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POLICY OF RAISING THE CAPACITY OF LOCAL SELF-GOVERNMENTS FOR MANAGEMENT OF EMERGENCIES

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Abstract: *Local self-governments (LSGs) cannot effectively manage emergencies. To overcome this problem, it is necessary to find action policies that would facilitate the increase of capacities of LSGs in such situations. The starting point for defining the policy was collecting data on the current abilities and capacities of LSGs in AP Vojvodina. The research covered 40% of the total number of LSGs and more than 64% of the population in the AP of Vojvodina. A combined open-ended survey questionnaire was constructed for data collection. The data was collected in field conditions through online procedures, direct sending of written surveys, and direct discussion of project implementation leaders. The statistical analysis of data identified that the legal aspect of LSGs and emergencies was not harmonized with other institutional documents at the level of LSGs. Most LSGs had serious difficulties in managing emergencies, especially civil protection. The platform is envisaged to facilitate raising the prevention capacity of LSGs by integrating all relevant information to provide early warnings and indications for implementing corresponding organizational, technical, and economic measures to deal with emergencies.*

Keywords: *Law; Security; Emergencies; Prevention Capacity; Serbia; Knowledge Management; Business Intelligence Systems*

INTRODUCTION

Local self-governments (LSG) represent an important element in the functioning of the state in crises and emergencies. They ensure the implementation of all decisions and create existential conditions for the population. In times of emergency when the coronavirus threatens the life of the nation, several segments are in a position to be threatened, such as public health, functional democracy, the rule of law, the protection of basic human rights and freedoms, as well as the possibility of introducing regimes that not only disturb the balance between branches of government but can also cause irreversible damage (Stefanovska 2021, 53). In such a situation at the LSG level, finding action policies to manage emergencies is important. It is necessary to implement different policies to enable the functioning of economic activities (Karović, Domazet, Ješić 2022, 22).

Raising the capacity of LSGs through effective emergency management policies in practice requires different capabilities of LSGs. In this sense, the various capacities of LSGs necessary for successful action in emergencies are analyzed and explained. Emphasis is placed on the current state of the LSG, its readiness in the organization's context, and the effectiveness of actions for various emergencies.

The paper proposes policies and specific solutions to increase the capacity of LSG for successful response in the prevention and management of emergencies. The proposed solutions were based on analyzed characteristic cases in the Autonomous Province (AP) of Vojvodina in the Republic of Serbia. The policy envisages a platform that would integrate all relevant information for LSGs, facilitate the building of the prevention capacity of each LSG and correlate all information to issue recommendations and early warnings in case of emergencies.

METHODOLOGY

The research was conducted in the autonomous province (AP) of Vojvodina (Republic of Serbia) at the level of LSGs. The AP of Vojvodina is an autonomous province of the citizens who live in it within the Republic of Serbia. It covers an area of 21,506 km^2 with 1,931,809 inhabitants (census 2011, 21.56% of the total population of Serbia). On the territory of Vojvodina, there are 45 municipalities and cities, as units of local self-government, distributed in seven districts, with headquarters in the cities of Subotica, Zrenjanin, Kikinda, Pančevo, Sombor, Novi Sad, and Sremska Mitrovica. The province borders Hungary to the north, Romania to the east, Croatia to the west, and Bosnia and Herzegovina (Republika Srpska) to the southwest. The southern border is largely formed by the rivers Danube and Sava. The largest city in the province is Novi Sad, which is also the administrative center of Vojvodina. Other larger cities (over 50,000 inhabitants) are Subotica, Zrenjanin, and Pancevo (AP of Vojvodina, official web page). It covers 40% of the total number of LSGs and more than 64% of the population in the AP of Vojvodina. A combined open-ended survey questionnaire was constructed for data collection. The data included the current situation at the level of LSGs, key activities carried out by LSGs regarding the prevention of emergencies, the equipment of LSGs with modern IT tools, training and staffing of personnel dealing with protection and rescue operations in emergencies, the quality of protection and rescue plans in emergencies and the existence of procedures for acting in different conditions of emergencies.

The data was collected in field conditions through online procedures, direct sending of written surveys, and direct discussion of project implementation leaders. It is important to emphasize that respondents were agile and responsible in providing data. They understood and supported the importance of such an important problem and showed interest in solving such complex and serious issues.

Data processing in the context of solving problems and raising the capacity of LSGs combined with the need to look at the current capacity of LSGs and the basic problems in the functioning of LSGs to manage emergencies. The data also looked at the basic elements and shortcomings of LSGs in the sphere of continuous action, development, and improvement of local LSGs' capacity building in managing emergencies. The analysis was comprehensive, and based on that, by cross-referencing different data, the current state of LSGs was derived regarding the ability to act in emergencies.

Many suggestions were made in light of the current state of affairs and operational issues to increase local management's capacity for effective response to emergencies. Concrete measures are aimed at organizational elements, IT support, risk assessment, responding to risks, preventive forms, and establishing clear emergency action procedures.

Data collection in the manner mentioned above was only possible because, in the current situation of the Covid-19 pandemic crisis, no other form was available. Nevertheless, it should be emphasized that the constructed survey questionnaire of the combined type provided the necessary data to create a picture of the situation in LSGs in the area of the AP of Vojvodina. Responses were received from emergency management officials and are considered fully relevant.

RESULTS

Data collected through a survey questionnaire are organized and presented in four units providing an insight into:

1. Existing capacities of LSGs for the prevention of emergencies.
2. Key activities of LSGs regarding the prevention of emergencies.
3. Content (forms) of emergency prevention and degree of risk management in LSGs.
4. Plans for building the capacity for the prevention of emergencies in LSGs.

Results are presented to indicate the level of prevention readiness of each LSG and present the spread of prevention capacities in Vojvodina regions.

Existing Capacities of LSGs for Prevention of Emergencies

Existing capacities of LSGs at the level of Vojvodina province are estimated through the evaluation of the requirements set, as summarized in Table 1. Most LSGs meet most of the requirements, and the weakest point is the use of IT and data in prevention activities. Only half of the LSGs keep the database on emergencies and related damages and plan to use IT and data in prevention.

All LSGs in Vojvodina analyzed their current situation at the local level and identified types of emergencies that would affect the area of their LSG. Realistic assessments of the scale of certain emergencies were performed in most LSGs (94%). Even 89% of LSGs reported having qualified personnel for emergency planning, organized work, and specified detailed activities in case of emergencies.

Table 1: Capacities of LSGs (Source: Authors' research)

Capacities of local self-governments (LSGs)	Percentage of LSGs (%)
Analysed current situation at the level of LSG regarding the possibility of emergency situations:	100.00%
Identified types of emergency situations that would affect the area of LSG	100.00%
Carried out realistic assessments of the scale of certain emergency situations at the level of the LSG	94.44%
LSGs have qualified personnel for emergency planning	88.89%
Work is organized and detailed activities in emergency situations are specified at the level of LSG	88.89%
Planned use of information technology and data as a preventive form of emergency situations	55.56%
Existence of database on emergency situations and damage caused by emergency situations in LSG	50.00%

Key Activities of LSGs for Prevention of Emergencies

The level of management and degree of preparedness for emergencies is evaluated through assessment of the following activities: (i) risk assessment and protection/rescue plans, (ii) compliance of documents with the legal framework, and (iii) planned activities based on results obtained from the assessment of effects of emergencies.

Table 2: Risk Assessment and Protection/Rescue Plans (Source: Authors' research)

The level of risk assessment and protection and rescue plan from emergencies	Percentage of LSG (%)
Economic enterprises are involved in the activities of preventive measures of emergency situations	100%
Protection and Rescue Plan is well defined with all risks identified?	94%
Protection and Rescue Plan provides for the evacuation of the population in case of disasters	89%
Transport capacities at the LSG ensure the transfer of public office holders to temporary places in case of disasters:	83%
Sufficient attention is paid to management of emergency situations in LSG	78%
Places of relocation of public office holders are at the LSG level clearly defined in case of disasters:	78%
Effects of climate change and corresponding economic consequences are assessed at the level of LSG?	67%
Assessments have been made on telecommunication system threats in the area of LSG	56%
Data on effects of KOVID-19 have been processed at the LSG	50%

The risk assessment activities and the level of development of protection and rescue plans are summarized in Table 2, showing the high percentage of LSGs meeting most of the requirements.

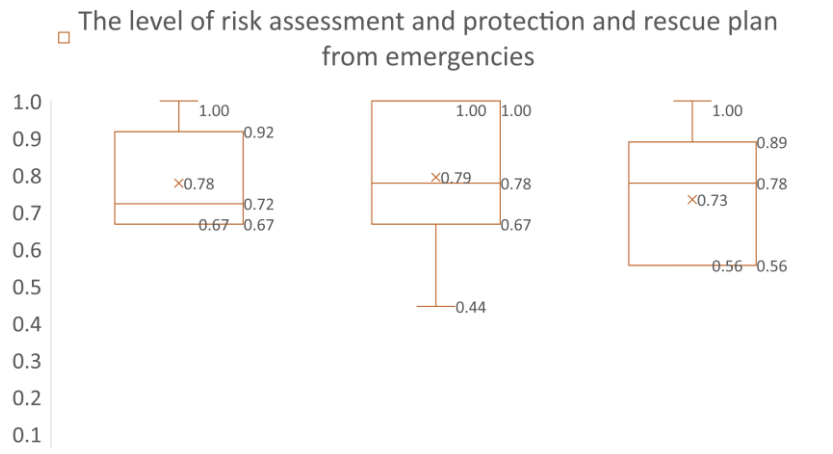

Figure 1: The Level of Risk Assessment and Development of Protection and Rescue Plans Summarised for Three Regions of Vojvodina (Source: Authors' research)

When presenting the summarized score, including all requirements as a function of LSGs within regions (Figure 1), it can be seen that half of the LSGs meet at least 72% of requirements.

However, there are still LSGs that require more engagement and work on raising the capacity in this segment. Full compliance and harmonization of the legal framework of emergencies with other institutional documents is achieved in 61% of considered LSGs.

LSGs will use the assessment of the effects of emergencies for revision and improvements of Protection and Rescue plans (72%), projection of development (32%), and allocation of financial help to the most vulnerable (22%).

Content (Forms) of Emergencies Prevention and Degree of Risk Management

Forms and content of prevention of emergencies are considered through the following categories: (1) achieved level of civil protection organization and operability and (2) defined forms of prevention and management of highest risks emergencies caused by identified realistic sources of threats for the specific LSG. Table 3 illustrates a very low civil protection and operability level in LSGs in Vojvodina province. No existing civil protection units are equipped according to defined related equipment and means.

Table 3: Level of Civil Protection Organization and Operability (Source: Authors' research)

Level of civil protection organisation and operability	Percentage of LSG (%)
There is a Plan for the use of civil protection units at the level of LSG and a clearly established command system for such units	33%
Level of civil protection is sufficiently developed at the level of LSG to be able to act effectively in emergency situations	28%
There are sufficient financial resources to finance civil protection units	22%
Civil protection units are equipped according to the defined related equipment and means	0%

Figure 3 shows an extremely low level of civil protection organization and operability in one Vojvodina region (Srem). There is a huge spread of readiness levels in the other two regions, with no LSG meeting all requirements.

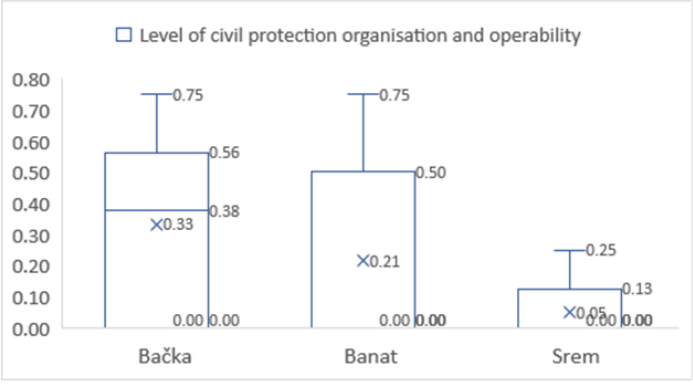

Figure 3: Level of Civil Protection Organization and Operability (Source: Authors' research)

Table 4 shows that almost all LSGs (94%) have a developed system for warning the population of a possible danger that could lead to declaring an emergency. A high percentage of LSGs (83%) have a clear vision of action in such a situation. The procedure for determining the state of consequences of emergencies exists only in 56% of LSGs. In comparison, only 39% of LSGs have clearly defined criteria for prioritizing financial assistance to vulnerable populations.

Table 4: Defined Forms of Prevention and Risk Management in Emergencies (Source: Authors' research)

Defined forms of prevention and risk management in emergencies	Percentage of LSG (%)
There is a developed system for warning the population of a possible danger that may cause the declaration of an emergency situation	94%
According to the risk assessment, there is a clear vision of action at the LSG level in such emergency situation	83%
Clearly defined procedure for determining the state of consequences of emergency situations	56%
Clearly defined criteria for the priority of financial assistance to vulnerable populations as a result of emergency situations	39%

The summarized score expressing the achieved definition of forms for prevention and risk management 0 (none) to 1 (fully met requirements) is shown in Figure 4 for three Vojvodina regions indicating a widespread achieved degree of fulfilled requirements.

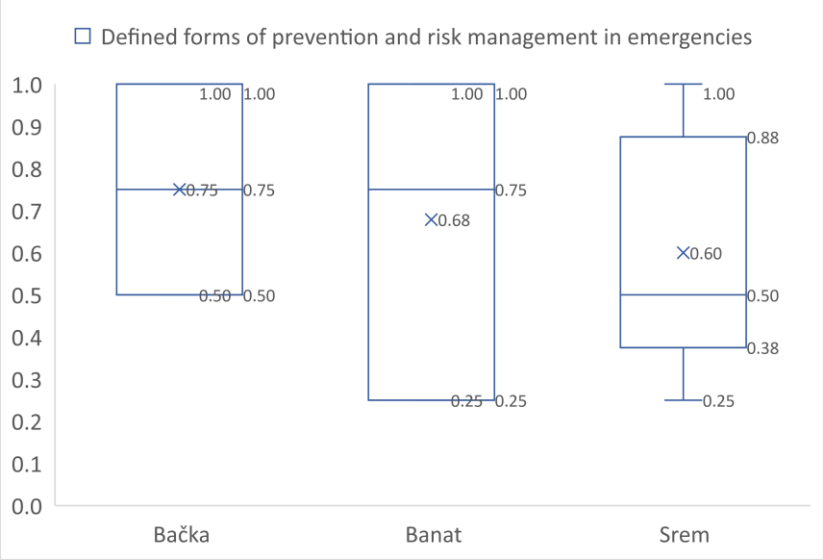

Figure 4: Defined Forms of Prevention and Management of Highest Risks Emergencies (Source: Authors' research)

Floods and extreme weather conditions are reported in most LSGs as those with major economic consequences.

Building and Strengthening Capacities for Emergencies

To build and strengthen capacities for the prevention of emergencies in LSGs, it is important to (1) understand the importance of local initiatives within LSGsfor risk reduction and emergency prevention, (2) understand requirements and necessary activities for capacity strengthening, (3) understand reasons for lacking local initiatives for strengthening capacities of LSG and (4) assess existing activities for capacity strengthening. The local community has the best understanding of regions' conditions and, thus, in any LSG. Their empowerment will enable anticipation of possible emergencies and help in the decision-making process and risk reduction.

Inquiry into the importance of local initiatives for strengthening the capacities of LSGs has shown that almost 95% of LSGs consider them important or very important. The most important initiatives include active city headquarters for risk monitoring, training, rescue exercises, equipment restoration in case of fire and floods, and connecting neighboring municipalities in emergencies. The insufficient financial resources, lack of information, and insufficient interest and proactivity of people can explain the reason for the non-existence of local initiatives in most LSGs. There is a high degree of understanding of requirements and required activities for capacity strengthening by LSGs in the region, as represented in Table 5.

Table 5: Understanding Requirements and Necessary Activities for Capacity Strengthening (Source: Authors' research)

Understanding requirements and necessary activities for capacity strengthening	Percentage of LSGs (%)
Considered necessary to organise training of all entities at the LSG level for prevention of emergency situations	94.44%
Considered important in prevention of emergency situations to have a clear vision of the concept of emergency prevention for all elected and appointed people in LSG	94.44%
Considered necessary at the level of LSG to have binding instructions for the collection and storage of data related to the effects of the actions of unfortunate events and the effects of the measures taken	88.89%
Considered necessary to have an electronic database where such data will be stored as well as to classify data types	88.89%
Considered necessary to provide continuous education of employees in LSG in the field of emergency situations, especially unpredictable ones:	88.89%
Considered necessary to have a list of tasks in the form of a checklist in the initial period of mitigating emergency situations, to monitor the work process of LSG bodies	83.33%
Considered necessary to separate data that will be specially standardized	72.22%
Considered necessary at the level of LSG to prepare instructions for dealing with emergency situations: Note: These instructions for various types of hazards have already been prepared by the Department for Security, the Association for Security, and others.	61.11%

The system for effective monitoring of the status of implementing preventive measures to reduce the consequences of emergencies in LSGs already exists in more than 50% of LSGs.

The importance of human (creativity, education, civil participation, science, culture), institutional (local regulations, good governance, local public policies), and technological factors (big data, open data, networking, digitalization) for strengthening the capacity of LSGs in the prevention of emergencies were also assessed by LSGs.

Results are in Figure 4 (0 - no importance to 10 - maximal level of importance). All factors are considered important, with the average mark between 7.5 and 8.5 giving a slight advantage to human and institutional factors.

DISCUSSION

The data collected in this research gave us a good understanding of the current prevention capacities of LSGs in AP Vojvodina. They indicated big variations in the level of prevention readiness among them in some categories.

There is a need to consider a series of measures that could help meet identified requirements and build and raise the preventive security capacities of all LSGs. Thus, the whole region minimizes potential risks for undesired events. Considered measures for raising the security capacity of LSGs are organized into three categories: (1) organizational measures, (2) technical measures/solutions, and (3) economic measures/aspects. Their implementation requires a systematic approach and IT support to manage emergencies (Figure 5).

Allocation of financial resources for raising the capacity of LSGs following the assessed situation and priorities comes after a confirmed analysis of the situation and with the necessary IT support (security, privacy, integrity, trust) in the form of equipment and process integration, determination of the necessary organizational measures (people roles, plans, policies, risk assessments, information spreading, communication, motivation) and technical solutions (technology infrastructure, resources, equipment, supplies, devices) in order to optimize the budget for emergency management. Every stage in an IT-supported system for security capacity building must be supported with legal measures.

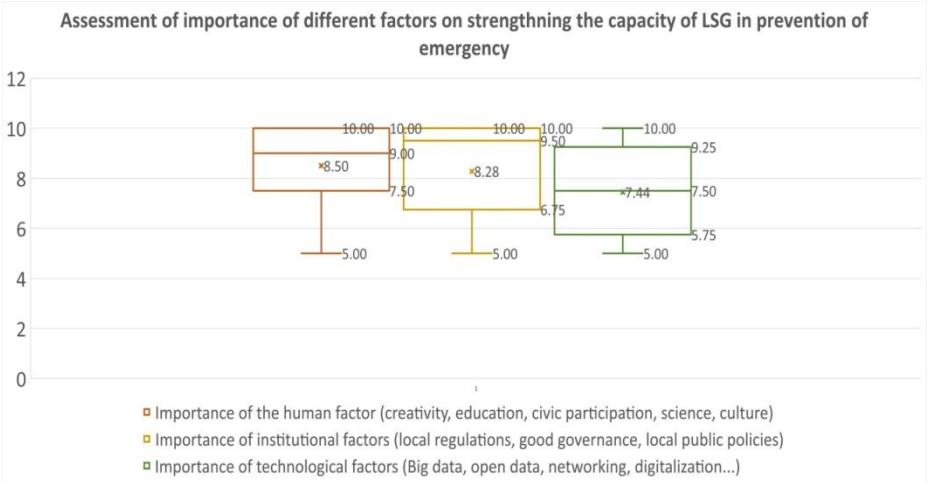

Figure 4: Assessment of Importance of Different Factors on Strengthening the Capacity of LSG In Prevention of Emergencies (Source: Authors' research)

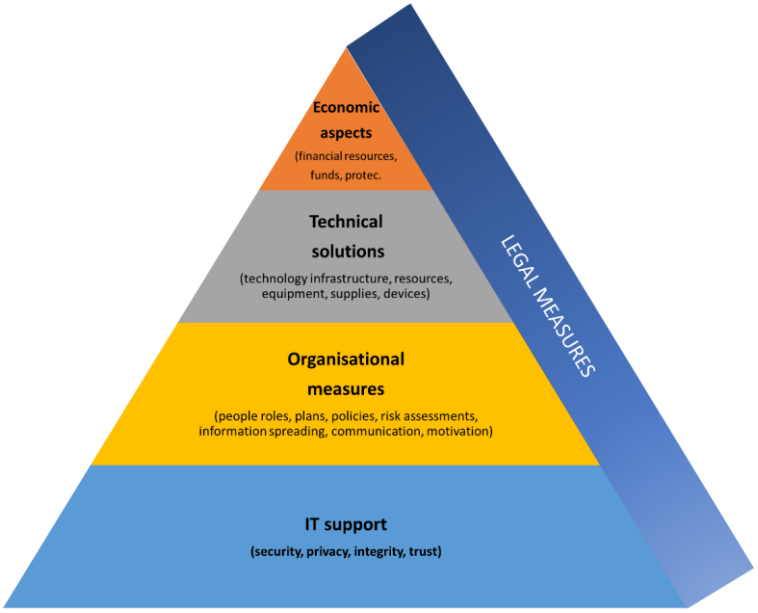

Figure 5: Structure of IT-Supported System for Security Capacity Building (Source: Authors' research)

The Platform for Capacity Raising and Management

Efficient application of measures requires a platform that connects and integrates technology, people, stakeholders, and procedures into an operable and efficient system to facilitate operability inside and among different LSGs, provide good communication with higher instances and set the basis for capacity raising in emergencies.

The top-level component diagram of the proposed platform for capacity raising and management in emergencies is illustrated in Figure 6.

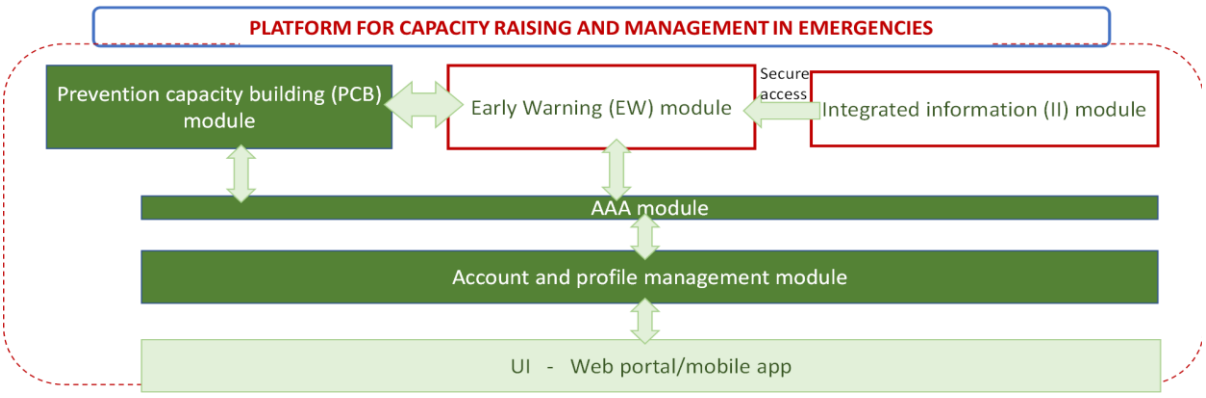

Figure 6: Platform for Capacity Raising in Emergencies - Basic Components (Source: Authors' research)

It encompasses three building modules, namely (1) Prevention Capacity Building (PCB) module, (2) Early Warning (EW) module, and (3) Integrated Information (II) module. These modules are considered necessary for capacity raising and management, i.e., monitoring, evaluating prevention capacity, risk assessment, geo-spatial information visualization, and timely coordination and the reaction of local authorities in response to emergencies. Such a platform must integrate heterogeneous data and ensure interoperability among services and technologies (Pereira et al. 2022) to support prevention and mitigation activities.

Information Integration (II) Module

The role of the II module is to collect and integrate all information relevant to the LSG from all available resources, which can include open city data, IoT and smart objects' data, existing smart management systems' data, citizens' reports, etc., providing information on weather conditions, pollution, water levels, traffic, transport, energy consumption, other incidents and providing in such a way an overall picture of LSG operation and possibly facilitating it.

Early Warning (EW) Module

The early warning module should actively monitor the real-time operation of LSG provided by the II model and correlate data with specific vulnerabilities identified within the PCB module, perform risk assessment, and accordingly issue early warnings for any risks and problems that can lead to emergencies. This module requires access to all the data and knowledge stored within the PCB module, including geo-spatial data, so all the relevant early warning information can be geo-spatially visualized.

The EW and II modules and their functions and interactions have already been described by Pereira et al. (2022) as essential parts of a potential smart city platform. In interaction with the PCB module, these two modules should ensure predictive and preventive information-based management and decision-making based on using artificial intelligence in big data analysis, detecting any correlations, patterns, or discrepancies that can help predict and conduct preventive measures of affected LSGs. This paper focuses on the PCB and the account and profile management (APM) modules.

Prevention Capacity Building (PCB) Module

PCB module should provide monitoring, assessment, and scoring of each LSG in terms of their organizational (OCS), technical (TCS), and economic capacity (ECS) for the prevention of emergencies. These scores are planned to take the values from 0-1 and to contribute equally to the total prevention capacity (TPC) score for each LSG (Figure 7), indicating the total level of LSG readiness also represented in a range from 0-1. PCB module should monitor the implementation of each measure, facilitate the effective estimation of preventive capacities of each LSG, and support capacity strengthening in the domain of prevention, planning, testing, estimation, and

maintenance to avoid or mitigate the consequences of emergencies. It should provide reminders through feedback mechanisms on any tasks/activities pending within the LSG.

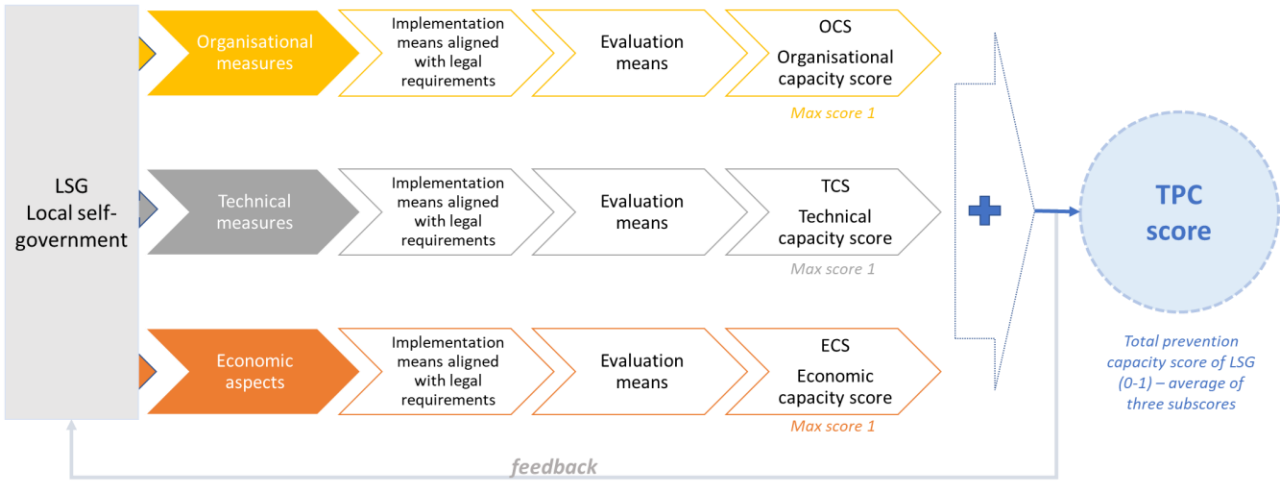

Figure 7: Prevention Capacity Building Module Components for Assessment of Organizational, Technical, and Economic Capacities and the Total Capacity Score (TPC) of LSGs (Source: Authors' research)

TPC score for each LSG can be presented through several levels of readiness such as: (1) highly resilient (0.8-1), (2) above average resilient (0.6-0.79) with room for improvement in a specific area, (3) average resilience (0.4-0.59) facing a higher level of stress and emphasizing the need to take actions in more than one area and (4) non-resilient (below 0.39) requiring immediate action to reduce the impact of potential hazards.

Organizational measures in prevention activities of LSGs in case the risk of emergency increases include a series of actions that would be coordinated by the local authority as described in (Karovic, Rankov, Domazet, Ješić 2021) and summarized in Table 6.

Technical measures for preventing emergencies and raising security capacities will result from risk analysis and maps, identifying critical parameters and selecting required systems and equipment to provide physical support, developing emergency response plans, etc. The plan is required for the economic/financial support in prevention, mitigation, and response activities, including required roles, responsibilities, and action steps (Table 6).

Table 6: Organizational, Technical, and Economic Measures to Increase Security Capacity (Source: Authors' research)

Organizational Measures to Increase Security Capacity	(1) dissemination of early warning notifications to all affected, (2) dissemination of risk maps including risky and vulnerable areas to all relevant stakeholders,(3) plans for protection and rescue evacuation, (4) risk assessment, (5) risk and vulnerability reduction through provision of specific recommendation to crucial public utility providers (6) preparation of resources, means and supplies, (7) human resources (clearly defined team structure, roles, and responsibilities, team for incident and process estimation, action plan and team for guiding and documenting) (8) education and training of personnel/human resources (can also be part of the non-emergency activity), (9) education and training of volunteers based on specific required skills, (10) informing citizens and visitors on any risks, (11) communication through available communication means.
Technical Measures to Increase Security Capacity	(1) real-time monitoring of critical parameters, (2) databases populated with both historical and current data, (3) maps with access to critical infrastructures, (4) maps of risks, previous hazards, and related consequences, (5) access to demographic data, etc. Technologies that can be used in preventing and mitigating disasters include: IoT, GIS, GPS, SATNAV, SATCOM, radio, TV, internet, mail, drones, robots, etc. Communication channels should enable different communications modes such as one to many, notifications based on geofencing etc.
Economic Aspects of Security Capacity Building	(1) involvement of economic enterprises, (2) assessment of economic consequences due to climate change, (3) financial resources for different purposes, (4) identifying priorities of financial assistance to vulnerable, (5) deriving economic policy measures to remedy consequences of emergencies. All stakeholders depend on services provided by public utility providers, and it is important to minimize any interruption and restore all vital services and functions asap.

User Interface and Account and Profile Management

The account and profile management module requires user registration and assignment of the profile/role. The platform would require secure registration for all groups of users through web and/or mobile applications. Users/stakeholders include platform administrators, government, public authorities, critical infrastructures command centers, emergency (first) responders, mobile network operators, citizens, visitors, etc. Engagement of the private sector in preventive activities is very important. The way to succeed is to provide them with integrated real-time information on security status at the local level.

The platform should include role-based access control, ensuring users can access the data defined by their role.

IT support in building prevention capacities and crisis management is inevitable. It offers numerous benefits but requires strong security and privacy measures in the system following GDPR imposing privacy and security by design concept and ensuring end-to-end security and trust in shared information (Bohli, Skarmeta, Moreno, García 2015). Implementation of incentive and reputation schemes can motivate the engagement of LSGs and any active stakeholder in activities leading to prevention capacity building and strengthening the resilience of the LSG.

Data Storage and Management

The platform must keep the acquired knowledge on emergencies to facilitate capacity raising and management. This refers to expert knowledge and models for the management of various hazards.

Historical data and information on previous hazards (from far and recent past events), damage caused, and lessons learned must be stored in the historical database. Current data stored in an operational system can come from various sources (Karovic, Rankov, Domazet, and

Ješić 2021) and in various formats, containing different content and context. It is recommendable to perform several data management operations (Stoyanovich et al. 2022).

Data classification can be based on content and context, putting the data into categories to be easily accessed, sorted, or stored. It facilitates access control and grouping of similar content. It supports confidentiality protecting sensitive data and the privacy of users as well as integrity, compliance, and availability.

Data separation uncouples data from its source and ensures the protection of the identities of individuals and organizations when integrating datasets.

Data standardization provides transforming and keeping data in a common format to facilitate data management and usability, improve analytics and data reliability, facilitate collaboration, and ensure consistency among different systems.

CONCLUSION

Capacity raising and management in emergencies represents both a decision-making process and a derivation of various preventive solutions to reduce the risk of possible consequences of endangering the safety of the population, organizations, and society as a whole. Its implementation is also conditioned by different types of qualitative areas related to a specific type of emergency, primarily because each emergency is multidisciplinary. Capacity raising and management in emergencies include a large number of people, an organization, and an organizational form of effective action with efficient and effective use of means and methods needed to resolve the emergency, as well as the introduction of various measures for effective functioning in such conditions.

The paper identifies that the legal aspect of LSGs and emergencies is not harmonized with other institutional documents at the level of LSGs. This refers to adopting protection and rescue plans for different types of emergencies, the organizational structure of action in an emergency, and types of risks.

In most LSGs, there are serious difficulties in managing emergencies, especially when it comes to civil protection. It was established that many LSGs do not have a plan for using civil protection units, nor is there an organized command system for those units. This directly affects emergency management and its implementation as a practice in raising the capacity of LSGs to manage emergencies effectively.

The proposal of measures (legal, organizational, technical, and economic) for implementing preventive security measures in LSGs introduced in this paper implies that future research will be directed onto the field of measuring and assigning the prevention capacity scores to LSGs related to the level of implementation of proposed measures. That will enable estimation of the level of resilience of each LSG in case of emergency. That is seen as a part of the envisaged capacity-raising and management platform that will provide early warnings to all LSGs and relevant stakeholders that can be affected by the emergency. This will be realized by implementing responsible data management to meet privacy and security regulations.

COMPLIANCE WITH ETHICAL STANDARDS

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This article does not contain any studies with animals performed by any authors.

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