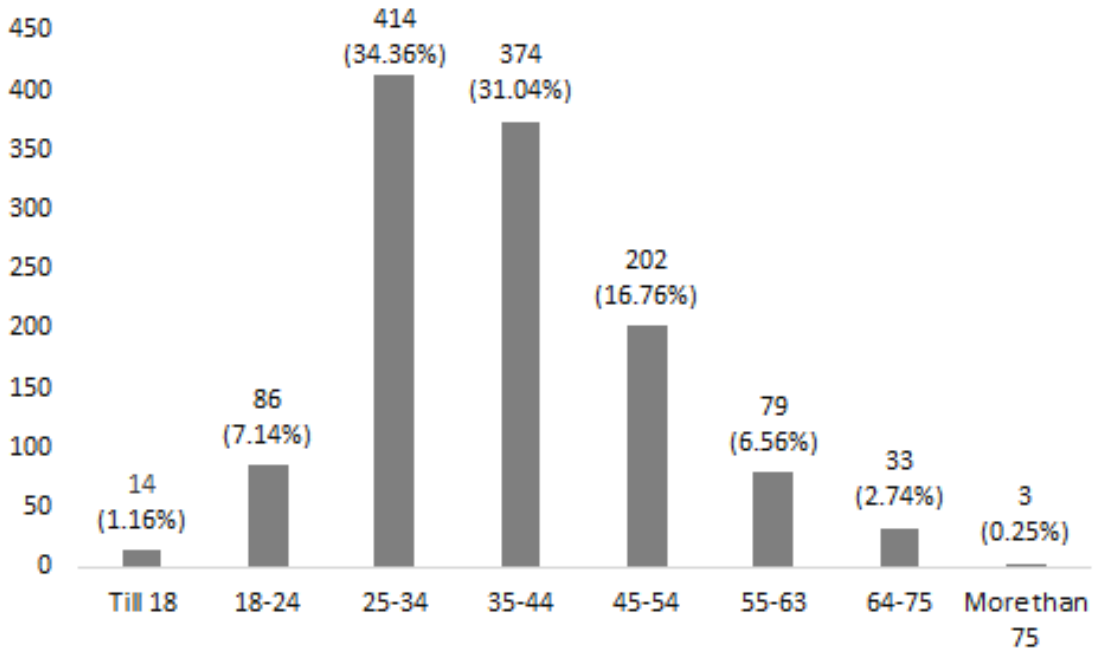

Figure 12. Age distribution of respondents.

94% of respondents indicated that their place of residence was a city, town or village, while 6% of respondents indicated that they live in Farmstead. Table 6 shows a summary of respondents' demographic profiles.

Table 6. Demographic characteristics of respondents.

Description	Number of respondents (n)	%
Total	1205	100%
Gender		
Female	703	58.34%
Male	502	41.66%
Age		

Description	Number of respondents (n)	%
Up to 18	14	1.16%
18-24	86	7.14%
25-34	414	34.36%
35-44	374	31.04%
45-54	202	16.76%
55-63	79	6.56%
64-75	33	2.74%
Over 75	3	0.25%
Place of residency		
City, town, village	1131	93.86%
Farmstead	74	6.14%
Language skills		
Latvian is native language	1103	91.54%
The Latvian language is not the native language, but it is well known	98	8.13%
Latvian is not the native language and it is known poorly	3	0.25%
Doesn't understand Latvian	1	0.08%

5.2. Results of the public survey

5.2.1. Mobile phone usage habits

In response to the first question of the questionnaire**, "*What kind of messages do you usually get on your mobile phone during the day?*"**, the majority of respondents - 1044 (86.64%) indicated that they receive text messages during the day, while messaging app notifications are received by 1027 (85.23%) respondents, e-mails 852 (70.71%). It should be noted that each respondent was able to choose multiple answers. Regarding other responses - most of them indicated receiving messages from news portals or receiving messages only from specifically selected people. A summary of respondents' answers to the question is shown in Figure 13.

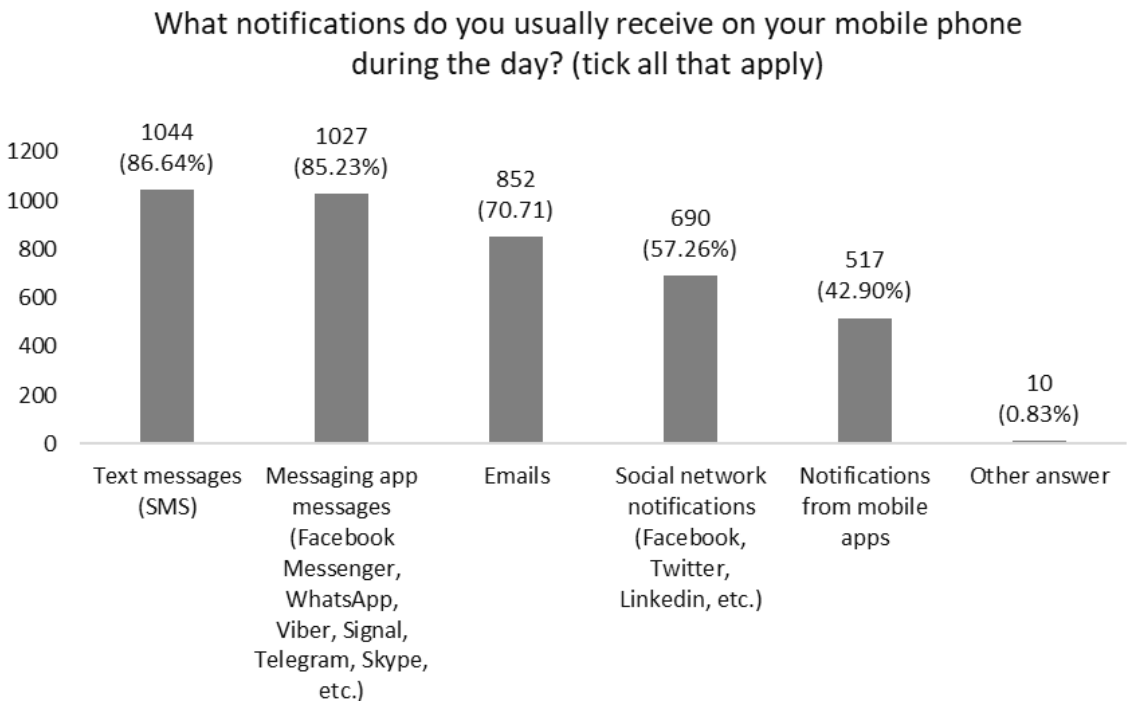

Figure 13. Types of notifications received.

The second question, ***"How do you use the Internet on your mobile phone?"***, was asked to find out if respondents could receive warning messages on their mobile phone if they were sent, for example through a mobile app. As shown in Figure 14, 873 (72.45%) of respondents indicated that their mobile phone uses both Wi-Fi and mobile data. 23 (1.91%) respondents indicated that they do not use the Internet on their mobile phones, respectively, they would not receive warning messages if they were sent via mobile application. 73 (6.06%) of respondents indicated that they were using only Wi-Fi connections, which would limit their ability to receive warning messages in general if they would not been connected to a Wi-Fi network (outside home/offices, etc.). A summary of respondents' answers to the question is shown in Figure 14.

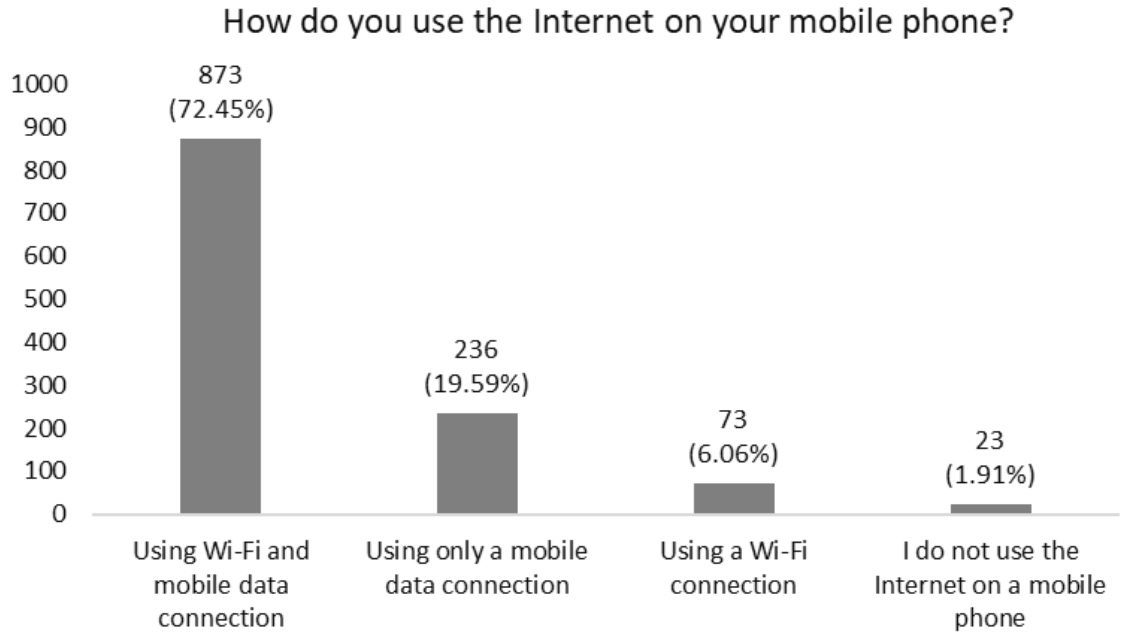

Figure 14. Usage of internet on mobile phones.

The third question, ***"What is the mode of your mobile phone during the day?"***, was asked to identify the possibility for population to receive alerts during the day, for example if they were sent as SMS without a different sound tone and vibration mode. A total of 848 (70.37%) respondents indicated that their mobile phone was in normal mode with the sound switched on during the day. Meanwhile, 486 (40.33%) of respondents indicated that their mobile phone is in vibrating mode during the day, while 254 (21.08%) respondents indicated that their mobile phone is in silent mode during the day, which means in that this group of respondents might not react when they receive a warning SMS (not hearing sound or feeling vibration). It should be noted that respondents were able to choose multiple answers. A summary of respondents' answers to the question is shown in Figure 15.

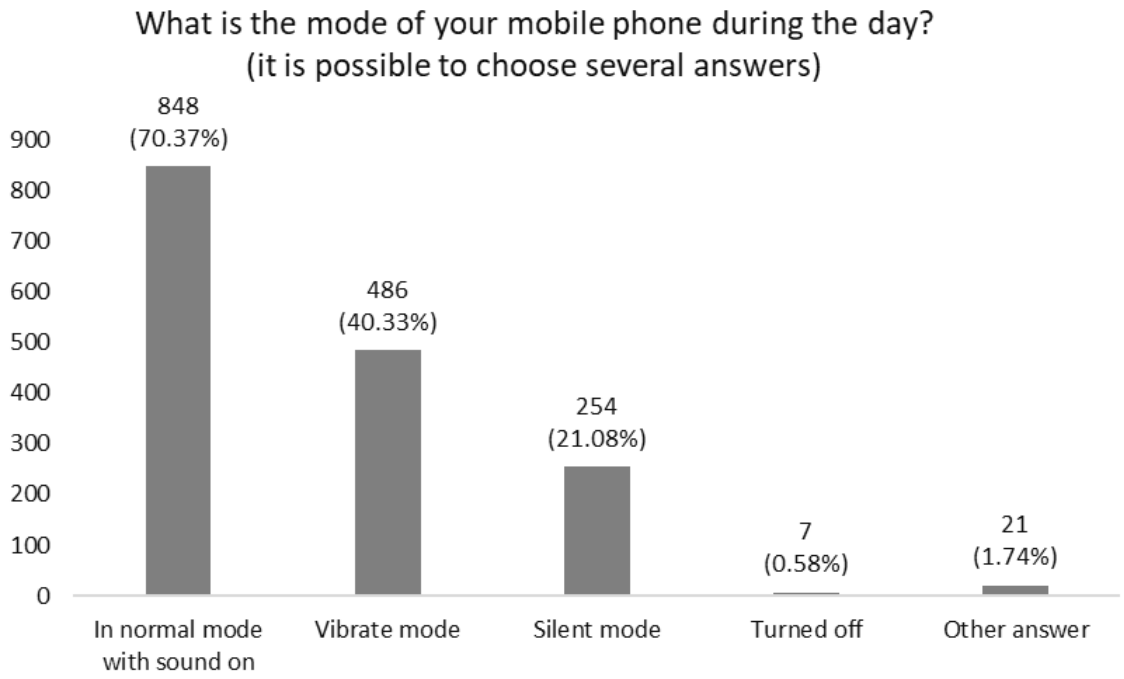

Figure 15. Mode of mobile phone during the day.

The fourth question, ***"What is the mode of your mobile phone at night?"***, like the third question in the survey, was asked with the aim of identifying the possibility for users to receive warning messages during the night, for example if they were sent as SMS without a different sound tone and vibration mode. A total of 567 (47.05%) respondents indicated that their mobile phone was in normal mode during the night with the sound switched on. Meanwhile, 352 (29.21%) respondents pointed out that their mobile phone was in vibrating mode during the night, while 388 (32.20%) respondents pointed out that their mobile phone was in silent mode during the night, which means in general that this group of respondents might not react to received warning SMS (not hearing sound, not feeling vibration). 53 (4.40%) of respondents added additional answers, which are summarized as follows:

- the sound is on, but mobile data and Wi-Fi have been switched off so not to get notifications from social networks, email notifications, etc.
- flight mode is used;
- with the sound turned off for calls, but turned off for notifications.

It should be noted that respondents were able to choose multiple answers. A summary of respondents' answers to the question is shown in Figure 16.

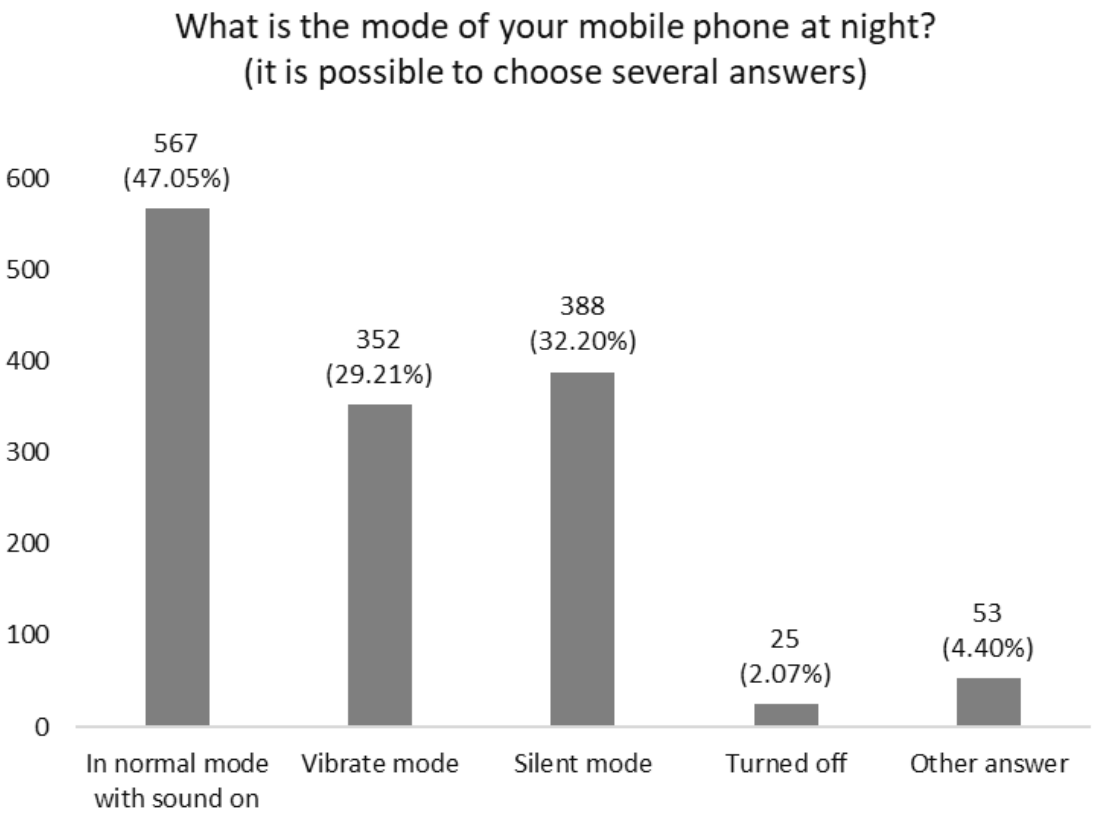

Figure 16. Mode of mobile phone during the night.

The fifth question, "***How long it usually takes from receiving a text message on your mobile phone to reading it***?", was asked with the aim of identifying how long it would take for people to read the warning message during the day. As shown in Figure 17, 331 (27.47%) respondents indicated that they read the text messages as soon as they are received during the day, while 698 (57.93%) respondents indicated that they read the messages within 2-30 minutes from receiving during day. 128 (10.62%) of respondents indicated that they read the text messages more than 30 minutes after they were received, which in the event of emergency might be too long to take the necessary action. 48 (3.98%) respondents identified other responses that in general can be described as follows:

- sometimes text messages are read immediately, other times after several hours.
- while working, text messages are read immediately, after working time, only in the evening.

A summary of respondents' answers to the question is shown in Figure 17.

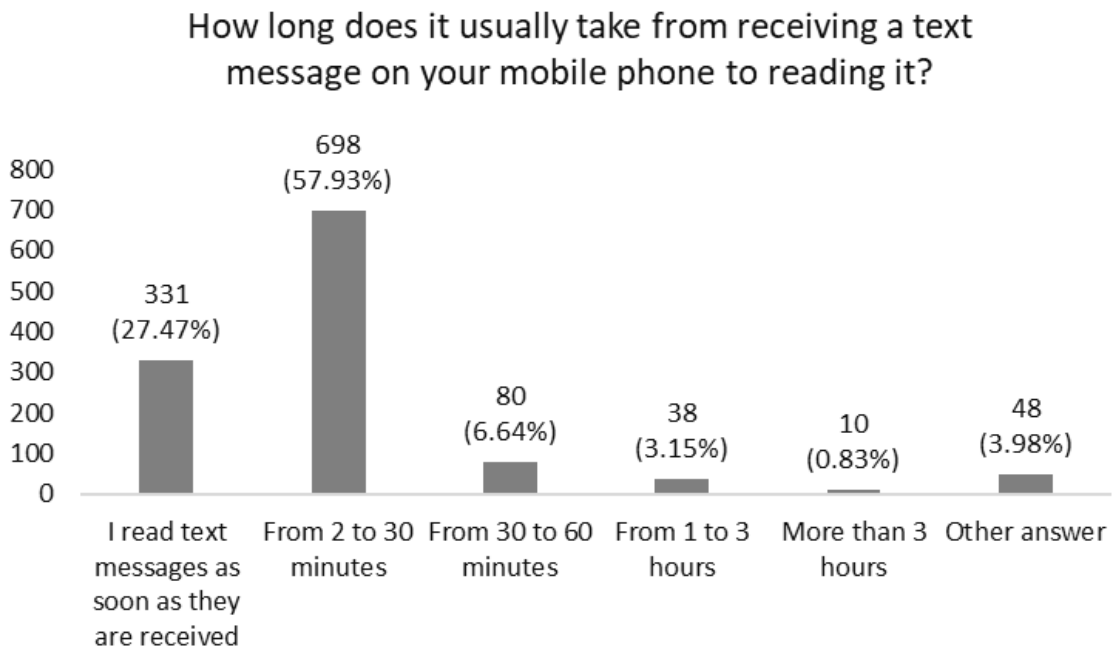

Figure 17. Time taken to read the message during the day.

The sixth question, ***"How long does it usually take during the night from receiving a text message to reading it?"***, was asked, like the fifth question of the survey, with a view to identifying how long it would take for citizens to read the warning messages they received during the night. As shown in Figure 18, 1032 (85.64%) of respondents indicated that they would only read text messages during the night after waking up. In general, this should be attributed to the fact that during the night, people turn off a sound signal on their mobile phones and do not pay attention to the text messages they have received. Only 90 (7.47%) of respondents indicated that they would read the message they received immediately after they were received, which means that if the warning messages were sent as a regular text message, the majority of citizens would read such warnings only in the morning after waking up, which could be critical in the event of a rapidly evolving threat when immediate action is needed. 28 (2.32%) respondents submitted further responses, which are generally to be described as follows:

- if you hear vibration/sound at night, the text message will be read.
- if you notice the signal lamp on the phone about the message, the message will be read.

A summary of respondents' answers to the question is shown in Figure 18.

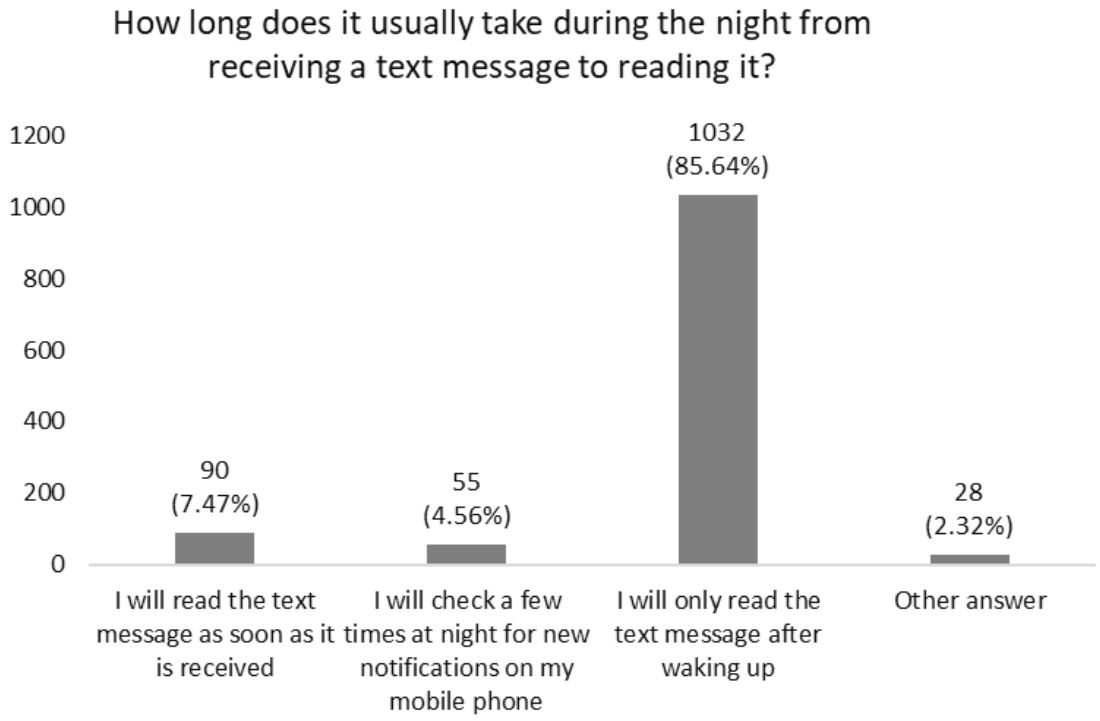

Figure 18. Time needed to read the message during the night.

5.2.2. Safety warnings and informational announcements

In the seventh question, respondents had to answer the question, ***"What kind of warning messages would you like to receive on your mobile phone?"***. Respondents were required to provide answers on their level of interest (from very interested to completely not interested) to receive safety warning messages on their mobile phones in case of the following hazards:

- Violent crimes nearby area
- Risk of property damage due to floods
- Dangerous weather warning
- Danger to life due to floods
- Local public health emergency including outbreaks of infectious diseases
- Terrorist attack or threat of deliberate explosion
- Chemical, biological, radioactive or explosion hazards.

Table 7 and Figure 19 summarize the interest of respondents in receiving alerts, broken down by type of hazard.

Table 7. Summary of respondents' interest in receiving warning notifications by type of threat.

Type of threat	Very interested	Interested	Maybe interested	Not interested	Completely not interested
Chemical, biological, radioactive or explosion hazards	836 (69.38%)	317 (26.31%)	38 (3.15%)	8 (0.66%)	6 (0.50%)
Terrorist attack or threat of deliberate explosion	788 (65.39%)	329 (27.30%)	67 (5.56%)	13 (1.08%)	8 (0.66%)
Local public health emergency including outbreaks of infectious diseases	570 (47.30%)	444 (36.85%)	141 (11.70%)	34 (2.82%)	16 (1.33%)
Danger to life due to floods	480 (39.83%)	411 (34.11%)	186 (15.44)	85 (7.05%)	43 (3.57%)
Dangerous weather warning	471 (39.09%)	494 (41.00%)	191 (15.85%)	35 (2.90%)	14 (1.16%)
Risk of property damage due to floods	439 (36.43%)	444 (36.85%)	192 (15.93%)	92 (7.63%)	38 (3.15%)
Violent crimes in nearby area	427 (35.44%)	450 37.34%)	242 (20.08%)	70 (5.81%)	16 (1.33%)

In general, respondents are most interested in receiving safety warnings for the following types of hazards:

- Chemical, biological, radioactive or explosion hazards (total of 1153 (95.69%) very interested and interested respondents);
- Terrorist attack or threat of deliberate explosion (total of very interested and interested respondents – 1117 (92.69%));
- Local public health emergency including outbreaks of infectious diseases (total of very interested and interested respondents together – 1014 (84.15%)).

On the other hand, the lowest interest of respondents in obtaining safety warnings is related to the following types of risks:

- Risk of property damage due to floods (total of not interested and completely not interested respondents – 130 (10.78%));
- Danger to life due to floods (total of not interested and completely not interested respondents – 128 (10.62%));
- Violent crimes in nearby areas (total of not interested and completely not interested respondents– 86 (7.14%)).

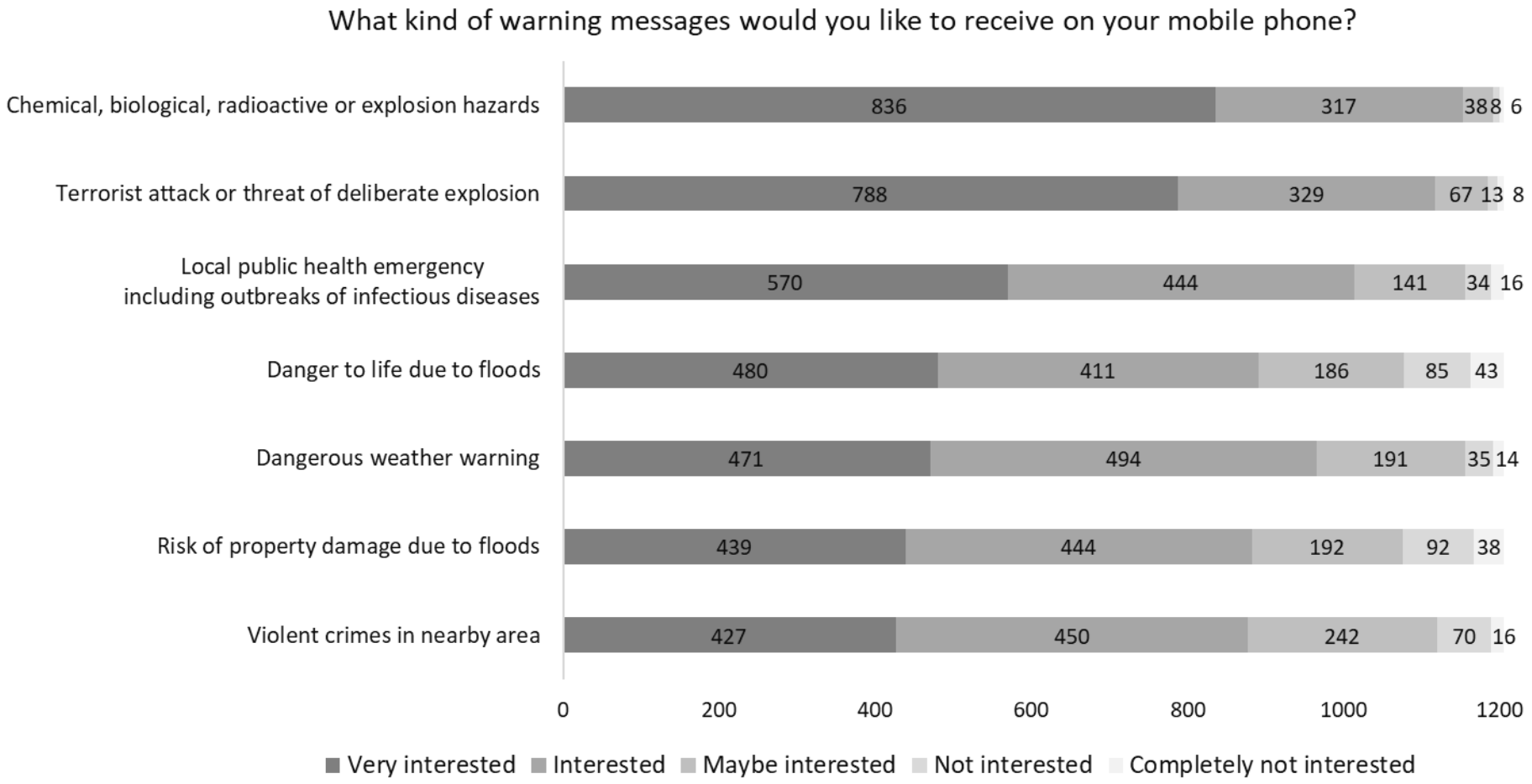

Figure 19. Summary of respondents' interest in receiving warning notifications by type of threat.

In the eighth question, respondents had to answer the question, ***"What informative messages would you like to receive on your mobile phone?"***. Respondents were required to provide answers on their level of interest (from very interested to completely not interested) to receive informative messages on their mobile phones about the following events:

- Car theft at nearby area;
- Notifications of missing children / persons;
- Notification of military exercises in nearby area;
- Notification of traffic accidents that blocks the main roads;
- Information that a nearby accident or incident does not endanger your life, health or property;
- Malfunctions of utilities (gas, electricity, water, heating, etc.).

Table 8 and Figure 20 shows a summary of respondents' interest of in receiving informative messages by type of event.

Table 8. Summary of respondents' interest in receiving informative messages by type of event.

Event	Very interested	Interested	Maybe interested	Not interested	Completely not interested
Malfunctions of utilities (gas, electricity, water, heating, etc.).	408 (33.86%)	568 (47.14%)	165 (13.69%)	42 (3.49%)	22 1.83%)
Information that a nearby accident or incident does not endanger your life, health or property	271 (22.49%)	392 (32.53%)	319 (26.47%)	159 (13.20%)	64 (5.31%)
Notification of traffic accidents that blocks the main roads	189 (15.68%)	413 (34.27%)	382 (31.70%)	176 (14.61%)	45 (3.73%)
Notification of military exercises in nearby area	156 (12.95%)	331 (27.47%)	425 (35.27%)	234 (19.42%)	59 (4.90%)
Notifications of missing children / persons	138 (11.45%)	321 (26.64%)	477 (39.59%)	217 (18.01%)	52 (4.32%)
Car theft at nearby area	123 (10.21%)	267 (22.16%)	386 (32.03%)	321 (26.64%)	108 (8.96%)

In general, respondents are most interested in receiving informative statements about the following events:

- Malfunctions of utilities (gas, electricity, water, heating, etc.) (total of very interested and interested respondents – 976 (81%));

- Information that a nearby accident or incident does not endanger your life, health or property (total of very interested and interested respondents - 663 (55.02%))
- Notification of traffic accidents that blocks the main roads (total of very interested and interested respondents - 602 (49.95%);

On the other hand, the lowest interest of respondents regarding possibility of receiving informative messages about the following events:

- Car theft at nearby area; (total of not interested and completely not interested respondents – 429 (35.6%));
- Notification of military exercises in nearby area (total of not interested and completely not interested respondents' respondents – 293 (24.32%));
- Notifications of missing children / persons (total of not interested and completely not interested respondents – 269 (22.33%)).

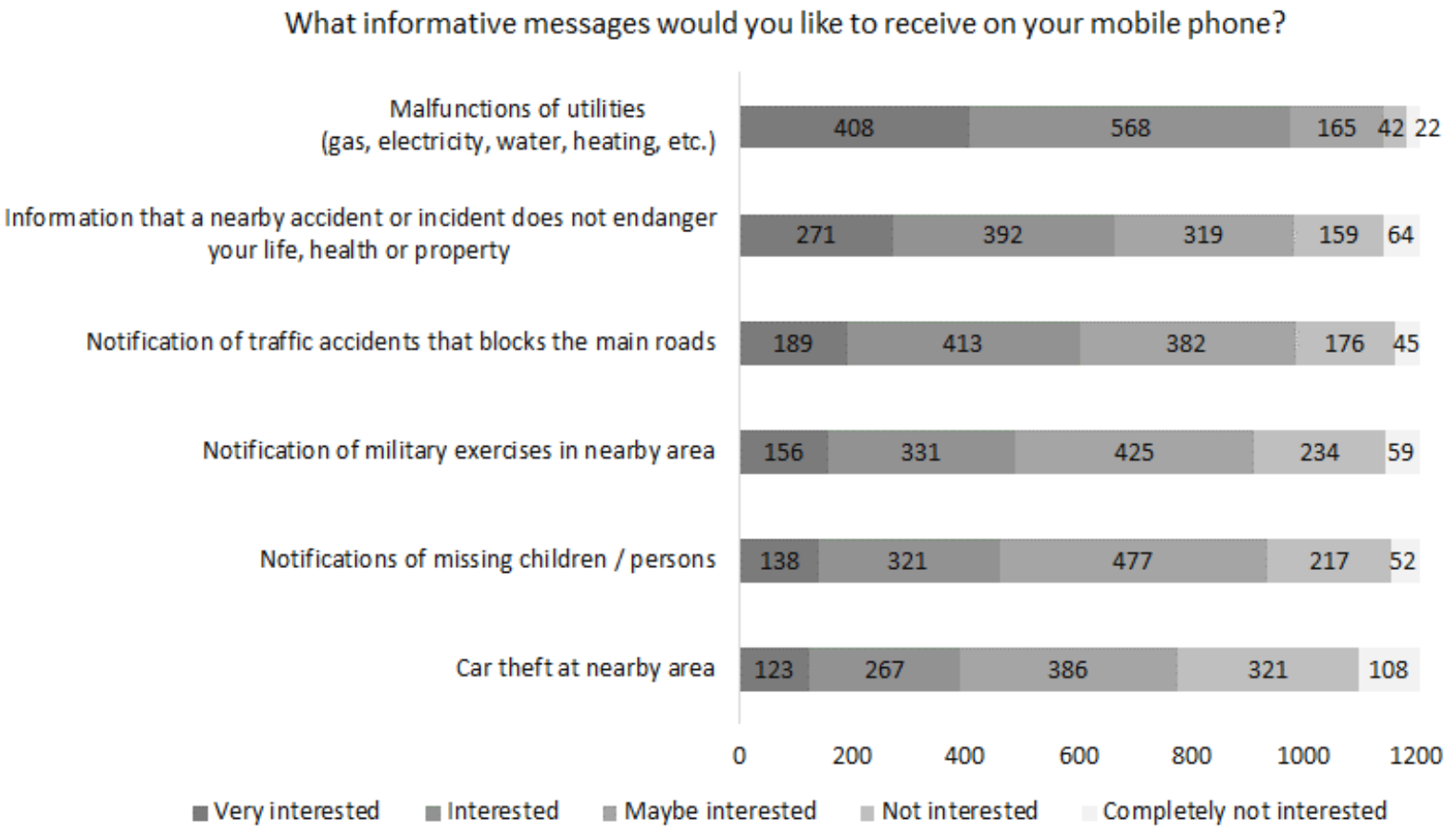

Figure 20. Summary of respondents' interest in receiving informatitative messages by type of event.

In the ninth question, respondents had the opportunity to answer the question, "***What other events would you like to receive warning messages for?"***. A total of 219 respondents answered this question. Most frequently, respondents indicated that they would like to receive warning messages about:

- alarm siren checks;
- poor air quality;
- stray animals which may endanger the people;
- nearby fires;
- trainings conducted operational services;
- escape of prisoners;
- military attack or threat/state of war;
- declaration of a state of emergency.

In the tenth question of the survey, respondents had to answer the question: ***"What degree of urgency would justify receiving warning messages on your mobile phone?"***. Respondents had to indicate whether warning messages would/would not be useful depending on the following degrees of urgency:

- Immediate danger - immediate action required;
- Expected / foreseeable danger - action should be taken within 1 hour;
- In the future - action must be taken in the near future;
- Unknown hazard time – the urgency of the needed action is unknown.

Table 9 and Figure 21 show an overview of the interest of respondents in receiving warning messages depending on degree of urgency.

Table 9. Summary of respondents' interest in receiving warning messages depending on the degree of urgency of the action.

Degree of urgency	Notification is definitely useful	Notification may be useful	Notification is not useful
Immediate threat - immediate action is needed	1078 (89.46%)	117 (9.71%)	10 (0.83%)
Expected/expected hazards – to be handled within 1 hour	1050 (87.14%)	151 (12.53%)	4 (0.33%)
In the future, action needs to be taken in the near future	640 (53.11%)	532 (44.15%)	33 (2.74%)
Unknown threat time – no known urgency of action	374 (31.04%)	601 (49.88%)	230 (19.09%)

In the event immediate danger where, immediate action is required 1078 (89.46%) of respondents indicated that a warning message would definitely be useful and only 10 (0.83%) of respondents indicated that the notification would not be useful in such a situation. Similarly, the statistics are about a situation when danger is expected / foreseeable and action should be taken within 1 hour. On the other hand, in a situation where the timing of the potential hazard is unknown and the urgency of action is unknown, only 374 (31.04%) respondents indicated that such a warning messages would be useful.

In general, it is concluded that the respondents consider warning messages to be useful in situations where there is immediate danger and immediate action is required. However, in situations where no such information is known, it is necessary to consider the need to issue warning messages in order not to undermine the importance of warning messages among the public (so that warnings do not become a tedious "routine warning").

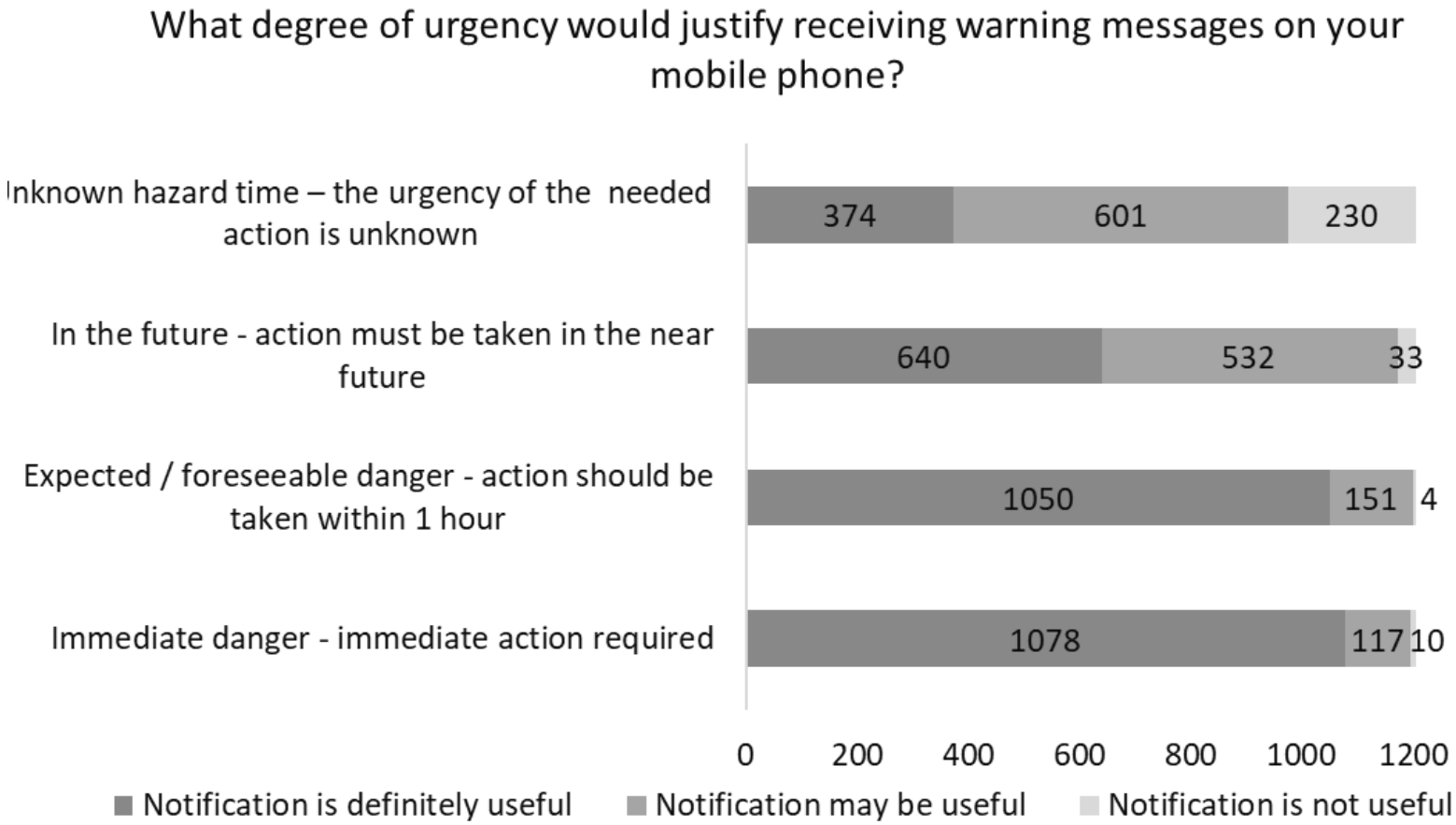

Figure 21. Summary of respondents' interest in receiving warning messages depending on the degree of urgency of the action.

In the eleventh question of the survey, respondents had to answer the question: ***"What should be the level of threat in order to receive a warning message on a mobile phone?"***. Respondents were required to indicate whether warning messages would/would not be useful depending on the following levels of risk:

- Extreme - there is an extreme danger to life or property;
- Significant - There is a significant risk to life or property;
- Moderate - Possible risk to life or property;
- Low - minimal risk to life or property;
- Unknown - the degree of possible level of danger is unknown.

Table 10 and Figure 22. show an overview of respondents' interest in receiving warning messages depending on the level or risk.

Table 10. Summary of respondents' interest in receiving warning messages depending on the level or risk.

Level of risk	Notification is definitely useful	Notification may be useful	Notification is not useful
Extreme - there is an extreme danger to life or property	1133 (94.02%)	69 (5.73%)	3 (0.25%)
Significant - there is a significant risk to life or property	1059 (87.88%)	140 (11.62%)	6 (0.50%)
Moderate - possible risk to life or property	646 (53.61%)	508 (42.16%)	51 (4.23%)
Low - minimal risk to life or property	289 (23.98%)	685 (56.85%)	231 (19.17%)
Unknown - the degree of possible level of danger is unknown.	260 (21.58%)	607 (50.37%)	338 (28.05%)

1133 (94.02%) of respondents indicated that warning messages were definitely useful when there is there is an extreme danger to life or property. When looking at the statistics, it is concluded that a reduction in the level of risk will also lead to a reduction in the number of respondents who believe that a warning messages would definitely be useful, while the number of respondents who believe that the notification could be useful, as well as the number of respondents who believe that the notification would not be useful. Accordingly, the lower the level of risk, the lower the interest of respondents in receiving warning messages.

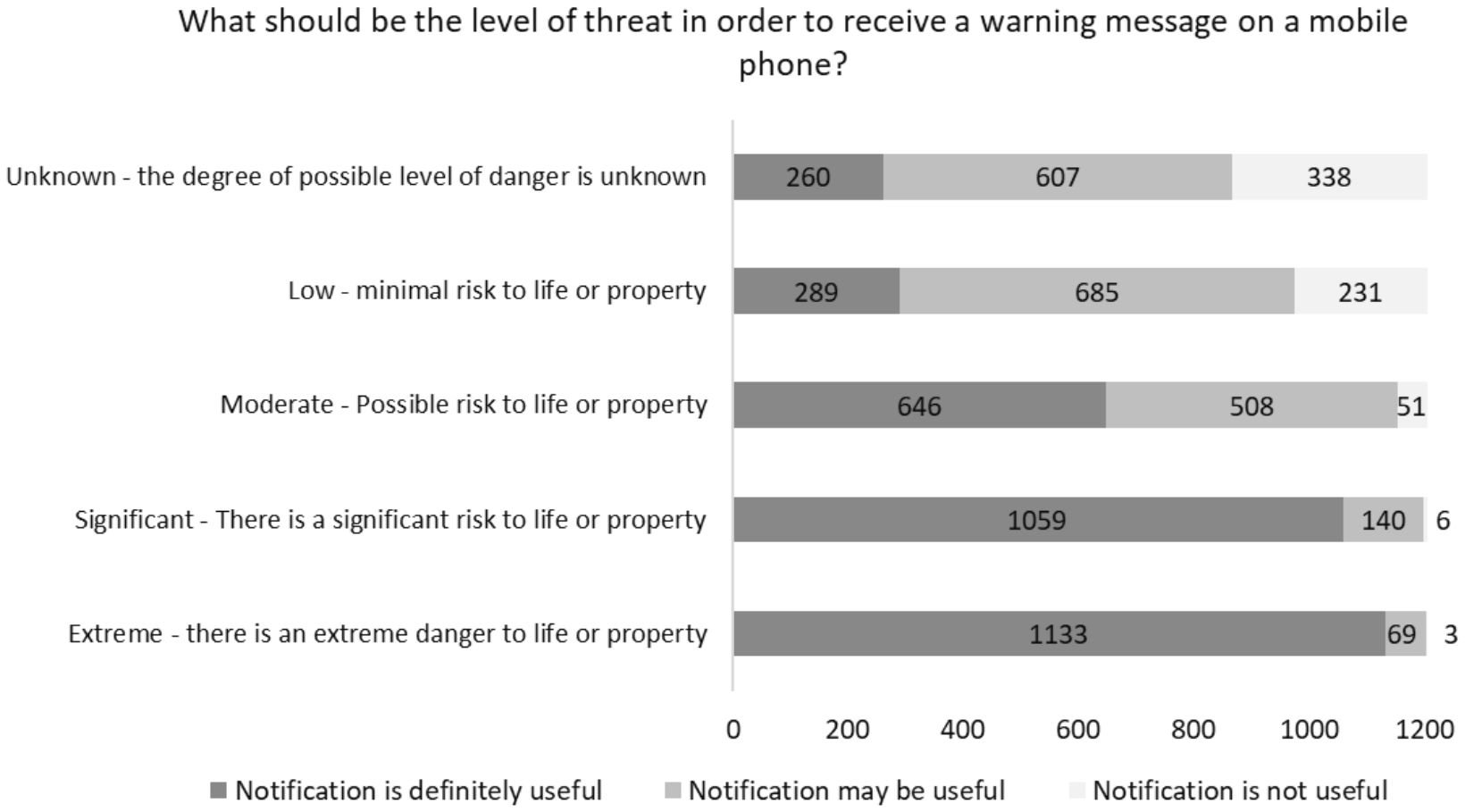

Figure 22. Summary of respondents' interest in receiving warning messages depending on the level or risk.

In the twelfth question of the survey, respondents had to answer the question: ***"Would you like to receive notifications on the end of the threat situation on your mobile phone?"***.

Overall, as shown in Figure 23, the majority of respondents – 1057 (87.72%) – strongly indicated that they would like to receive notifications on their mobile phone about the end of the threat situation.

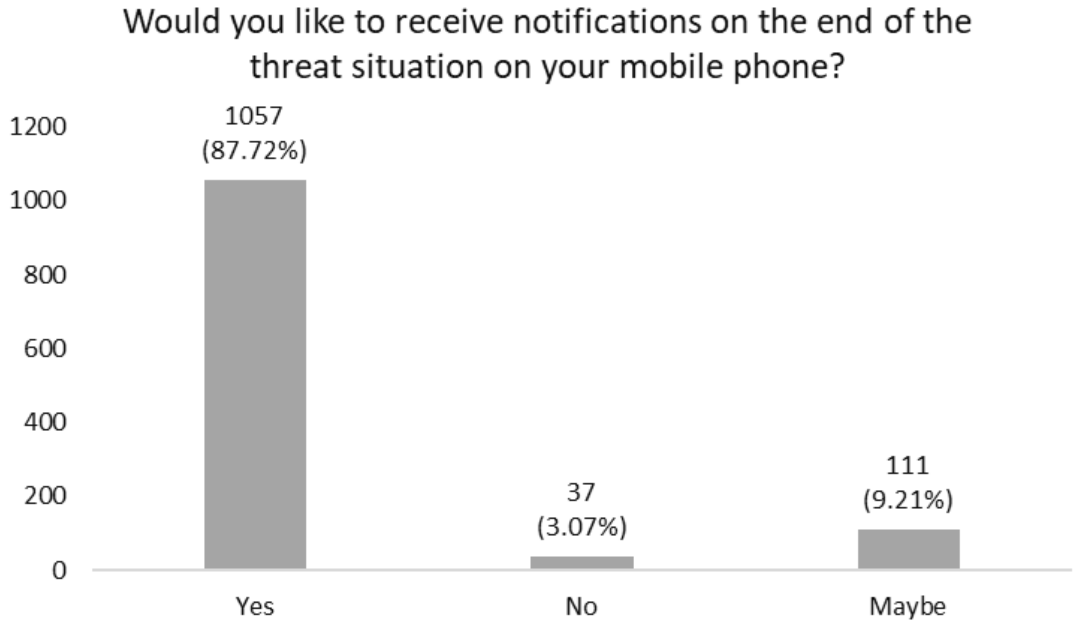

Figure 23. Summary of respondents' willingness to receive notifications after the threat has ended.

In the thirteenth question of the survey, respondents had to answer the question: ***"From which authorities would you expect warning messages on your mobile phone? (choose all that apply)?"***. As shown in Figure 24, the most respondents – 995 (82.57%) expect warning messages to be received from SFRS. 50% of respondents also indicated that warning messages would be expected from the municipality or from any public administration's organization. It should be noted it was possible for respondents to choose multiple answers.

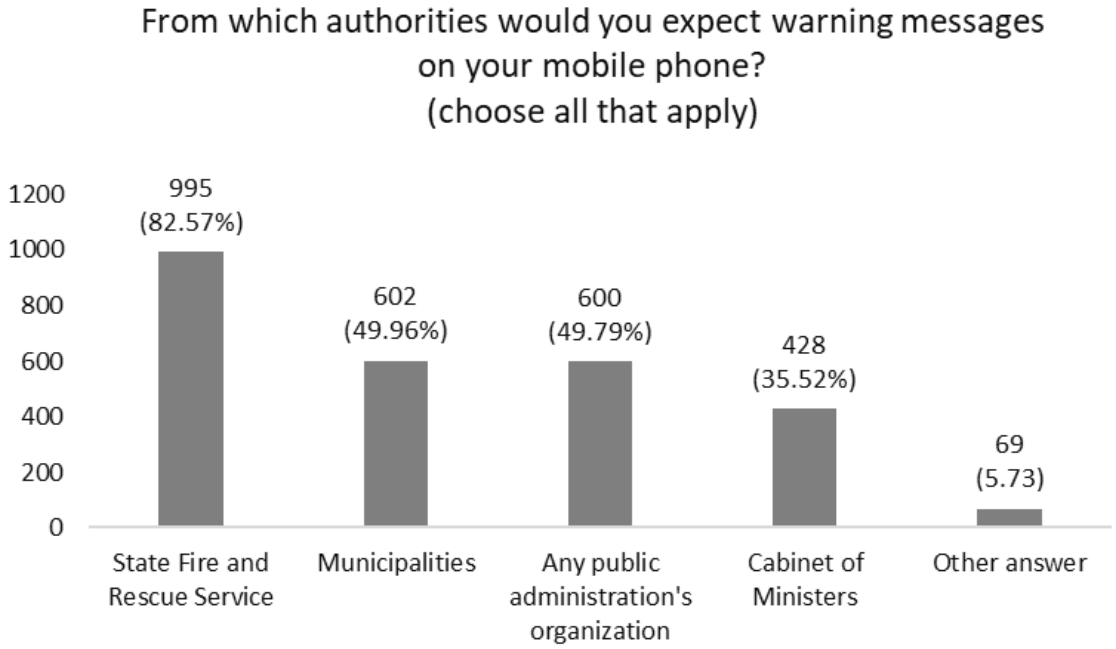

Figure 24. Summary of the views of respondents from which they associate safety warnings.

Respondents also had the opportunity to indicate from which authorities they also would to receive warning message on their mobile phones and from 69 received answers most frequently mentioned authorities were:

- State police
- Emergency medical service
- Center for Disease Prevention and Control
- Ministry of Defence
- National armed forces
- State Security Service
- Public service providers (Latvenergo, Sadales tīkls, Gaso, etc.)

In the fourteenth question of the survey, respondents had to answer the question: ***What is your opinion on receiving warning messages on your mobile phone?"***. The options proposed were:

- I would like to receive warning messages regarding threats as well as informative notifications;

- I would only like to receive warning messages about threats;
- Probably I may want to receive warning messages, but I need more information about these notifications;
- I don't want to receive warning messages.

As shown in Figure 25, 647 (53.69%) of respondents indicated that they would like to receive both receive warning messages regarding threats as well as informative notifications, while 396 (32.86%) respondents indicated that they would only like to receive warning messages about threats. When developing the public warning system, it might be useful to provide an opportunity for citizens to choose whether they also want to receive informative notifications.

Similarly, 151 (12.53%) respondents indicated that they probably want to receive warning messages, but more information about these notifications are needed, and therefore the SFRS should carry out a public awareness campaign on the new public warning solution before introducing it to public. Only 6 (0.5%) respondents indicated that they don't want to receive warning messages.

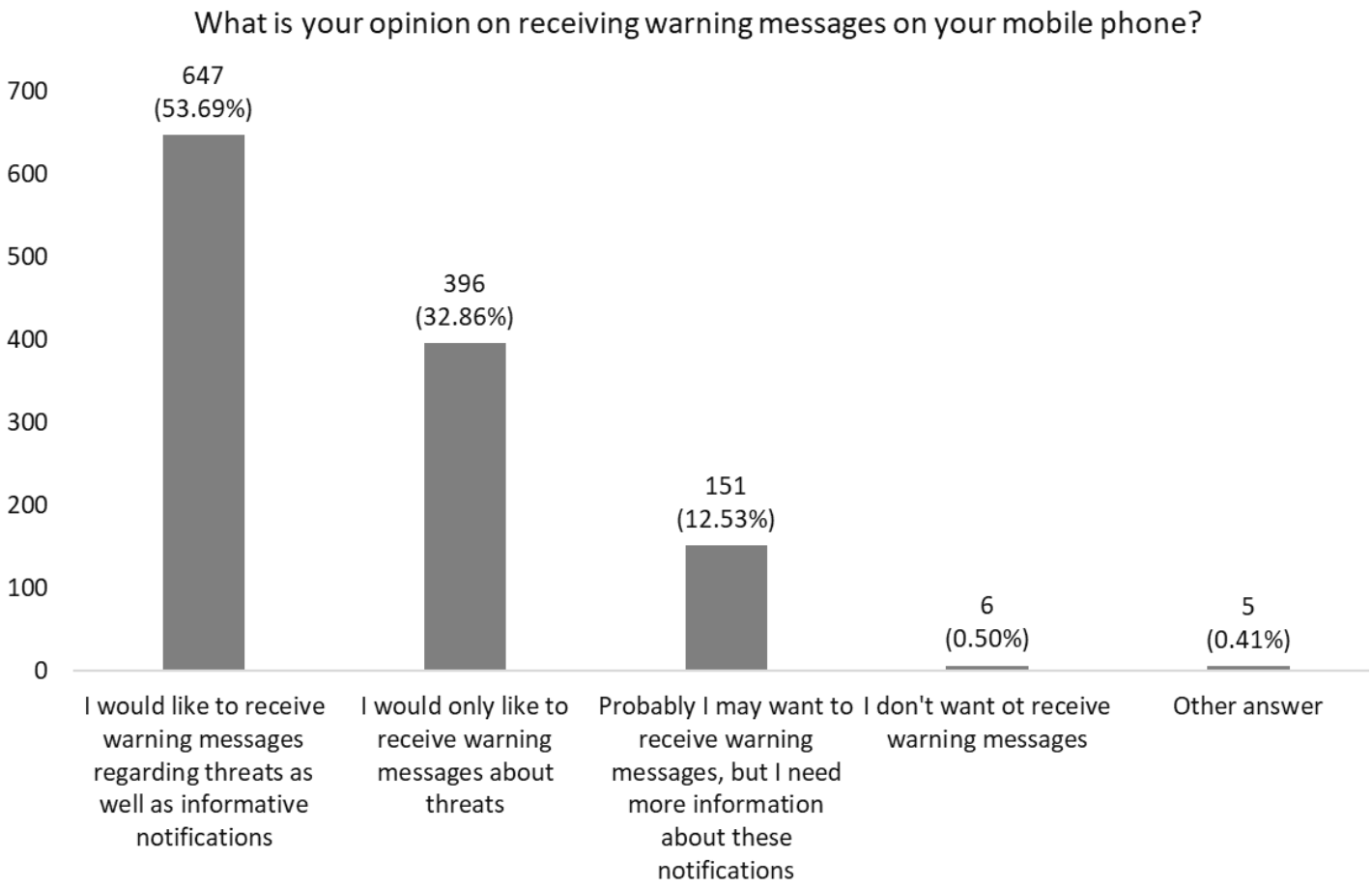

Figure 25. Summary of respondents' willingness to receive warning messages.

When analyzing other responses provided by respondents, they are essentially the following:

- it is recommended that the warning messages be indicated on the color principle of traffic lights (red, yellow, green), in order to quickly understand existing threat;
- provide an opportunity for the end user to choose which types of notifications they would like to receive.

5.3. Key findings

1. The results of the survey showed that **99.75% of respondents would like to receive warning messages on a mobile phone**. Most respondents indicated that they would like to receive warning messages in cases where the threat is extreme or significant, as well as in cases where the threat is imminent or expected in the near future.
2. Respondents are most interested in receiving warning messages about the following types of threats:
    - 96% for chemical, biological, radioactive or explosion hazards;
    - 93% due to terrorist attacks or the threat of a deliberate explosion;
    - 84% for local public health emergencies, including infectious disease outbreaks
3. 88% of respondents indicated that they would like to receive message on the end of the threat/emergency situation on their mobile phone.
4. 54% of respondents indicated that they would like to receive not only warning messages but also informative messages. However, respondents indicated that frequent sending of alerts / information notices without a justified need would lead to citizens ignoring these notices and trying to disable them.
5. In addition to the types of information messages already mentioned in the questionnaire, respondents indicated that they would like to:
    - to receive warning messages about the siren checks and poor air quality;
    - the possibility to select additional areas, including the current location, for which to receive warning messages;
    - see a sign of the effect of the warning, for example, by the colors of the traffic light (red, yellow, green), to quickly be able to realize the potential threat to the extent and impact;
    - the possibility for the end-user to choose which types of messages they would like to receive.

6. 83% of respondents noted that they would expect to receive warning messages on mobile phones from the SFRS. 50% respondents that they would also expect to receive warning messages from local governments and public administration institutions in general. Other preferable authorities mentioned were: State Police, Emergency Medical Service, Center for Disease Prevention and Control, Ministry of Defense, National Armed Forces, State Security Service, and public service providers (Latvenergo, Gaso, etc.).
7. Analyzing the mobile phone usage habits of the Latvian population, it should be noted that:
    - More than 85% of the population receives and reads text messages and messaging applications (Facebook, WhatsApp, Viber, Telegram, etc.) during the day. Less than half (43%) also check notifications from other mobile apps;
    - 72% of respondents use a mobile data connection and Wi-Fi where available. This means that ¾ the population is potentially ready to use incl. public alert mobile app;
    - **40% of respondents** indicated that they often use mobile phones during the day in vibrating or silent mode. In the normal mode (with the sound on) 2/3 of the respondents (70%) use it daily. This indicates a high risk that the **message will not be noticed quickly enough, even if received during the day;**
    - Only 47% of respondents use mobile phones in the normal mode (with the sound on) at night. Others turn on vibrate, silent, or other restricted modes, such as flight mode, with beep on and off for notifications, with beep on, and mobile data and Wi-Fi turned off. This figure indicates that at least half of mobile phone users will not read a message sent at night that may be critical for health or safety.
8. From the results of the survey, it can be concluded that a possible reaction to the notification received on the mobile phone would be the following:
    - Only 27% will read the message as soon as it is received during the day and 7% at night;
    - 58% of respondents read text messages within 30 minutes of receiving them during the day, another 7% will need up to 60 minutes to read the message;
    - 4% of respondents indicated that sometimes text messages are read immediately and other times after several hours, another part of respondents informed that text messages are read immediately during working hours, after working hours - only in the evening;
    - **During the night, 86% of respondents do not read text messages**, which could be critical in the event of a rapidly evolving threat that requires immediate action.

6. EVALUATION AND RECOMMENDATIONS OF ABS + TECHNOLOGICAL SOLUTIONS

The evaluation of technological solutions is structured in the following areas:

1. Compliance of the solution with public warning needs;
2. Compliance of the solution with regulatory enactments;
3. Costs and deadlines for implementing the solution.

6.1. ABS + solution evaluation methodology

The approach to evaluating technological solutions for public warning is schematically shown in Figure 26.

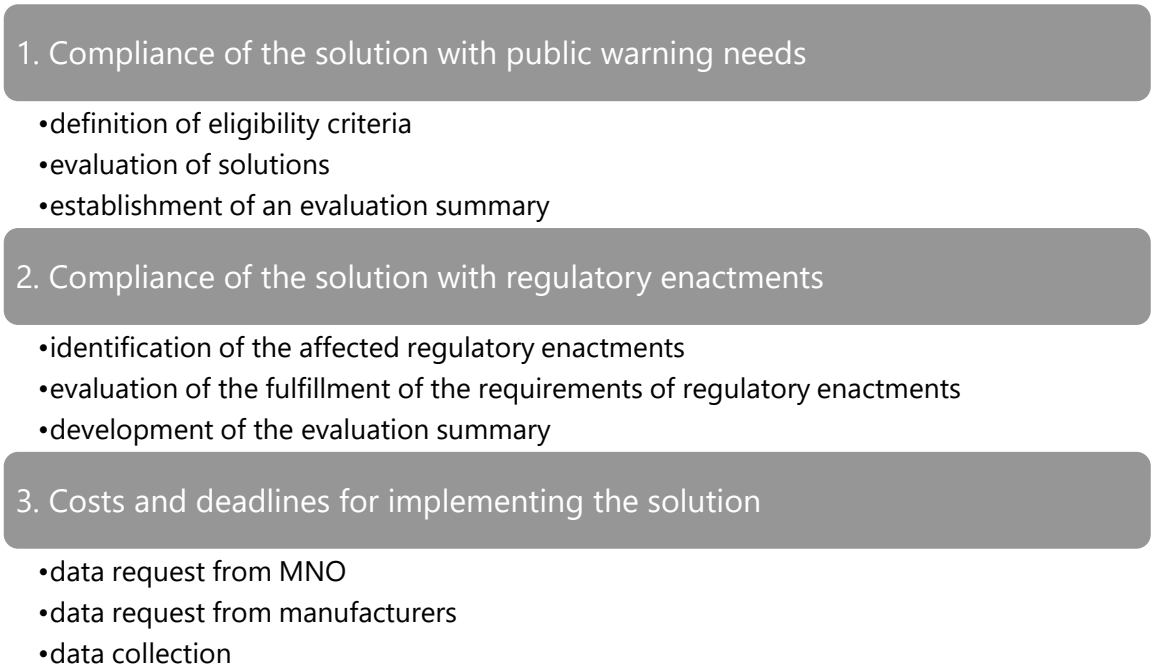

Figure 26. Approach for evaluating technological solutions for public warning.

6.1.1. Criteria and methodology for assessing the suitability of a solution for public warning purposes

The capacity of technological solutions to ensure the public warning for Latvian population is assessed according to several criteria. The evaluation criteria derive from the BEREC guidelines, as well as from the SFRS as the Customer's terms of reference. The adequacy of the solution for the needs of public warning is assessed according to the following criteria:

1. **Coverage** of the technological solution:

   1.1. Geographical coverage of Latvia;

   1.2. **Percentage reach** of Latvian population – not less than 97%, reaching the public in places of residence, workplaces, public places (supermarkets, gyms, theaters, etc.), outdoors, in vehicles.

2. **Capacity to reach end-users of the mobile network.**

   2.1. **Broadcast speed** - Technology capability (capacity) to send a warning messages as soon as possible to the target group:

   a) warning message received by 50% of the public within 3-6-minute interval;

   b) warning message received by 97% of the public within 6-10-minute time interval.

   2.2. **Geographical** options for delivery of warning messages.

   a) Technology provides an opportunity to send warning messages to the public geographically, from a small area to the entire territory of Latvia.

   b) The technology provides an active warning period, or an opportunity to deliver a warning message to persons who entered the area affected by the event after the initial warning message was sent.

   c) The technology provides an opportunity to independently send different warning message to multiple geographic areas at the same time.

   2.3. **The technological capability of** mobile devices to receive warning messages.

   2.4. Opportunities to reach mobile device users who are in the geographical area of the event **when roaming** (entering in Latvia from abroad).

   2.5. **People with special needs** (blind, deaf) will also be able to understand the received warning messages.

2.6. Language support.

2.7. Managing long messages - warning messages are clear and, easy to understand.

2.8. **Simplicity of action for people** to enable receiving warning messages on their mobile devices.

a) People do not have to go through the registration process to receive warning messages.

b) People do not need to configure mobile device settings to receive warning messages.

c) People will receive warning messages on their mobile device with a special, unique, loud tone, vibration to attract attention.

2.9. **Reliability of the solution,** simplicity of architecture

2.10. **Broader warning and** communication **capabilities**

a) An alert is sent if the event has occurred or may occur in the persons area of interest, such as the persons hometown.

b) Options to send warning message in the context of previously sent warning messages. For example, people in the Event area have received warning message No. 1 about the Event and recommended actions for evacuation. After Event is mitigated the warning message No. 2 is sent with information and recommended actions to return home.

c) Real-time information on received warning messages (number of recipients), as well as opportunities to monitor the movement of people in real time and in connection with it, send Alerts and inform about recommended actions.

d) Possibilities to enable receiving a response from the warning message recipients in certain cases.

e) Possibilities to reach Latvian citizens abroad.

The evaluation is carried out according to the following approach:

1. Both key criteria - **coverage of the technological solution** and **the ability to reach end-users of the mobile communication network**, are given the same weight as 50% for each.
2. Compliance of solutions with specified sub-criteria, e.g., 1.1. Geographical coverage, 1.2. The percentage reach of Latvian people, etc., is assessed as follows:
   - Highly efficient performance of the solution **+ +**

- Moderately efficient performance of the solution **+**
- Inefficient performance of the solution **-**

3. The main criterion for each option, such as 1. The coverage of the technological solution results in a total **+** count, summing up the ratings of the corresponding sub-criteria.
4. The overall assessment of the solution is carried out on a valuation scale ranging from 0% to 100% (maximum possible rating or absolute compliance of the solution with all criteria), following an assessment of the main criteria (see above) and the weight of these key criteria, 50% for each.

6.1.2. Approach to evaluating the compliance of the solution with regulatory requirements

The following working approach was used to assess the compliance of solutions with regulatory enactments:

- Identification and analysis of regulatory requirements affecting ABS +;
- Development of the conformity assessment form;
- Conformity assessment, including legislation draft, which will be discussed at the meeting of the State Secretaries.

The assessment has been carried out in accordance with the information obtained in interviews with experts from the Ministry of Interior, the Ministry of Defence, the Ministry of Transport, experts from the Public Utilities Commission (PUC), as well as by analyzing EU and LV legislation.

The assessment covers the following legislative acts:

- 05.05.2016. Civil Protection and Disaster Management Law (CPDML);
- Directive (EU) 2018/1972 of the European Parliament and of the Council of 11 December 2018 establishing the European Electronic Communications Code;
- Electronic Communications Law (ECL);
- General authorisation conditions in the electronic communications sector (General authorisation);
- Cabinet of Ministers Regulation No. 440 of 8 August 2017, "Procedures for Establishing, Operating and Financing the National Early Warning System" (Regulation No. 440);
- 02.05.2002. Law on State Information Systems (IS law);

- 28.10.2010. Law on the Security of Information Technologies (ITS law);
- 07.03.2013. Law on Emergency Situation and State of Exception;
- Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation);
- Directive 2002/58/EC of the European Parliament and of the Council of 12 July 2002 concerning the processing of personal data and the protection of privacy in the electronic communications sector (Directive on privacy and electronic communications);
- Cabinet of Ministers Regulation No. 442 of 28 July 2015, "Procedures for the Ensuring Conformity of Information and Communication Technologies Systems to Minimum Security Requirements";
- Cabinet of Ministers Regulation No. 764 of 11 October 2005, "General Technical Requirements of State Information Systems".

The assessment also analyzed BEREC guidelines (BoR (19) 255) on how to assess the effectiveness of the various means for transmitting public warning system messages.

Compliance with the regulatory framework is considered for the following options for transmitting ABS + system warning messages to public mobile electronic communications networks (hereinafter referred to as options):

- CB solution option. Mobile electronic communications network cell broadcasting solution in accordance with the EU-ALERT standard (ETSI TS 102 900) (Cell Broadcast);
- LB-SMS solution option. Sending a warning to users of a mobile electronic communications network located in a defined geographical location (network cell) using an SMS message (Location Based SMS);
- Mobile Application Solution option. A solution that allows warning messages to be sent to mobile applications via Internet access service (Internet access service (IAS) based PWS).

6.1.3. Approach to determining the costs and deadlines for the implementation of the solution

The following approach was used to determine the costs and deadlines for the implementation of the solution:

1. Data request to MNOs on the necessary investments in MNO infrastructure for the implementation of each technological solution with the aim to determine the necessary State's contribution to the MNO infrastructure;
2. Data request for manufacturers regarding public warning systems in order to determine the necessary State investments and deadlines for the implementation of the public warning system in Latvia
3. Data collection

6.2. Evaluation of ABS + solutions

6.2.1. Assessment of the suitability of the solution for the needs of public warning

In accordance with the methodology for evaluating the solutions described in point 6.1.1, an assessment of the compliance of the solutions with the needs of public warning has been performed, which is reflected in Table 11.

Table 11. Assessment of the suitability of the solution for the needs of public warning

Criteria	Weight of criteria, %	Assessment, -/+/+ +			Notes
		CB	LB-SMS	Mobile app	
1. Coverage of a technological solution	50%	4	4	4	
1.1. Geographical coverage		+ +	+ +	+ +	According to PUC and MNO, geographical coverage (measured by population percentage reach) exceeds 99%. The geographical coverage or reach of the population is the same in all options, none of which has an advantage compared to other variant. In the case of a mobile app, data coverage is required to ensure that warning messages are sent to mobile phone apps. As the MNO notes, there is no 4G coverage available in some places of Latvia (in some rural areas) and there is still 3G coverage that provides data connection with parameters sufficient to ensure that text information is sent to mobile phone users.
1.2. Percentage reach of Latvian residents		+ +	+ +	+ +	
2. Capacity to reach end-users of the mobile network.	50%	15	14	12	

Criteria	Weight of criteria, %	Assessment, -/+/+ +			Notes
		CB	LB-SMS	Mobile app	
2.1. Broadcast speed - Technology capability (capacity) to send a warning messages as soon as possible to the target group: - 50% of the public receives warning messages within 3-6 minutes; - 97% of the public receives warning messages within 6-10 minutes.		+ +	+	+ +	CB have the greatest ability to send warning messages in the shortest possible time, as the technological solution is not limited by capacity - MNO base stations located in cells act as transmitters that ensure signal transmission within the cell. The maximum standardized length of an SMS message is 160 characters. The longest SMS message will be technologically divided into several messages. The user will receive and perceive such a message as one, but technologically it will be several SMS messages that place higher demands on capacity. According to the information provided by the MNO, sending SMS messages to all Latvian residents could take up to 2 days, which is an unacceptably long period of time. The mobile app will also comply with the requirement, unless large amounts of information (video, large images) are transmitted.
2.2. Geographical warning delivery options		+ +	+	+ +	CB provides CB broadcasting at cell level – the minimum broadcasting unit is one cell, which is a sufficiently small geographical unit to provide the required geographic coverage of warnings. For LB-SMS, currently not all MNOs have the technological capability to send warning messages in a such detail as the broadcast cell. Currently, the MNO cannot determine the

Criteria	Weight of criteria, %	Assessment, -/+/+ +			Notes
		CB	LB-SMS	Mobile app	
					location of the MNO subscribers at the cell level, the MNO maintains much larger location areas. When an MNO subscriber changes area (crossing area boarders), then subscriber connects to the MNO network, which significantly loads the user's mobile device by discharging the battery. Investments should be made in the MNO network to cover a larger number of location areas. The mobile application has the widest possibilities to realize the expressed requirement provided that the GPS receiver of the mobile device is used. This gives the widest possibilities to define the area of influence of the emergency event without any connection to the cells of the mobile network. This solution provides the ability to identify a person approaching the event area and proactively warn the person.
2.3. Technological ability of mobile devices to receive warning messages		+	+ +	-	Practically all mobile technology supports SMS service. In the case of CB, not all mobile devices have this functionality enabled. In the Netherlands, for example, about 90% of mobile devices have this feature enabled. While in Lithuania this figure is much lower at about 30% - 50%. In the case of a mobile app, the user needs a smartphone with an operating system that allows to download and install an app that will allow to warning messages. According to

Criteria	Weight of criteria, %	Assessment, -/+/+ +			Notes
		CB	LB-SMS	Mobile app	
					available information, smartphones account for about 74% of all users of mobile electronic communications networks. The app should be installed by the user on its smartphone. The scenario that mobile devices would have a preinstalled mobile app would be a potential breach of the EU market and competition rules. Therefore, even with the most optimistic forecasts, it is not expected that the mobile app would be downloaded by 1/3 - ½ of all mobile smartphone users.
2.4. Opportunities to reach mobile device users who are roaming in the geographical area of the event (arrived in Latvia from abroad)		+ +	+	-	The CB ensures the fulfillment of this criterion in the most optimal way - any MNO user who will be in the specified cell of the MNO network where the warning messages are sent will receive these Alerts, regardless of the status - MNO network user registered in Latvia or roaming (entering Latvia from abroad). LB-SMS requires the exchange of information between MNOs on international level. The mobile application fulfils this condition if the MNO user who arrives in Latvia will have installed a mobile app that allows warning messages to be received while in Latvia. Not all mobile devices support a mobile app solution, nor will all users install a mobile app.

Criteria	Weight of criteria, %	Assessment, -/+/+ +			Notes
		CB	LB-SMS	Mobile app	
2.5. People with special needs (blind, deaf) will be able to receive and understand the warnings.		+	+	+	None of the solutions can guarantee that people with disabilities will be able to perceive and understand the warning messages sent by the ABS + system. Rather, it depends on the capabilities of a particular end-user's device. For example, blind and visually impaired people have mobile devices that enable them to play text information in audio format. Deaf people have mobile devices that will attract attention with the vibrating and/or flash light at the time the when warning messages is received. People with hearing disabilities have mobile devices equipped with a particularly loud sound tone.
2.6. Language support		+	+ +	+ +	The mobile app offers the most extensive options for receiving a warning message in the end-users chosen language. For example, during the initial configuration process of a mobile application, the user is asked about the language of the communication. Based on this setting, the mobile device will display a warning message in the language selected by the user. CB also has the potential to display warning messages in the language of the user's choice, provided that the specific mobile device model and operating system supports it. In practice, this means that the warning message would be

Criteria	Weight of criteria, %	Assessment, -/+/+ +			Notes
		CB	LB-SMS	Mobile app	
					transmitted in several languages, for example, Latvian, Russian, English. However, only the warning messages in the user-selected language will be displayed on the mobile device. The only way to choose the communication language in the case of LB-SMS is to choose the communication language on the self-service portal. If it is not used then the warning message must be sent in several languages within one SMS message, as there is no other way than how to ensure at least partial compliance with this criterion.
2.7. Long message management (warning messages are easy to understand)		+ +	+ +	+ +	The criterion idea is to make sure that the considered solutions do not lead to the risk that warning messages might be confusing or misunderstood, for example because of the limited number of symbols etc. It should be noted that: The CB message supports the maximum message length of 1395 characters in Latin and 615 characters in the Universal Encoded Character Set (UCS-2). In the case of LB-SMS, a single message supports a maximum SMS message length of 160 characters in Latin and 59 characters IN UCS-2 format. It should be noted that there are

Criteria	Weight of criteria, %	Assessment, -/+/+ +			Notes
		CB	LB-SMS	Mobile app	
					technically several SMS messages that will be perceived by the MNO end-user as one single message. The mobile app has no such restrictions.
2.8. Simple steps for people to enable warning message receiving on their mobile device: People do not have to carry out a registration process in order to receive warning messages; People do not need to configure mobile device settings to receive warning messages. People will receive an warning message on their mobile device with a special, unique, loud tone, vibration to attract attention.		+ +	+ +	-	In the case of CB and LB-SMS, people do not have to go through the registration process. In turn, registration is required for the Mobile App option. Regarding the requirement that people do not have to change the settings of the mobile device, the following should be noted: LB-SMS ensures that this requirement is met because there are a small number of users that have disabled for SMS sending/receiving option on their mobile phones. Option CB provides partial fulfilment of this requirement because there has been a period of time in the history of mobile device development when developers and suppliers, disabled cell broadcasting function in end-user devices. User of the mobile device needs to activate CB function in order to receive warning messages. It should be noted, that for mobile devices shipped in recent years, have this feature enabled at and the end-user does not need to make any changes to receive CB warning messages.

Criteria	Weight of criteria, %	Assessment, -/+/+ +			Notes
		CB	LB-SMS	Mobile app	
					In the case of the Mobile App, the user must download and install a mobile app that supports receiving warning messages. As regards the possibility of receiving a warning message with a special, unique, loud tone and vibration, the following should be noted: CB meets this requirement because, regardless of the settings of the user's mobile device, ABS + system warning messages are received with a special, unique, loud tone and vibration if particular mobile device does not disabled option to receive cell broadcasting messages; The mobile app also provides these features, as developing a mobile app has all the capabilities to create attention-grabbing alerts. In the case of LB-SMS, the tone and volume level set for the standard SMS is used, as well as there is dependence on whether the user has switched to silent mode or switched to vibrating mode.
2.9. Reliability of the solution, simplicity of architecture		+ +	+	+	CB is a more reliable, robust technological solution than LB-SMS or Mobile Application because it uses less sophisticated solution components and uses minimal network capacity when sending warning messages.

Criteria	Weight of criteria, %	Assessment, -/+/+ +			Notes
		CB	LB-SMS	Mobile app	
					LB-SMS requires the involvement of the MNO to determine the location of end-users, and the mobile network must ensure that each SMS is sent to a specific recipient.
2.10. Increased warning and communication capabilities		-	+	+ +	The mobile app has the most extensive warning and communication capabilities since it provides: The sending of a warning message if an event has occurred or may occur in the persons area of interest, such as the place of residence. Send warning messages in context with previously sent warning messages. For example, Warning No 1 on the event and recommended action on evacuation has been sent to people in particular area. After liquidation of the consequences of the Event, Warning No. 2 is sent with updated information and recommended action to return to the place of residence. Real-time information on received warning messages (number of recipients), as well as opportunities to monitor the movement of people in real time and in connection with information about recommended actions. The ability to receive an answer from end-user in specific cases.

Criteria	Weight of criteria, %	Assessment, -/+/+ +			Notes
		CB	LB-SMS	Mobile app	
					The possibility of reaching Latvian citizens abroad. CB does not provide the above-mentioned possibilities, because the technological solution does not provide for bilateral information and communication possibilities. LB-SMS actually provide these capabilities, but not in such performance as the Mobile app. For example, the Mobile app could provide more accurate location by using GPS coordinates.
Rating		87.5%	85.0%	80.0%	

6.2.2. Other considerations in the evaluation of solutions

Table 12 presents other considerations in the assessment of solutions that are not addressed in the BEREC guidelines, but in the framework of the Study the SFRS has identified these considerations as significant.

Table 12. Evaluation of other aspects

No.	Characteristic feature of the solution	CB	LB-SMS	Mobile app
1.	Standardization of the solution	Yes, EU-Alert standard TS 102 900 V1.3.1.	No, there is no standardized method for Mobile Location Centers to track mobile devices as they move through the mobile network, and there is a degree of inaccuracy.	Depending on the developed solution.
2.	Security	High - security measures practically prevent the possibility that cell broadcast messages could be generated and sent.	Low - Users do not have confirmation that the message is being sent by a competent authority. Risk of SMS spoofing.	Depending on the developed solution. Potentially cyber-attack threats.
3.	The sustainability of the solution and the potential for further expansion from the perspective of the life cycle of the solution.	The growth potential is limited.	The growth potential is limited.	High growth potential, additional development opportunities. Providing diverse and voluminous content, identifying a more accurate location, adapting to the needs of the individual.

6.2.3. Assessment of solution compliance with regulatory requirements

In accordance with the conformity assessment approach described in paragraph 6.1.2, in Table 13 is shown assessment of solution compliance with regulatory requirements.

Table 13. Assessment of solution compliance with regulatory requirements

Regulatory requirement	Article, section, paragraph No.	Rules, requirements that could be extended to the ABS + solution	Assessment of the compliance of the solution			Are amendments to regulatory enactments necessary	Brief description of the necessary amendments
			CB	LB-SMS	Mobile app		
05.05.2016. Civil Protection and Disaster Management Law (CPDML)							
	Section 12 (2) (1)	Legal and natural persons have the following rights in the field of civil protection: to receive an early warning and recommendations regarding action in case of a disaster or threats thereof.		All solutions comply.		No	_ _ _ _ _ _ _
	Section 1	Early warning - targeted and immediate provision of information to persons and responsible authorities on a disaster or threats of a disaster and the required action.		All solutions comply.		No	_ _ _ _ _ _ _
	Article 12 (1) 1) and (2) 4)	Tasks and rights of the SFRS, including the task of managing, coordinating and		All solutions comply.		No. The mentioned article of the	_ _ _ _ _ _ _

Regulatory requirement	Article, section, paragraph No.	Rules, requirements that could be extended to the ABS + solution	Assessment of the compliance of the solution			Are amendments to regulatory enactments necessary	Brief description of the necessary amendments
			CB	LB-SMS	Mobile app		
		controlling the functioning of the civil protection system, as well as the right to involve State and local government authorities, legal and natural persons, as well as the resources at their disposal.				CPDML law gives the SFRS the right to involve public mobile electronic communications network merchants.	
	Article 8 (2) (7)	The Cabinet shall determine the procedures for establishing, operating and financing the national early warning system.		All solutions comply.		No. As mentioned, more detailed arrangements for the early warning system will be determined in The Cabinet of ministers Regulation No. 440 of 8 august 2017, "Procedures for Establishing, Operating and Financing the National Early Warning System" (Regulation No. 440).	_ _ _ _ _ _ _

Regulatory requirement	Article, section, paragraph No.	Rules, requirements that could be extended to the ABS + solution	Assessment of the compliance of the solution			Are amendments to regulatory enactments necessary	Brief description of the necessary amendments
			CB	LB-SMS	Mobile app		
Directive (EU) 2018/1972 of the European Parliament and of the Council of 11 December 2018 establishing the European Electronic Communications Code							
	Article 110 (1)	By 21 June 2022, Member States shall ensure that, when public warning systems regarding imminent or developing major emergencies and disasters are in place, public warnings are transmitted by providers of mobile number-based interpersonal communications services to the end-users concerned.	Comply	Comply	Not comply (see Point 2.2)	_ _ _ _ _ _ _	_ _ _ _ _ _ _
	Article 110 (2)	Notwithstanding paragraph 1, Member States may determine that public warnings be transmitted through publicly available electronic communications services other than those referred to in paragraph 1, and other than broadcasting services, or through a mobile application relying on an internet access service,	No need to evaluate	No need to evaluate	Article 110 (2) of the EU Directive allows that the option Mobile application may also be implemented. The suitability of the mobile version of the solution can be judged by		

Regulatory requirement	Article, section, paragraph No.	Rules, requirements that could be extended to the ABS + solution	Assessment of the compliance of the solution			Are amendments to regulatory enactments necessary	Brief description of the necessary amendments
			CB	LB-SMS	Mobile app		
		provided that the effectiveness of the public warning system is equivalent in terms of coverage and capacity to reach end-users, including those only temporarily present in the area concerned, taking utmost account of BEREC guidelines. Public warnings shall be easy for end-users to receive.			assessing according to the guidelines set by BEREC (see the next paragraph).		
BEREC guidelines (BoR (19) 255) on how to assess the effectiveness of public warning systems transmitted by different means							
	Section 3.1	The requirements of the guidelines on the compliance of the solution with the performance criteria set out in these guidelines: - Coverage o Geographical coverage o Coverage percentage of population reached - Capacity to reach end-users	It should not be assessed as already complies with the EU Directive 2018/1972 (11 December 2018), paragraph 1	It should not be assessed as already complies with the EU Directive 2018/1972 (11 December 2018), paragraph 1	The mobile application does not comply with BEREC guidelines. The efficiency of this solution is not equivalent to CB and LB-SMS, because in the case of the Mobile application, the user needs a	_ _ _ _ _ _ _	_ _ _ _ _ _ _

Regulatory requirement	Article, section, paragraph No.	Rules, requirements that could be extended to the ABS + solution	Assessment of the compliance of the solution			Are amendments to regulatory enactments necessary	Brief description of the necessary amendments
			CB	LB-SMS	Mobile app		
		○ The ability to reach mobile users on roaming with us; ○ Supported terminal equipment, operating systems; ○ language support; ○ support for "long" statements, ○ Necessary steps to enable warning messages ○ The capacity to reach people with disabilities; ○ Reliability of the solution; ○ The capacity to reach more precisely the population in the endangered geographical area;			smartphone that allows downloading and installing an application that would ensure receiving ABS + alerts. According to available information, smartphones account for about 75% of all mobile electronic network users. The Mobile Application may only be implemented as a complementary option (CB or LB-SMS) if the implementation of such a complementary		

Regulatory requirement	Article, section, paragraph No.	Rules, requirements that could be extended to the ABS + solution	Assessment of the compliance of the solution			Are amendments to regulatory enactments necessary	Brief description of the necessary amendments
			CB	LB-SMS	Mobile app		
		○ Scalability - the technological ability to send a number of messages (quantity) per unit of time (second, minute)			option is useful, for example, the solution can optimally reach a certain group of society and the overall efficiency of the basic and complementary solution is higher than only basic solution.		
Electronic Communications Law (ECL)							
	Section 19 (1) 26)	Electronic communications merchants have the following obligations: "if the electronic communications merchant ensures a public mobile electronic communications network, upon receipt of a notification from the Ministry of Foreign Affairs regarding a disaster or threats of a disaster which are related to threats to the life or health of a person, to send, as soon as possible in a text message, the	There is no reason to assess, as the ECL requires amendments to the obligation for Electronic communications merchants, which provide a public mobile electronic communications network, to transmit notifications of disasters or threat of disasters to network end-users.			Yes	It is necessary to supplement the obligations of electronic communications merchants set out in the ECL with a new obligation for those electronic communications merchants that provide the public mobile electronic communications

Regulatory requirement	Article, section, paragraph No.	Rules, requirements that could be extended to the ABS + solution	Assessment of the compliance of the solution			Are amendments to regulatory enactments necessary	Brief description of the necessary amendments
			CB	LB-SMS	Mobile app		
		information prepared by the Ministry of Foreign Affairs to its users and subscribers in the relevant country regarding the possible action in case of a threat"					network, by determining task to send early warning messages received from SFRS to end-users as well as information prepared by the SFRS on the action in the event of a threat.
	13. Article [2]	The article in question clarifies that State policy in the field of the single emergency telephone number "112" and eCall shall be implemented by the State Fire and Rescue Service. However, the current ECL does not provide an explanation of the competence in the field of early warning.	There is no reason to assess. The ESL requires changes.			Yes	The ECL needs to be supplemented by an explanation that the competence of the subjects of early warning intended for the public is determined by the Civil Protection and Disaster Management Law.
	Transitional provisions	The ECL lists the regulations that the Cabinet of Ministers must adopt in order to implement the objectives,	There is no reason to assess.			Yes	The ECL could be complemented by a delegation to the Cabinet of Ministers to adopt rules on early

Regulatory requirement	Article, section, paragraph No.	Rules, requirements that could be extended to the ABS + solution	Assessment of the compliance of the solution			Are amendments to regulatory enactments necessary	Brief description of the necessary amendments
			CB	LB-SMS	Mobile app		
		requirements and tasks of the ECL.					warning procedures in the event of disasters or disaster threats using public mobile electronic communications networks. This procedure could also be included in the Cabinet Regulation No. 440 of 8 august 2017, "Procedures for Establishing, Operating and Financing the National Early Warning System" (Regulation No. 440)
General Authorisation Regulations in the Field of Electronic Communications (General Authorisation Regulations)							
	Title II, 11.	In emergency situations, the electronic communications merchant has an obligation to take all the necessary measures to continue to ensure the electronic communications network or to provide the electronic communications service as far	There is no reason to assess. Changes to the General Authorisation Regulations are required.			Yes	It is necessary to supplement the General Authorisation Regulations with the obligation of the electronic communications merchant, which provides a public

Regulatory requirement	Article, section, paragraph No.	Rules, requirements that could be extended to the ABS + solution	Assessment of the compliance of the solution			Are amendments to regulatory enactments necessary	Brief description of the necessary amendments
			CB	LB-SMS	Mobile app		
		as technically possible, conforming to the conditions of the general authorisation and the requirements laid down in the laws and regulations. In emergency situations, the electronic communications merchant which provides voice telephony services shall, as far as technically possible, perform activities in relation to the ensuring of electronic communications networks or electronic communications service to the State Fire and Rescue Service, the State Police, the State Emergency Medical Service, gas emergency service, the Maritime Search and Rescue Service, telephone number "112" service and State administrative institutions in accordance with the procedures laid down in the laws and regulations, as well as the informing of the					mobile electronic communications network, to transmit to end-users of their network a public warning messages about emergencies and disaster hazards received from the SFRS.

Regulatory requirement	Article, section, paragraph No.	Rules, requirements that could be extended to the ABS + solution	Assessment of the compliance of the solution			Are amendments to regulatory enactments necessary	Brief description of the necessary amendments
			CB	LB-SMS	Mobile app		
		inhabitants in emergency situations.					
Cabinet Regulation No. 440 of 8 august 2017, "Procedures for Establishing, Operating and Financing the National Early Warning System" (Regulation No. 440)							
	I, II, III, IV	Procedures for the establishment, operation and financing of the ABS +, by addressing the responsibilities, duties and tasks of the parties involved in providing early warning to public.	There is no reason to assess. Regulation No. 440 needs changes to ensure the sending of ABS warning message to users of public mobile electronic communications networks.			Yes	It is necessary to supplement Regulation No. 440, the procedures for the establishment, operation and financing of the early warning system with the provisions according to which the warnings of the early warning system are sent to the users of public mobile electronic communications networks. When making changes Regulation No. 440, it is necessary to make the following changes: 1. Description of the service provided by

Regulatory requirement	Article, section, paragraph No.	Rules, requirements that could be extended to the ABS + solution	Assessment of the compliance of the solution			Are amendments to regulatory enactments necessary	Brief description of the necessary amendments
			CB	LB-SMS	Mobile app		the public mobile electronic communications network (sending ABS + warning messages to the users of the public mobile electronic communications network); 2. Procedures for the provision of the service, considering the obligations and tasks and terms of the involved parties (SFRS, merchants of public mobile electronic communications networks); 3. Requirements for warning message parameters (standard, message length, languages, options to attach

Regulatory requirement	Article, section, paragraph No.	Rules, requirements that could be extended to the ABS + solution	Assessment of the compliance of the solution			Are amendments to regulatory enactments necessary	Brief description of the necessary amendments
			CB	LB-SMS	Mobile app		image files, other additional information, etc.); 4. Parameters of the service level agreement (SLA), for example, distribution of the warning throughout the territory of Latvia: ▪ warning message received by 50% of the public within 3-6-minute interval; ▪ warning message received by 97% of the public within 6-10-minute time interval. 5. Procedures for submitting reports about sent warning messages. 6. Source and procedure of financing the service:

Regulatory requirement	Article, section, paragraph No.	Rules, requirements that could be extended to the ABS + solution	Assessment of the compliance of the solution			Are amendments to regulatory enactments necessary	Brief description of the necessary amendments
			CB	LB-SMS	Mobile app		
							A more detailed proposal for Regulation No. 440 additions to be made will be developed in Phase 2 of the Study.

Table 14 provides an overview of the regulatory enactments whose requirements should be taken into account when implementing the ABS +. The compliance of the solution with these regulatory enactments cannot be assessed, but the requirements of these regulatory enactments must be taken into account when developing the solution.

Table 14. Overview of the regulatory requirements to be taken into account in the development of ABS +.

Regulatory enactment	Article, section, paragraph No.	Rules, requirements that could be extended to the ABS + solution	Comments on the extension of the relevant regulatory enactment, requirement or regulation to the ABS + solution	Are amendments to regulatory enactments necessary	Brief description of the necessary amendments
02.05.2002. Law on State Information Systems (IS law)	Section 1 1)	State information system - a structured aggregate of information technology and databases, the use of which ensures the proposal, creation, compilation, accumulation, processing, utilization and destruction of	Regardless of the option of the selected public warning solution, the ABS + system is to be classified as a State information system which would be covered by the scope defined in the IS law, including: 2) the procedures by which State information systems are established,	No.	– – – – – – –

Regulatory enactment	Article, section, paragraph No.	Rules, requirements that could be extended to the ABS + solution	Comments on the extension of the relevant regulatory enactment, requirement or regulation to the ABS + solution	Are amendments to regulatory enactments necessary	Brief description of the necessary amendments
		information (hereinafter - circulation of information) necessary for the implementation of State functions.	registered, maintained, used, reorganized or eliminated; 3) the functions of the State information system owner and the rights and obligations of the data subject of the Sate information system; 4) security management of State information systems; 5) requirements which are significant for the protection of State information systems integrators and State information systems forming part of an integrated State information system; 6) the procedures by which the circulation of information shall be ensured with the assistance of the State information system integrator.		
28.10.2010. Law on the Security of Information Technologies (ITS law)	Article 3 (1)	The critical infrastructure of information technologies is an infrastructure, which is approved by the Cabinet in accordance with the National Security Law. According to the National Security Law Section 22.[2]	Regardless of the chosen public warning solution, the ABS + should be defined as critical infrastructure for information technologies, as it is essential for the important public functions, as well as for the protection of human health, safety and economic well-being.	No	– – – – – – –

Regulatory enactment	Article, section, paragraph No.	Rules, requirements that could be extended to the ABS + solution	Comments on the extension of the relevant regulatory enactment, requirement or regulation to the ABS + solution	Are amendments to regulatory enactments necessary	Brief description of the necessary amendments
		Critical Infrastructure (1): (1) Critical infrastructure is objects, systems or parts thereof located in the Republic of Latvia, which are of significance for ensuring the implementation of important public functions, as well as human health protection, security, economic or social welfare and destruction of or interferences in the operation of which would significantly affect the implementation of State functions.	Consequently, the ABS + information system solution would be covered by the National Security Law Section 22.[2], as well as Cabinet of Ministers Regulation No. 442 of 28 July 2015, "Procedures for the Ensuring Conformity of Information and Communication Technologies Systems to Minimum Security Requirements".		
	Section 8. Management of the Security of Information Technologies (5)	The Cabinet shall determine the minimum security requirements for information and communication technologies, and the procedures by which the State and local government institutions, the owners or lawful possessors of the critical infrastructure of information technologies	Regardless of the variant of the alert transmission solution, when defining the ABS + information system as critical infrastructure for information technologies, it would be subject to the requirements laid down in Cabinet of Ministers Regulation No. 442 of 28 July 2015, "Procedures for the Ensuring Conformity of Information and Communication Technologies Systems to Minimum Security Requirements".	No	– – – – – – –

Regulatory enactment	Article, section, paragraph No.	Rules, requirements that could be extended to the ABS + solution	Comments on the extension of the relevant regulatory enactment, requirement or regulation to the ABS + solution	Are amendments to regulatory enactments necessary	Brief description of the necessary amendments
		ensure conformity of information and communication technologies systems with the minimum security requirements.			
07.03.2013. Law "On Emergency Situation and State of Exception"	Article 4 (1) and (2).	(1) Emergency situation is a special legal regime, during which the Cabinet has the right to restrict the rights and freedoms of State administration and local government authorities, natural persons and legal persons, as well as to impose additional duties to them. (2) Emergency situation may be declared in case of such threat to national security, which is related to a disaster, danger thereof or threat to the critical infrastructure, if safety of the State, society, environment, economic activity or health and life of human beings is significantly endangered.	Additional obligations would also apply to public mobile electronic communications network operators (see the recommendations regarding Section 9 (4) of the Law.	See recommendations regarding Section 9 (4) of the Law	-------

Regulatory enactment	Article, section, paragraph No.	Rules, requirements that could be extended to the ABS + solution	Comments on the extension of the relevant regulatory enactment, requirement or regulation to the ABS + solution	Are amendments to regulatory enactments necessary	Brief description of the necessary amendments
	Section 8. Right of the Cabinet in Declaring Emergency Situation (2)	(2) In declaring emergency situation, in addition to the rights referred to in Paragraph one of this Section the Cabinet has the right to determine measures necessary in the particular emergency situation, which are provided for the prevention or overcoming of threat to national security and consequences thereof in laws, as well as the competence of State administration and local government authorities in the prevention or overcoming of threat to national security.	The necessary measures, if deemed appropriate, would also apply to public mobile electronic communications network operators (see recommendations regarding Section 9 (4) of the Law.	See recommendations regarding Section 9 (4) of the Law	– – – – – – –
	Article 9 (4)	(4) Public electronic mass media shall notify a decision on emergency situation free of charge, as well as provide other information regarding emergency situation and recommendations for actions of inhabitants in conformity with the conditions of the	The required requirement would also apply to public mobile electronic communications operators, not only to Public electronic mass media	Yes	Merchants of public mobile electronic communications networks shall, at the request of the SFRS, send a warning messages free of charge to the end-users of the network regarding the emergency situation, as well as to provide other information regarding

Regulatory enactment	Article, section, paragraph No.	Rules, requirements that could be extended to the ABS + solution	Comments on the extension of the relevant regulatory enactment, requirement or regulation to the ABS + solution	Are amendments to regulatory enactments necessary	Brief description of the necessary amendments
		Cabinet and the responsible authority regarding the procedures and urgency of providing the information.			the emergency situation and recommendations for the action of the population, taking into account the conditions of the Cabinet of Ministers and the responsible authority regarding the procedure and urgency for the provision of information.
	Section 11. Conditions for Declaring State of Exception (1) and (2)	State of exception is a special legal regime to be declared if: 1) the State is endangered by an external enemy; 2) internal disturbances which endanger the democratic structure of the State have arisen or are in danger of arising in the State or any part thereof. (2) State of exception allows to restrict the rights and freedoms of natural persons and legal persons to the extent and according to the	Additional duties would also apply to public mobile electronic communications network operators (see recommendations regarding Section 15 (2) of the Law.	See recommendations regarding Section 15 (2) of the Law	– – – – – – –

Regulatory enactment	Article, section, paragraph No.	Rules, requirements that could be extended to the ABS + solution	Comments on the extension of the relevant regulatory enactment, requirement or regulation to the ABS + solution	Are amendments to regulatory enactments necessary	Brief description of the necessary amendments
		procedures laid down in law, as well as to impose additional duties on them.			
	Section 13. Decision on State of Exception (1) 5)	A decision on state of exception shall include the following information: 5) restrictions to the rights and freedoms of natural persons and legal persons or additional duties.	Additional duties would also apply to public mobile electronic communications network operators (see recommendations regarding Section 15 (2) of the Law.	See recommendations regarding Section 15 (2) of the Law	– – – – – – –
	Section 15. Informing of Inhabitants Regarding State of Exception (2)	Public electronic mass media shall notify a decision on state of exception free of charge, as well as provide other information regarding state of exception and recommendations for actions of inhabitants in conformity with the conditions of the Cabinet and the responsible authority regarding the procedures and urgency of providing the information.	The required requirement would also apply to public mobile electronic communications operators, not only to Public electronic mass media.	Yes, you need it.	Merchants of public mobile electronic communications networks shall, at the request of the SFRS, send a warning messages free of charge to the end-users of the network regarding the state of exception, as well as provide other information regarding the state of emergency and recommendations for the action of the population, according to statements of the Cabinet of Ministers and the responsible authority regarding the procedure and

Regulatory enactment	Article, section, paragraph No.	Rules, requirements that could be extended to the ABS + solution	Comments on the extension of the relevant regulatory enactment, requirement or regulation to the ABS + solution	Are amendments to regulatory enactments necessary	Brief description of the necessary amendments
					urgency for the provision of information.
EU 2016/679 General Data Protection Regulation (GDPR)	Article 4(1) and (2)	'personal data' means any information relating to an identified or identifiable natural person ('data subject'); an identifiable natural person is one who can be identified, directly or indirectly, in particular by reference to an identifier such as a name, an identification number, location data, an online identifier or to one or more factors specific to the physical, physiological, genetic, mental, economic, cultural or social identity of that natural person; 'processing' means any operation or set of operations which is performed on personal data or on sets of personal data, whether or not by automated means, such as collection, recording, organization, structuring,	The LB-SMS and Mobile app require the processing of data (location data) from end-users of the cellular network. This does not mean that such solutions are prohibited from being introduced and applied, but rather that certain rules on the processing of personal data should be complied with. The CB does not intend to use end-user location data, as it technologically provides signal transmission within a cellular network - to all end-users located in the cell without "interest" in the data of these end-users.	-	-

Regulatory enactment	Article, section, paragraph No.	Rules, requirements that could be extended to the ABS + solution	Comments on the extension of the relevant regulatory enactment, requirement or regulation to the ABS + solution	Are amendments to regulatory enactments necessary	Brief description of the necessary amendments
		storage, adaptation or alteration, retrieval, consultation, use, disclosure by transmission, dissemination or otherwise making available, alignment or combination, restriction, erasure or destruction.			
	Article 95	Relationship with Directive 2002/58/EC This Regulation shall not impose additional obligations on natural or legal persons in relation to processing in connection with the provision of publicly available electronic communications services in public communication networks in the Union in relation to matters for which they are subject to specific obligations with the same objective set out in Directive 2002/58/EC.	ABS + solutions must comply with EU Directive 2002/58/EC on the processing of personal data and the protection of privacy in the electronic communications sector, as referred to in Article 95 GDPR Regulation.	-	-
Directive 2002/58/EC of the European	Article 2, definition (c)	(c) "location data" means any data processed in an electronic communications	The LB-SMS and Mobile app require the processing of data (location data) from end-users of the cellular network. This does not	-	-

Regulatory enactment	Article, section, paragraph No.	Rules, requirements that could be extended to the ABS + solution	Comments on the extension of the relevant regulatory enactment, requirement or regulation to the ABS + solution	Are amendments to regulatory enactments necessary	Brief description of the necessary amendments
Parliament and of the Council of 12 July 2002 concerning the processing of personal data and the protection of privacy in the electronic communications sector (Directive on privacy and electronic communications)		network, indicating the geographic position of the terminal equipment of a user of a publicly available electronic communications service.	mean that such solutions are prohibited from being introduced and applied, but rather that certain rules on the processing of personal data should be complied with. The CB does not intend to use end-user location data, as it technologically provides signal transmission within a cellular network - to all end-users located in the cell without "interest" in the data of these end-users.		
	Point (36)	(36) Member States may restrict the users' and subscribers' rights to privacy with regard to calling line identification where this is necessary to trace nuisance calls and with regard to calling line identification and location data where this is necessary to allow emergency services to carry out their tasks as effectively as possible. For these	We can conclude that LB-SMS and Mobile Application solutions can be provided because location data is required for emergency services (including (SFRS) in order to effectively fulfil its obligations.	Clarification in ECL is required	An electronic communications merchant may process location data without the consent of a registered end-user if the processing of location data is necessary to send a warning message prepared by the SFRS about threat of a disaster and recommended action in such a situation.

Regulatory enactment	Article, section, paragraph No.	Rules, requirements that could be extended to the ABS + solution	Comments on the extension of the relevant regulatory enactment, requirement or regulation to the ABS + solution	Are amendments to regulatory enactments necessary	Brief description of the necessary amendments
		purposes, Member States may adopt specific provisions to entitle providers of electronic communications services to provide access to calling line identification and location data without the prior consent of the users or subscribers concerned.			
21.06.2018 Personal Data Processing Law	Section 2. Purpose of this Law	The purpose of this Law is to create legal preconditions for setting up of a system for the protection of personal data (hereinafter - the data) of a natural person at a national level by providing for the institutions necessary for such purpose, determining the competence and basic principles of operation thereof, as well as regulating operation of data protection officers and provisions of data processing and free movement.	In essence, the law provides for the establishment of the necessary institutions. Defining their competence and basic operating principles in the field of personal data processing in such a way that the requirements of the GDPR and the tasks specified therein are fulfilled. This law does not specify the types of requirements and regulations that would be directly applicable to ABS + solutions.	No	-------
Cabinet Regulation No.	Point 1.1	The minimum security requirements for the	Regardless of the chosen ABS + solution it's information system would be critical	No	———

Regulatory enactment	Article, section, paragraph No.	Rules, requirements that could be extended to the ABS + solution	Comments on the extension of the relevant regulatory enactment, requirement or regulation to the ABS + solution	Are amendments to regulatory enactments necessary	Brief description of the necessary amendments
442 of 28 July 2015, "Procedures for the Ensuring Conformity of Information and Communication Technologies Systems to Minimum Security Requirements"		information and communication technologies of the State and local government authorities, and the procedures by which the State and local government authorities and the owners or lawful possessors of the critical infrastructure of information technologies ensure conformity of the information and communication technologies systems to the minimum requirements	information technology infrastructure and it would be subject to the requirements set out in this Regulation.		
Cabinet of Ministers Regulation No. 764 of 11 October 2005, "General Technical Requirements of State Information Systems".	Point 1	These Regulations prescribe the general technical requirements of State information systems.	Regardless of the chosen ABS + solution it's information system would be critical information technology infrastructure and it would be subject to the requirements set out in this Regulation.	No	———

Regulatory enactment	Article, section, paragraph No.	Rules, requirements that could be extended to the ABS + solution	Comments on the extension of the relevant regulatory enactment, requirement or regulation to the ABS + solution	Are amendments to regulatory enactments necessary	Brief description of the necessary amendments
Cabinet Regulation No. 442 of 28 July 2015, "Procedures for the Ensuring Conformity of Information and Communication Technologies Systems to Minimum Security Requirements"	Points 1.1, 7, 8	Regulation No. 442 lays down the minimum ICT security requirements of national and local authorities and the procedures by which national and local government authorities and owners of critical infrastructure for information technologies or legal holders ensure that ICT systems comply with the minimum requirements. Critical infrastructure information systems and systems used for the provision of a basic service or digital service, as appropriate, by a provider of a basic service or a digital service provider, shall be recognized as enhanced security systems. These systems are covered by Regulation No. 442 III. The requirements of this section	Regardless of the chosen ABS + solution, the requirements of Regulation No. 442 must be met. The first question to be answered is whether the IS to be developed is a critical infrastructure IS. If so, these systems are subject to Regulation No. 442 Requirements for enhanced security systems set out in Title III. It should be noted that the list of critical infrastructure IS is a state secret. On the other hand, if the IS to be developed is not recognized as a critical infrastructure IS, then an assessment must be made in accordance with Regulation No. To the methodology specified in Paragraph 7 in order to divide the IS into a basic or high security system. If the assessment concludes that the IS system is an enhanced security system, Regulation No. 442 Requirements for enhanced security systems set out in Title III. IS identified as Critical Infrastructure IS or High Security IS must develop Regulation No. 442 the documents specified in Paragraph 8, as	No.	_ _ _ _ _ _ _

Regulatory enactment	Article, section, paragraph No.	Rules, requirements that could be extended to the ABS + solution	Comments on the extension of the relevant regulatory enactment, requirement or regulation to the ABS + solution	Are amendments to regulatory enactments necessary	Brief description of the necessary amendments
		for enhanced security systems. In order to allocate a system of State and local government authorities other than a critical infrastructure information system or system used to provide a basic service and a digital service to a basic or enhanced security system, the person responsible for information technology security management shall assess it in accordance with the methodology set out in paragraph (7) Regulation No. 442.	well as ensure the supervision and control of the fulfillment of the requirements specified therein: - system security policy; - internal system security rules; - system usage rules; - system security risk management plan; - system recovery plan.		

6.2.4. Costs and deadlines for implementing the solution

The cost of implementing a solution largely depends not only on the technological solution, but also on the functional components of the solution, the chosen architecture of the solution, the solution chosen by a particular manufacturer.

This section summarizes cost information based on information provided by several public alert system suppliers, identifying historical costs in other countries, as well as the views of Latvian MNO received.

Costs in other countries

When identifying the equipment and infrastructure to be set up on the national side, the consultants identified different implementations in different countries in terms of setting up a cell broadcasting center and mobile location centers on the national side and on the MNO side.

Table 15. Costs of introducing of public warning system by country

Country	Cost position	Costs, EUR	Notes
CB			
Lithuania	**Total implementation:**	**6 100 000**	Centralized CBC, introduced in 2012.
	Establishment of a notification and management system (NMS):	**900 000**	
	NMS hardware	100 000	
	NMS Software	150 000	
	Design, implementation and documentation services of the system	650 000	
	Cell Broadcasting Centre (CBC) infrastructure for a 2G, 3G, 4G cell network connection consisting of:	**2 200 000**	
	Hardware CBC	700 000	
	CBC software	1 500 000	
	Activate cell broadcast cells on 2G, 3G, 4G	**3 000 000**	

Country	Cost position	Costs, EUR	Notes
	Annual maintenance services:	**400 000**	
	Annual maintenance services of the system	150 000	
	Annual maintenance services for cell broadcasting on 2G, 3G, 4G cellular network	250 000	
The Netherlands	**Total implementation:**	**15 000 000**	CB introduced in 2012. Currently implementing new procurement on other terms
	Feasibility studies and public education campaign	2 000 000	
	CBE Software	1 000 000	
	CBC Software and Infrastructure	12 000 000	3 decentralized CBC
	Annual maintenance services:	**1 000 000**	
LB-SM			
Sweden	**Implementation costs**	**Not known**	
	Annual maintenance services, including	**2 500 000**	
	Compensation for MNO	1 200 000	4 MNO

Public warning system supplier prices

On the basis of initial negotiations with 5 manufacturers of public warning systems, preliminary costs were identified in the table below.

For a price benchmark CB solution, it is assumed that:

1. The State shall introduce a centralized CBC solution (indicating in brackets the costs of the decentralized CBC);
2. The deployment and operation of the solution takes place in existing State's data centres (computing capacity, networks, security requirements).

Table 16. Price level of suppliers of warning systems, EUR, not applicable. VAT.

Cost lines	CB		LB-SM		Mob Application
	min	Max	min	Max	
Total implementation:	**1 865 000 (1 889 000)**	**4 547 000 (5 020 000)**	**1 695 000**	**3 575 000**	**250 000**
Software	1 240 000 (1 240 000)	2 570 000 (2 570 000)	N/a	2 140 000	200 000
Infrastructure	150 000 (174 000)	427 000 (900 000)	Not known	Not known	Not relevant
Deployment services	475 000	1 550 000	N/a	1 435 000 (without customization)	50 000 (without translation)
Annual maintenance	**215 000**	**390 000**	**220 500**	**460 000**	**50 000**

MNO costs

The data provided by the MNO on the necessary investments in their infrastructure is fragmented and does not provide the desired view of potential costs by introducing one or other technological solutions.

By introducing **a cell broadcasting solution** with centralized CBC architecture, the Latvian MNO should carry out various preparatory work. It can be concluded that 2 out of 3 MNO has a ready-made infrastructure of CB that should be activated and tested. CB functionality is not available for the third MNO. For operations related to the deployment of equipment, software, etc. Regarding the functionality of CB, have not been identified at the time of preparation of the results of the evaluation. The MNO has indicated that investments in their infrastructure, facilities and services would be between EUR 100 000 and EUR 1 000 000 each, to introduce a **LB-SMS solution**.

The introduction of **a mobile app** to MNO will not lead to additional costs, not including providing free data transmission for the dissemination of warning messages.

The investment in providing the CB solution depends to a large extent on the commercial terms of the specific MNO with their solution suppliers. For example, the cell broadcasting functionality may be included in a specific service suite that the MNO has already purchased with other necessary services. In the case of other MNO, this functionality should be purchased separately for a certain, fee with.

The establishment and updating of a list of MNO base stations and their coordinates is another cost item that will be required by the single national CB center. It is also important to agree on a protocol for the exchange of information between the MNO and the single national CB center.

In the case of the LB-SMS solution, it is assumed that there is a single, state-managed and maintained SMS center in the country, as well as one or more Mobile Location Centers. Such an assumption is rational, given that it would not be appropriate for each operator to make a huge investment to significantly increase the capacity of its SMS center, knowing in advance that the SMS center will be congested only at the moment of sending Alerts and only a few percent. It should be noted that the establishment of such an SMS center would cost the state several million EUR. Under this assumption, investments on the MNO side would consist of:

- Investments related to the establishment of the list of subscribers of the MNO communications network in a pre-defined format;
- Investments related to sending warning messages in the shortest possible time. These investments should be made in increasing channels (to be specified).

In the case of a mobile application, MNO call operators do not have to invest in new mobile network functionality or increase network capacity, provided that high-volume content - video files or large image files - are not transmitted.

Implementation deadlines

Referring to the experience of other countries and information provided by individual manufacturers, the implementation period of all solutions does not exceed 1 year, counting from the beginning of the solution implementation project to the full operational solution.

6.3. Assessment results and recommendations for selection of ABS + solution

Summarizing the results of the assessment of the technological solutions for the public warning system (part 5.2. of this document), it can be concluded that the **cell broadcast (CB) technology is the most suitable solution for the implementation of the public warning system in Latvia.**

Table 17 summarizes the assessment of the variants for the solution according to the chosen criteria.

Table 17. Summary of assessment variant scores

Sub-criteria	Weight of criteria, %	Assessment, given one of the assessments "+", "+", "-"		
		CB	LB-SMS	Mobile app
1. Coverage of a technological solution	**50%**	**4**	**4**	**4**
1.1. Geographical coverage		+ +	+ +	+ +
1.2. Percentage reach of Latvian population		+ +	+ +	+ +
2. Capacity to reach end-users of the mobile network.	**50%**	**15**	**14**	**12**
2.1. Notification speed		+ +	+	+ +
2.2. Geographic warning Delivery Opportunities		+ +	+	+ +
2.3. Technological ability of mobile devices to receive warning messages.		+	+ +	-
2.4. Opportunities to reach mobile device users who have entered Latvia.		+ +	+	-
2.5. People with special needs will be able to understand the warnings they have received.		+	+	+
2.6. Language support.		+	+ +	+ +
2.7. Long message management.		+ +	+ +	+ +
2.8. Simple operation.		+ +	+ +	-
2.9. Reliability of the solution.		+ +	+	+
2.10. Broader communication capabilities.		-	+	+ +

ASSESSMENT	87.5%	85.0%	80.0%

Table 18 shows the strengths and weaknesses of variants for the solution.

Table 18. The strengths and weaknesses of the solutions

	CB	LB-SM	Mobile app
Strong sides	1. Reporting rate 2. Ability to reach LV guests 3. Architectural simplicity 4. Users of new Android OS and iOS terminals don't have to take additional action to turn on CB 5. If some MNO network does not work, other MNO will report to the population	1. Unlimited support for mobile equipment 2. Increased warning, communication capabilities	1. Extensive warning, communication capabilities 2. Opportunities to reach certain groups of society 3. Reporting rate
Weak sides	1. Limited communication capabilities (one-way communication) 2. Reports on message delivery are not available 3. Users of old Android OS equipment must take additional steps to turn on CB	1. Reporting rate 2. MNO Infrastructure Load 3. Complexity (keeping the list of active subscribers) 4. Security threats - potentially spoofing of SMS messages.	1. Need for the Internet 2. Limited mobile support (not applicable on button phone) 3. Complex to end-users

In summary, **consultants recommend implementing CB solution for public warning purposes.**

Main arguments for this choice:

- CB ensure rapid, efficient, secure and guaranteed public warning to all users of mobile devices with acceptable and improvable reach indicators in the future.

- CB main advantages compared to LB-SMS:
  - LB-SMS uses standard mobile services for SMS notification, which may be unavailable in the event of an emergency event (CB uses a special data transmission protocol for the transmission of messages, which works regardless of the availability of mobile communications)
  - LB-SMS sends individual messages to specific subscribers; thus, it requires significantly more time to send messages and increases the load on the mobile network
  - The use of LB-SMS needs to maintain a list of active subscribers which significantly complicates the design/integration of the system and poses potential risks of non-availability of the solution and breaches of personal privacy;
  - LB-SMS message recipients need to register with a particular mobile operator network, as opposed to CB, which provides messages to all mobile device users without registration (including foreign and other operator customers physically located in the coverage area);
  - CB solution is safer because LB-SMS includes the risk of SMS spoofing.
- CB main advantages compared to mobile application
  - Mobile application requires an Internet connection that may be unavailable in the event of an emergency and not all mobile device users have access to it (for example, non-European roaming subscriber);
  - Mobile application may not be installed or technically available on end-user devices (smartphone users Latvia ~ 74%);
- The relative shortcomings of CB are acceptable and in the future avoidable/resolvable:
  - Insufficient reach due to CB reception settings are currently turned off should be addressed in cooperation with mobile device manufacturers and mobile network operators (in the case of LB-SMS, this problem does not exist because the SMS can be received by all users);
  - Feedback communication may be provided via other channels such as SMS, mobile application, web browser, etc.
- From a cost point of view, the costs of CB and LB-SMS solutions are equivalent

The advice of the consultants is to introduce a mobile app as an additional option within the limits of financial possibilities, which would serve to reach certain groups of the society in the short term, but in the long term, when the smartphones would available for every citizen of Latvia, it could also become a mainic channel for public warning about disasters and threats and for providing other information that is important to the public.

1. ANNEX - QUESTIONNAIRE QUESTIONS

1. **What kind of messages do you usually get on your mobile phone during the day**

   - Text messages (SMS)
   - Messaging app messages (Facebook Messenger, WhatsApp, Viber, Signal, Telegram, Skype, etc.)
   - Emails
   - Social network notifications (Facebook, Twitter, LinkedIn, etc.)
   - Notifications from mobile apps
   - Other answer

2. **How do you use the Internet on your mobile phone?**

   - Using Wi-Fi and mobile data connection
   - Using only a mobile data connection
   - Using a Wi-Fi connection
   - I do not use the Internet on a mobile phone

3. **What is the mode of your mobile phone during the day**

   - In normal mode with sound on
   - Vibrate mode
   - Silent mode
   - Turned off
   - Other answer:

4. **What is the mode of your mobile phone at night?**

   - In normal mode with sound on
   - Vibrate mode
   - Silent mode
   - Turned off
   - Other answer:

5. **How long does it usually take from receiving a text message on your mobile phone to reading it?**

   - I read text messages as soon as they are received
   - From 2 to 30 minutes
   - From 30 to 60 minutes

- From 1 to 3 hours
- More than 3 hours
- Other answer:

6. **How long does it usually take during the night from receiving a text message to reading it?**

- I will read the text message as soon as it is received
- I will check a few times at night for new notifications on my mobile phone
- I will only read the text message after waking up
- Other answer:

7. **What kind of warning messages would you like to receive on your mobile phone?**

	Very interested	**Interested**	**Maybe interested**	**Not interested**	**Completely not interested**
Violent crimes in nearby area					
Risk of property damage due to floods					
Dangerous weather warning					
Danger to life due to floods					
Local public health emergency including outbreaks of infectious diseases					
Terrorist attack or threat of deliberate explosion					

	Very interested	Interested	Maybe interested	Not interested	Completely not interested
Chemical, biological, radioactive or explosion hazards					

8. What informative messages would you like to receive on your mobile phone?

	Very interested	Interested	Maybe interested	Not interested	Completely not interested
Car theft at nearby area					
Notifications of missing children / persons					
Notification of military exercises in nearby area					
Notification of traffic accidents that blocks the main roads					
Information that a nearby accident or incident does not endanger your life, health or property					
Malfunctions of utilities					

	Very interested	Interested	Maybe interested	Not interested	Completely not interested
(gas, electricity, water, heating, etc.)					

9. About what other events would you like to receive security warning messages?

10. What degree of urgency would justify receiving warning messages on your mobile phone?

	Notification is definitely useful	Notification may be useful	Notification is not useful
Immediate danger - immediate action required			
Expected / foreseeable danger - action should be taken within 1 hour			
In the future - action must be taken in the near future			
Unknown hazard time – the urgency of the needed action is unknown			

11. What should be the level of threat in order to receive a warning message on a mobile phone?

	Notification is definitely useful	Notification may be useful	Notification is not useful
Extreme - there is an extreme danger to life or property			
Significant - There is a significant risk to life or property			

	Notification is definitely useful	Notification may be useful	Notification is not useful
Moderate - Possible risk to life or property			
Low - minimal risk to life or property			
Unknown - the degree of possible level of danger is unknown			

12. **Would you like to receive notifications on the end of the threat situation on your mobile phone?**
    - Yes
    - No
    - Maybe
13. **From which authorities would you expect warning messages on your mobile phone? (choose all that apply)**
    - State Fire and Rescue Service
    - Municipalities
    - Any public administration's organization
    - Cabinet of Ministers
    - Other answer:
14. **What is your opinion on receiving warning messages on your mobile phone?**
    - I would like to receive warning messages regarding threats as well as informative notifications
    - I would only like to receive warning messages about threats
    - Probably I may want to receive warning messages, but I need more information about these notifications
    - I don't want to receive warning messages
    - Other answer:

The following questions relate to the demographic situation of respondents

1. **Your gender?**
   - Male
   - Female
2. **Your age?**
   - Up to 18

- 18-24
- 25-34
- 35-44
- 45-54
- 55-63
- 64-75
- Over 75

3. Your place of residence?

- City, Town, village
- Farmstead

4. Is the Latvian your native language?

- Yes
- No, but I know it well
- No, I know it poorly
- No, I don't understand it

5. Do you have any comments or suggestions regarding this public warning initiative?

2. ANNEX - INTERVIEWS CARRIED OUT

Date	Subject	Members
02-07-20	Kickoff meeting of the "ABS + Assessment and Development of Technical Specification" project	Information Centre of the Ministry of Interior, State Fire and Rescue Service, Corporate Consulting
06-07-20	Discuss the vision and requirements of the Ministry of Interior for the implementation of ABS +	Ministry of Interior, State Fire and Rescue Service, Corporate Consulting
16-07-20	Meeting with the Department of Industry Policy and ICT department of the Ministry of Interior.	Ministry of Interior, State Fire and Rescue Service, Corporate Consulting
21-07-20	Meeting with BITE to discuss the feasibility of CB and LB-SMS solutions.	BITE, State Fire and Rescue Service, Corporate Consulting
22-07-20	Regular project meeting.	State Fire and Rescue Service, Corporate Consulting
30-07-20	Regular project meeting	State Fire and Rescue Service, Corporate Consulting
03-08-20	Meeting with LMT to discuss the feasibility of CB and LB-SMS solutions.	LMT, Ministry of Interior Information Centre, State Fire and Rescue Service, Corporate Consulting
06-08-20	Present to the representatives of the Ministry of Transport the ABS + project and discuss potentially necessary legislative changes in relation to ABS +	Ministry of Transport, Information Centre of the Ministry of the Interior, State Fire and Rescue Service, Corporate Consulting
10-08-20	Meeting with the National Security Service to discuss the National Security Service's vision for ABS + security requirements and usage capabilities.	National Security Service, State Fire and Rescue Service, Corporate Consulting

Date	Subject	Members
11-08-20	Meeting with the PUC to discuss potentially necessary legislative amendments related to the implementation of ABS +	PUC, State Fire and Rescue Service, Corporate Consulting
14-08-20	Meeting with the State Fire and Rescue Service Operational Management Board on the activation of the State Early Warning System in relation to the ABS + project	State Fire and Rescue Service, Corporate Consulting
18-08-20	Meeting with Ministry of Defence and National Armed Forces regarding the National Early Warning System	Ministry of Defence, Information Centre of the Ministry of the Interior, Joint Headquarters of the National Armed Forces, State Fire and Rescue Service, Corporate Consulting
28-08-20	Regular project meeting	State Fire and Rescue Service, Corporate Consulting
04-09-20	Introduction the LB-SMS and CB solutions provided by Everbridge and the foreign experience that uses the solutions of this manufacturer.	Everbridge, State Fire and Rescue Service, Corporate Consulting
08-09-20	ABS + coordination Group meeting on the regarding first document	State Fire and Rescue Service, Corporate Consulting
09-09-20	Introduction regarding solutions provided by Intersec for LB-SMS and CB and the foreign experience that uses the solutions of this manufacturer.	Intersec, State Fire and Rescue Service, Corporate Consulting
16-09-20	Meeting with representatives of the Fire and Rescue Services of the Lithuanian Ministry of Interior to discuss Lithuania's experience in	The Fire and Rescue Department of the Lithuanian Ministry of Interior, State Fire and Rescue Service, Corporate Consulting

Date	Subject	Members
	using a cell broadcasting solution for warning the public.	
17-09-20	Introduction to the solution provided by NT Service.	NT Service, State Fire and Rescue Service, Corporate Consulting
18-09-20	Meeting with representatives of the Ministry of Justice and Security of the Nederlands to discuss the experience of the introduction of the Dutch public warning system in the use of a cell broadcasting solution for public warning.	Ministry of Justice and Security (The Netherlands), State Fire and Rescue Service, Corporate Consulting
21-09-20	Regular project meeting	State Fire and Rescue Service, Corporate Consulting
21-09-20	Get acquainted with the mobile app solution KATWARN and the foreign experience that uses this solution.	TURM Solutions, State Fire and Rescue Service, Corporate Consulting
22-09-20	A more detailed presentation of the solutions offered by Everbridge.	Everbridge, State Fire and Rescue Service, Corporate Consulting
23-09-20	Meeting with the Sector Policy Department of the Ministry of the Interior, the ICT Department of the Legal Department and the Information Center of the Ministry of the Interior on the comparison and evaluation of the project ABS + solutions.	Ministry of Interior, State Fire and Rescue Service, Corporate Consulting
28-09-20	Meeting with TELE2 to discuss the CB and LB-SMS solutions.	TELE2, Information Centre of the Ministry of Interior, State Fire and Rescue Service, Corporate Consulting
01-10-20	Question and answer session for the CB solution provided by everbidge.	Everbridge, State Fire and Rescue Service, Corporate Consulting

Date	Subject	Members
05-10-20	Meeting with representatives of the Ministry of Interior to discuss the potential technical architecture and procurement principles of the ABS + solution.	Ministry of Interior, State Fire and Rescue Service, Corporate Consulting
12-10-20	Regular project meeting.	State Fire and Rescue Service, Corporate Consulting
14-10-20	Presentation of the CB solution by everbidge to the Ministry of Interior.	Everbridge, Ministry of Interior, State Fire and Rescue Service, Corporate Consulting

3. ANNEX - SOURCES OF INFORMATION USED

Document Date	Name	Available
05.05.2016.	Civil Protection and Disaster Management Law	https://likumi.lv/ta/en/en/id/282333
28.10.2004.	Electronic Communications Law	https://likumi.lv/ta/en/en/id/96611
02.05.2002.	Law On State Information Systems	https://likumi.lv/ta/en/en/id/62324
28.10.2010.	Law on the Security of Information Technologies	https://likumi.lv/ta/en/en/id/220962
07.03.2013.	Law On Emergency Situation and State of Exception	https://likumi.lv/ta/en/en/id/255713
20.12.2018.	General Authorisation Regulations in the Field of Electronic Communications	https://likumi.lv/ta/en/en/id/303972
28.07.2015.	Cabinet Regulation No. 442, "Procedures for the Ensuring Conformity of Information and Communication Technologies Systems to Minimum Security Requirements"	https://likumi.lv/ta/en/en/id/275671
11.10.2005.	Cabinet Regulation No. 764, "General Technical Requirements of State Information Systems"	https://likumi.lv/ta/en/en/id/118986
08.08.2017.	Cabinet Regulation No. 440 "Procedures for Establishing, Operating and Financing the National Early Warning System"	https://likumi.lv/ta/en/en/id/292740
11.12.2018.	Directive (EU) 2018/1972 of the European Parliament and of the Council of 11 December 2018 establishing the European Electronic Communications Code	https://eur-lex.europa.eu/legal-content/LV/TXT/HTML/? uri = CELEX: 32018L1972 & from = EN
27.04.2016.	Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of	https://eur-lex.europa.eu/legal-content/LV/TXT/HTML/? uri = CELEX: 32016R0679 & from = EN

Document Date	Name	Available
	personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation)	
12.07.2002.	Directive 2002/58/EC of the European Parliament and of the Council of 12 July 2002 concerning the processing of personal data and the protection of privacy in the electronic communications sector (Directive on privacy and electronic communications)	https://eur-lex.europa.eu/legal-content/LV/TXT/HTML/? uri = CELEX: 32002L0058 & from = EN
09.07.2020.	Information report on the CB system and other possible notification systems, their implementation and maintenance costs	http://tap.mk.gov.lv/lv/mk/tap/?pid=40489470
05.12.2019.	BEREC Guidelines on how to assess the effectiveness of public warning systems transmitted by different means	https://berec.europa.eu/eng/document_register/subject_matter/berec/regulatory_best_practices/guidelines/9286-berec-guidelines-on-how-to-assess-the-effectiveness-of-public-warning-systems-transmitted-by-different-means
17.01.2019.	Five approaches to build functional early warning systems	https://www.eurasia.undp.org/content/rbec/en/home/library/environment_energy/five-approaches-to-build-functional-early-warning-systems.html