A Predictive Model of Community Disaster Resilience based on Social Identity Influences

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Article

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Abstract: The territory of Serbia is vulnerable to various types of natural and man-made disasters. The risk is not equal across the entire territory, depending on the type of hazard and the expected potential for damage. So far, the level of community disaster resilience has not been determined in Serbia. There are no scientific preconditions for its improvement to reduce the future material and intangible consequences of disasters. Regarding that, the project's main objective is to develop and validate a predictive model of community disaster resilience based on social identity influences through an investigation impact of social identity indicators on the level of community disaster resilience in Serbia. The project is based on the upcoming research on whether the level of community disaster resilience can be predicted based on social identity indicators, how social identity indicators affect different dimensions of community disaster resilience, and how disasters shape social identity. The project is based on multimethod research in which quantitative (face-to-face interviews in 40 of the 191 municipalities), and qualitative (semi-structured interviews) research methodology will be applied. A developed predictive model with an index of community disaster resilience in Serbia will empower the creation of preconditions for designing public policies, strategies and procedures for improving resilience and reducing the consequences of disasters on people and their property and enhancing citizens' security. The project will encourage the prediction of community disaster resilience based on social identity indicators, improving disaster foresight and preparing to limit disaster losses. Based on the development of analytical frameworks for understanding community disaster resilience and social identity in disasters, essential preconditions for designing innovative information systems will be created to enable local communities to increase their level of resilience.

Keywords: disaster; community resilience; social identity; predictive model; factors

1. Introduction

The disaster risk increase, and on an annual basis, they happen daily, accompanied by the increasing vulnerability of people and their property, directly imposing the necessity and need for a responsible society in Serbia (RS) to improve its resilience. Serbia is sensitive to various types of disasters (floods, earthquakes, epidemics, forest fires, droughts, landslides, terrorist attacks, nuclear disasters, etc.), and the risk is not the same throughout the territory. Still, it varies depending on the type of disaster and expected damage potential. The current state of disaster protection in RS is characterised by incompleteness and unavailability of information on the risks of possible disasters and the consequences they may cause, with insufficient "public participation". The inadequate capacity of local authorities, professional services and consultants to improve society's resilience to disasters is highlighted.

Community disaster resilience (CDR) has become an important social goal that attracts the attention of scientists and decision-makers in various sectors and scientific disciplines. The analysis of the literature on CDR and social identity (SI) has identified a number of shortcomings that need to be addressed, which indicate significant importance of the projected research: insufficiently examined the impact of SI on building CDR; there is no consensus on the content and scope of the concept of resilience, on the unique dimensions and indicators of CDR and SI; there are no clearly

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defined measures and scales of CDR and SI; development of tools to measure CDR are at the emerging stage insufficiently developed, undeveloped generic framework of CDR that could be applied to different social communities; insufficiently developed procedures for designing and validating tools for measuring CDR; insufficiently examined influences systematized indicators of SI on building CDR; some CDR frameworks have been developed specific to a particular disaster and some other for a specific geographical area; insufficiently developed strategies, recommendations and programs for improving the level of CDR; insufficiently developed and elaborated predictive models of the impact of different variables on the further development of CDR; insufficiently investigated influences of SI (cognitive, evolutionary and emotional dimensions) on strengthening or weakening CDR; the lack of a methodology to engage and empower resilience in society; the complexity of reaching consensus on the unique characteristics of resilient communities among researchers and policy makers; lack of interest of researchers in examining the potential of SI to contribute to CDR due to lack of available data at the local level; the existence of different disciplinary and methodological frameworks for analysing CDR without their deeper analytical connection; tool development and monitoring of CDR progress are critical components requiring extensive research to better understand and apply in practice.

The application of the concept of CDR in the domestic demographic, socio-cultural and psychological context is an exciting and fruitful field for discussion and potential reformulation of the concept of resilience. The development of the predictive model will enable further development of analytical frameworks of CDR and SI and improve human security, reducing the future direct and indirect damage from disasters. Public policy and recommendations will be created based on the developed model to improve CDR and compare it with other developed countries. A developed predictive model with an index of CDR in RS will create preconditions for designing public policies, strategies and procedures for improving resilience or reducing the consequences of disasters on people and their property. So far, the level of CDR has not been entirely determined in RS and other Balkan countries. Also, there are no scientific preconditions for its improvement, intending to reduce disasters' future material and intangible consequences.

As mentioned, the project will enable: the development of public policies, strategies, programs and campaigns to improve CDR in the context of different SI; the theoretical and empirical fund of knowledge in disaster studies, CDR and SI will be enhanced; development of analytical frameworks for understanding CDR and SI in disasters; creating preconditions for designing information systems to support local communities to improve the level of CDR; integration of the literature and reflect on the current state of CDR measurement; development of a CDR model that can be applied in other countries, by simply adapting to a specific social environment. Furthermore, relevant strategic prospects of MODERSI are: enabling the creation of preconditions for further and deeper development of theoretical and analytical frameworks of CDR and SI in the conditions of disasters; allowing the comparison of the established index of CDR in RS with other countries; the created treasury of data CDR based on SI will be relevant for further sociological research about resilience and identity; enabling the design of information systems that will allow local governments to create and implement programs, strategies and campaigns to improve CDR; enables the improvement of the safety of citizens, reduction of future consequences of disasters, decrease in financial costs; this model will be able to be applied in other countries in the region, with adapting to their specific socio-economic, political and cultural environments.

1.1. Literary review

The term resilience was used for the first time in 1973 to describe the stability of a system and its various abilities to absorb changes and disturbances. Resilience theory encompasses modern understandings of stressful situations, adaptation and resource dynamics [1]. One of the essential characteristics of the concept of resistance is its multidimensionality, which ranges from jumping and rebirth, human resourcefulness and endurance to elasticity ad resistance as properties of materials such as steel. The English word "resilience" comes from the Latin verb "resilire", which means jump, backwards or recovering [2]. The word resilience is a metaphor and originates from the physical and

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mathematical sciences. It was first used to describe the ability of a material or system to return to equilibrium after specific physical influences [3]. According to the 2009 ISDR, resilience is the ability of a system, community or society exposed to hazards to resist, absorb, respond to and recover from hazards in a timely and effective manner, including conservation and restoration of its essential basic structures and functions [4].

Although more than 30 years have passed since the concept of resilience has been actively re-examined in practice, due to different resilience has different meanings and dimensions in disaster studies due to different epistemological bases and methodological approaches seen through a multidisciplinary framework that takes into account the degree of normativity and the level of complexity: a) capacity for recovery and recovery; b) the ability to maintain the desired condition; c) capacity to withstand pressures; d) ability to adapt and progress [5]. Perspectives of resilience can be summarised in three main directions taking into account their characteristics: a) resilience as stability (depreciation capacity); b) resilience as recovery (bounce back); c) resilience as transformation (creativity) [6]. It is possible to distinguish three levels of social resilience: a) resilience to resistance to change, b) resilience through slight marginal change, and c) resilience through openness and adaptability [7]. Also, some authors distinguish four critical aspects of resilience: a) the latitude or capacity of the system to change before it loses its ability to recover; b) resistance to system change; c) ambiguities regarding the limits or threshold of endurance of the system; d) mutual interaction and influences of the mentioned aspects [8]. There are different DR dimensions: citizens' resilience, households and local communities, engineering and institutional resilience, and organisations.

Research efforts to better understand resilience focused on four different topics of interest [9]: resistance as a biophysical attribute; resilience as a social attribute; resilience of the socio-ecological system; attribute of a particular area. Resilience has many areas of application, dimensions, and indicators and different dimensions are used in the literature to assess the level of CDR associated with different systems (physical, human, social). Measuring CDR is no easy task, and so far, no universal and verified frameworks have been developed that could be used [10]. Although there has always been a tendency to establish and use accurate indicators to measure DR, this has been very difficult in practice. The reasons for the initial lack of CDR indicators were related to [11-14]: a) insufficient theoretical development of the concept and theory of disaster resilience; b) impossibility of operationalisation of theoretical constructs of resilience in reality; c) partially or poorly developed resilience indicators; g) lack of data based on which resilience indicators could be applied in specific cases; e) irresponsibility of different entities to establish comprehensive and accurate databases on various aspects of disasters. Nine core elements have been consistently suggested as constituting CDR: local knowledge, community networks and relationships, communication, health, governance and leadership, resources, economic investment, preparedness, and mental outlook [15]. The literature suggests that different factors are potentially relevant for CDR [16]: trust; leadership; collective efficacy; social capital; social cohesion and sense of community; community involvement; existing norms/attitudes/values; communication and information; resource dependency.

On the other side, in social psychology, the theory of social identity was proposed by Tyfel and his colleagues in early 1978 [17]. Social identity refers to how people's self-perception is based on their membership in social groups. Social identity theory deals with how social identities influence people's attitudes and behaviours about their other external groups. Belonging to a group gives self-esteem, which helps maintain social identity. Some critical processes related to crucial social identity include assimilation within the group (pressures to conform to group norms) and forms of intergroup bias (positive evaluation of one's group about an external group – favouring within a group about an external group and possible negative assessment of an outgroup)[18-22]. Drury [19] found that a sense of shared fate is the source of an emergent shared social identity among survivors of the disaster, which gives them social support to others affected. Also, that can engender further behavioural and cognitive consequences that contribute to collective self-organisation in disasters, including expected support, coordination of behaviour, and collective efficacy.

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2. The main aim and ambition

The project's main aim is to develop and validate a predictive model of CDR based on SI influences through an investigation impact of SI indicators on the CDR in RS. The project is based on the following research question, what is the level of CDR in Serbia; whether the level of CDR can be predicted based on SI indicators, how do SI indicator affects the dimensions of CDR and are there a transformation (changes) of SI in the conditions of disasters. Thus, the scientific aim is to explain the impact of selected indicators of SI on building CDR. On the other hand, the social aim of the research is to develop an index of CDR in RS, which will enable the creation of preconditions for designing public policies, strategies and procedures for improving resilience or reducing the consequences of disasters on people and their property and improvement of citizens security.

So far, the level of CDR has not been entirely determined in RS and influences on its construction have not been examined. There are no scientific preconditions for its improvement, intending to reduce disasters' future material and intangible consequences. Keeping in mind the increase of disasters in Serbia due to increasingly pronounced climate changes and insufficient research and development of society's resilience to disasters and investments in its development, it can be pointed out that the realisation of the project is significant. Regarding timeliness, it can be said that it is necessary to implement a project as soon as possible based on which to propose concrete measures to improve society's resilience to disasters, bearing in mind the assessment of future disasters that could affect our area and cause severe consequences for people and their property. Based on the project, clear ones will be developed public policies, strategies, programs and campaigns to improve CDR in the context of different social identities and create preconditions for designing information systems to support local communities to enhance the level of CDR.

Achieving the envisaged goal of the research is based on the comprehensive implementation of quantitative and qualitative research that will enable the creation of public policy and recommendations for improving the current situation in CDR. The research results help many identified shortcomings that have already been mentioned. The development of the model will enable the development of analytical frameworks of CDR based on SI, and improve human security, reducing the future direct and indirect damage from disasters. Public policy and recommendations will be created based on the developed model to strengthen CDR and compare it with other developed countries. A developed predictive model with an index of CDR in RS will create preconditions for designing public policies, strategies and procedures for improving CDR. The novelty of this project is grounded in the fact that the results obtained from the research will represent a real new treasury of data that will be of strategic and operational importance for the advancement of the scientific and practical sphere of CDR.

The project's general objective is to develop and validate the predictive model of CDR based on SI influences through an investigation impact of SI indicators on CDR in RS. The particular objectives of the Project can be summarized as follows: a) development of the analytical frameworks of CDR and SI in disasters: problem identification, characteristics and conceptualization of the concepts; b) identification of gaps in existing analytical frameworks, procedures and techniques for identification and selection of dimensions and indicators; c) development of tools (questionnaires) for assessing CDR and SI in disasters; d) pre-model exploration, statistical distributions, identification and selection of dimensions and indicators from developed adaptive CDR framework and SI framework relevant to the predictive model; e) establish the hypothesis and build the test model, matrix of possible impacts of SI indicators on CDR; f) electing the correct predictive modelling technique, determine whether parametric or nonparametric predictive modelling is the most effective; g) developed research schedule, sampling frame, sample size and selection procedures, design of the survey instruments; pretested the survey instrument and selected and training interviewers; h) implemented the quantitative and qualitative survey, field research, coded the completed questionnaires and computerised the data, developed the interview guide; i) analyzed and presented quantitative and qualitative survey results of the predictive model of CDR based on SI Influences; j) development of public policy CDR based on SI influences in RS with recommendations for improving the level of CDR.

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Despite the efforts made to improve society's preparedness in Serbia for disasters, it cannot be said that the internationally recommended level of disaster resistance has been achieved. Therefore, it is tough to achieve the optimal level of sustainable development due to the increasing devastating consequences of disasters in Serbia. Developing a predictive model of CDR based on SI will create preconditions for reducing the consequences of disasters in 35% of local communities in which the research is conducted. In addition, MODERSI will enable the improvement of Disaster Risk Assessments and Protection and Rescue Plan in 30 local communities based on the new research results. At the same time, the remaining ten will influence the development of such planning documentation. Implementing recommendations for improving resilience will reduce disasters' direct and indirect consequences by about 45%. Indirectly, the project results will affect the improvement of resilience and the remaining 60% of local communities that were not covered by the survey by organising the dissemination of recommendations for improving resilience with the support of the Standing Conference of Towns and Municipalities. The goals are achievable, considering that the leader and team members are experts in their fields, have experience in disaster research, and achieve significant cooperation with local self-government and relevant ministries. The team has the support of the RS Emergency Situations Department and their experts (verbal consent was received, and a letter of support can be provided). The goals are relevant, given the disasters that have occurred in Serbia in the past (earthquake 2010; floods 2014; Kovid-19, etc.), assumed but not met international obligations (Hyogo, Sendai, UNISDR) to improve society's resilience to disasters, and to implement further projects of the World Bank LID. The project envisages continuous monitoring of each work package (created contingency plan) to react promptly in case of certain deviations.

3. Theoretical framework and concepts

The project is based on theories of disaster resilience and social identity. Disaster resilience theory encompasses contemporary understandings of stressful situations, adaptation and resource dynamics [1]. Although resilience theory has been evolving over the previous 70-80 years, it has had a revival in the last two or three decades. Resilience theory is a broad topic of research that has been addressed throughout the previous few decades by social workers, psychologists, sociologists, educators, and many others. In essence, resilience theory addresses the traits that people and systems have that allow them to overcome adversity [22]. On the other side, the function of self-concept, related cognitive processes, and social beliefs in group processes and intergroup connections is the subject of social identity theory, an interactionist social psychology theory. On the other side, in social psychology, the theory of social identity was proposed by Tyfel and his colleagues in early 1978 [17]. Developed extensively from the start of the 1980s as a general explanation of group dynamics and the nature of the social group, it was first offered in the 1970s mainly as an account of intergroup connections [23]. Since then, sub-theories of social identity theory have emerged, focusing on social influence and group norms, leadership within and between groups, self-enhancement and uncertainty reduction motivations, deindividuation and collective behaviour, social mobilisation and protest, and marginalisation and deviance within groups, to name a few [23]. Some critical processes related to important SI include assimilation within the group (pressures to conform to group norms) and intergroup bias (positive evaluation of one's group concerning an external group – favouring within a group about an external group and possible negative evaluatioassessmenttgroup).

To develop and validate a predictive model of CDR based on the impact of SI, firstly, it will develop analytical frameworks of CDR and SI using problem identification, characteristics and conceptualisation of the mentioned concepts. That will enable the development of specific research definitions of CDR and SI. Also, that will bring about empirical observations representing this concept in the context of the actual situation. After that, it will realise identification of gaps, using PRISMA – identification, screening & eligibility, and inclusion words such as: have not been clarified, studied, reported; further research is required or needed; is not well reported; poorly understood or known, etc. It will be utilised in research papers for citation analysis, systematic reviews in the

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introductory section, and lastly, in the discussions and future research directions) in existing analytical frameworks.

Secondly, it will be realised identification and selection of dimensions (CDR – social structure; social capital; social values, social equity and diversity, social beliefs/culture/faith; SI – perception of the intergroup context; interdependency belief; depersonalisation) as well as specific indicators (gender, age, education, engagement, family structure, socioeconomic stratification, self-sufficiency, social class, disabilities, etc.). The initial literature search will be conducted in the Scopus, Web of Science and other databases of peer-reviewed papers (Title, Abstract, and Keywords published between 2002 and 2022) for a general adaptive analytical framework for CDR and SI. Based on that, tools (questionnaires) will be developed for assessing the CDR and SI. It will be identified the dimensionality of the construct; determine the format in which the questionnaire will be administered; determine the item format and development, the intended length of the questionnaire; review and revise the initial pool of items; preliminary pilot testing; validation (initial validation, content and construct validity; reliability: internal consistency).

Based on previous research, the predictive model SI influence factors on CDR will be developed based on the research hypothesis and chosen modelling techniques. Creating an adaptive CDR and SI relevant framework to the predictive model will establish the hypothesis and then build the test model, a matrix of possible impacts of SI indicators on CDR. SI predictions will be selected based on their accepted importance and empirical performance. Then, the correct predictive modelling technique will be selected to determine whether parametric or nonparametric predictive modelling is the most effective. Based on that, it will be recognised methods for assessing the validity of developed regression models, such as comparing model predictions and coefficients with theory.

After that, quantitative research on CDR will be realised based on the SI impact. It will be developed research schedule (establish a timetable for completing the survey research), sampling frame (the population will consist of all adult citizens of the RS), sample size and selection procedures, pretested the survey instrument and selected and training interviewers. Regarding sampling, communities will be chosen for their different demographic and social characteristics, being a census-based representation of the whole population of RS. In these municipalities, participants will select multi-stage randomly (first stage: using multi-hazards maps, parts of the community in the research were selected; second stage: streets or sections of streets were determined by the level of primary causal units; third stage: each research core was defined as the path with specified start and endpoints of movement; fourth stage: selection of respondents will conduct following the procedure of the next birthday for adult members), with subject to the number of respondents being proportional to its size, using a representative sampling approach.

Face-to-face interviews will conduct in 40 of the 191 municipalities in the Republic of RS. All subjects will give their informed consent for inclusion before participating in the study. Also, it will implement the quantitative survey and field research, code the completed questionnaires, computerise the data and monitor, supervise the interview process, and analyse and present quantitative survey results. It will be designing the survey instrument based on CDR and SI analytical frameworks and developing a matrix. After that, a pilot pre-test of the questionnaire will be realised, assessing critical factors such as questionnaire clarity, comprehensiveness, and acceptability. The sample size for the pretest will be approximately 50 respondents. When research is finished, it will be computerising the data: defining variable names, preparing a codebook, encrypting answers and open-ended questions; creating a structured data file; removing errors from data files; modification of variables for further analysis). After that, it will perform statistical analyses (SPSS software) to investigate relations (correlations, multiple regression, logistic regression, factor analysis) and to compare groups (non-parametric techniques, T-tests, analysis of variance). After that, descriptive statistical analysis is realised, and the mentioned correlation and predictive analyses.

After quantitative research, it will start with qualitative research on CDR based on SI influence. The interactive research design model will be determined with general research questions. It will use systematic, non-probability sampling (specific groups of people). It will develop the interview guide that will reflect a semistructured interview format with appropriate interview settings and

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practicalities of conducting interviews. It will be used as semi-structured interviews with a participant (40) focused on a small set of topics (30-60 minutes). Regarding presenting and analysing the survey (data), it will have 2 phases: phase I – the analysis of the data collected by the interview will begin by downloading the interview transcript. Data transfer to text will be done using a word processor. The conditions will be met to enter the data into the program by fulfilling the previous activities. In the next step, data will be indexed, with the help of which all data related to a specific topic will be combined and thus become suitable for coding (codes and conceptual categories generated using open coding; themes developing based on categories/codes; narratives constructing based on themes). Some popular programs will be used for qualitative analysis: Hyper Research, Atlas/Ti. Each data segment will be assigned codes that will enable adequate classification organisation of data. Transcripts of the interview will be supplemented by scanned notes that will be kept during the interview, which will refer to all observations about the non-verbal reactions of the respondents, their gestures; phase II – process induction to search for causal pathways; links assigned between codes, categories and concepts; detail description of the action and conceptual processes, essential elements and influences.

Based on the results, a public policy in the RS will be developed with recommendations for improving the CDR level based on SI influence. It is expanding the public policy, identifying the issue to be addressed by the proposed policy, formulating the policy, and identifying the specific objectives and policy options. It will be defined the goals and guide on how to improve CDR based on SI factors and critical activities for strengthening public policy and institutional arrangements for enhancing the level of CDR-based. After that, it will draft public policy with recommendations. After policy evaluation (policy content, implementation and impact evaluation) and impact assessment – systematic collection and analysis of information to make judgments about contexts, activities, and characteristics regarding CDR be presented to wider audiences.

One of the basic features of disaster research is interdisciplinarity, which conditions the use of methods of different scientific disciplines. The interdisciplinarity of conducting research conditions the application of theoretical frameworks of various scientific disciplines, such as sociology, psychology, geography, organisational theories, etc. Researchers use a variety of theoretical frameworks – theories of rational choice, vulnerability, resilience, planned behaviour, symbolic interactionism, etc. Starting from the multidisciplinarity of disaster research, researchers can use various existing theories from the mentioned scientific disciplines. The Project will use the views of various social sciences – DRM, civil protection, security, sociology, psychology or more specifically, social psychology, geography, mathematics and statistics, etc.

4. Expected impact and data usage

It's a fact that beyond the state-of-the-art, in the RS, no comprehensive scientific multimethod research has been conducted to identify the level of CDR based on SI influences. The necessity and urgency of conducting scientific research in the field of CDR have gained a leading position in many international and national frameworks: a) Hyogo Framework for Action (2005-2015): Strengthening the Resilience of Nations and Communities to Disaster; b) Sendai Disaster Risk Reduction Framework 2015-2030: two of the four priorities for states, relate to improving CDR; c) International Disaster Risk Reduction Strategy (resilience is a priority for all world society); d) UN Conference on Sustainable Development entitled "The Future We Want" was an appeal to reduce disaster risk and develop resilience to disasters; e) Sustainable Development Goals – 2030 Agenda; d) National Strategy for Disaster Protection and Rescue (2011); f) National Law on Disaster Risk Reduction. Also, the Union Civil Protection Mechanism encourages measures to promote resilience at different societal levels. The scientific importance of the projected research is reflected in the creation of assumptions for advancing theoretical and empirical knowledge in the scientific field of DRM, bearing in mind that it is a relatively young scientific discipline in RS. The novelty of this project is grounded in the fact that the results obtained from the research will represent a real treasury of data that will be of strategic and operational importance for the advancement of the scientific and practical sphere of CDR. Also,

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it is essential to point out that there were no funded national scientific projects in RS regarding devastating disasters.

Regarding society's impact and culture, the current state of disaster protection in RS is characterised by incompleteness and unavailability of information on the possible disaster risks and CDR level. The insufficient capacity of local authorities, professional services and consultants for a modern proactive approach to DRM stands out. The project research results will make it easier for decision-makers in RS to understand the shortcomings of the CDR and provide innovative opportunities to improve their functioning in conditions of increasingly frequent and severe disasters. A vital contribution of the research findings will be to create a new model of CDR that will be supported by the appropriate amount of information regarding innovative capabilities and solutions identified as necessary to raise resilience to a much higher level. Developing a model of CDR will enable a significant reduction in mortality, the number of the affected population, and reduction of damage and direct economic losses due to disasters that are increasingly common in RS. They can also reduce losses in major manufacturing sectors such as agriculture, industry, trade and mining, and damage to critical infrastructure, which is costly to repair. Its impact on reducing the level of vulnerability of critical infrastructure will mitigate the disabling or limitation of the realisation of vital state functions.

Regarding economic impact, disasters that have struck certain areas of RS have caused enormous material, financial and human losses in the past. After the 2014 floods, in addition to the direct threat to life and human health, total damage exceeded €1.7 billion, accounting for more than 4% of gross domestic product. The project will indicate the possibilities and needs for designing and implementing innovation, which can directly influence the business sector to move towards finding and producing innovative technical solutions for DRM. It will influence the connection of manufacturers of innovative technological solutions and users themselves through a transparent platform of partnership cooperation and support. Innovative solutions in DRR can directly reduce the primary, secondary and tertiary effects of disaster on people and their health.

Regarding education impact, there is an evident lack of preventive measures to mitigate the effects of disasters in RS insufficiently developed citizens' knowledge and awareness of their importance. By identifying the needs and limitations of education about disasters, Project will offer innovative solutions regarding the most appropriate and acceptable way of educating the RS citizens of different age categories. Namely, citizens informed about the risks of disaster in local communities, trained to respond to such situations in a timely and effective manner, and adequately equipped to survive such events are more likely to prevent or eliminate the effects.

In the short-term perspective, the Project will enable CDR prediction based on SI indicators, improving disaster foresight and preparing to limit disaster losses — rather than waiting for a disaster to occur and then paying for it. From a long-term perspective, it should be borne in mind that climate change is increasingly affecting the frequency and consequences of disasters and that society will face even more severe disasters in the future. The project will enable communities and households better understand and increase their ability to deal with, survive, and recover from disasters by assessing and strengthening DR. The practice has shown that any society that based its security policy on disaster management on science-based facts and principles could significantly mitigate or recover from the consequences of disasters. Modern societies invest considerable funds in scientific research of CDR, to create scientific and social preconditions for mitigating future damages and losses. The project results will enable further development of scientific and empirical knowledge in disaster and future studies. They will be the starting point for further elaboration and development of predictive models.

The project will enable the improvement of the theoretical and empirical fund of scientific knowledge in the field of DRM. Education, which teaches individuals how to act in the event of a disaster and how to avoid unsafe scenarios that vary based on the hazard, is one of the most successful ways to increase community resilience. Several parties are involved in this goal: scientists, policymakers, emergency management organisations, and people. Despite this, disaster management knowledge looks scattered, highlighting perceived information coordination and sharing need. The

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sharing of appropriate knowledge and good practices in CDR will enable the young researcher to conduct new research studies in this field. The project will contribute to exchanging knowledge, innovations and experiences in DRM. In this synergy, sustainable preconditions will be created for their further continuous work and cooperation in the design and implementation of scientific research, the scientific and social implications of which can significantly raise the level of security and resilience of citizens and communities to disasters.

Direct Project beneficiaries are local communities in RS that, based on the developed public policy, will be able to improve and strengthen their level of resilience to disasters based on the effects of SI; political key stakeholders who will gain insight into the need to enhance and implement disaster risk reduction measures; then, the RS Sector for Emergency Situations, which will receive all relevant information on the current situation on the level of DR in RS, as well as recommendations; scientific-professional and academic communities (faculties and institutes) which have accredited study programs in the field of DRM (Faculty of Security, CPU, Military Academy, etc.) and which will benefit from the theoretical and empirical fund of knowledge; IT firms that will develop new goods or improve current ones regarding Project results.

Indirect Project beneficiaries are the end-users such as citizens who, based on the recommendations, will be able to improve their resilience and reduce the future consequences of disasters; intervention and rescue services (police, fire and rescue units and emergency medical services) which will be easier to act in social environments with a higher degree of resilience and other legal entities (educational institutions, healthcare facilities, government or private institutions, media, etc.).

During Project, research data will be generated by conducting multimethod surveys involving the use of questionnaires and conducting interviews. Data and metadata will be stored in an SAV (SPSS) format, and the expected size depends on the realisation of quantitative field research (sampling size and developed tools). Within the Project, various academic research databases will be used: Scopus, Web of Science, PubMed, ERIC, IEEE Xplore, ScienceDirect, Directory of Open Access Journals (DOAJ), and JSTOR, to systematically review the literature for research purposes. In addition, all the existing data containedcurrentting documentation (laws, strategies, reports, notes, etc.) and existing databases (Republic hydro-meteorological office of RS, Republic seismology office, etc.) will be used. The project is expected to generate Intellectual Property through the obtained results project's main aim. Numerous primary and secondary data (scientific and professional publications, reports, bulletins, etc.) are needed to implement the project. Primary and secondary data will be generated at all stages of project implementation. No particular approaches and approvals are distinct for publicly available data, while for individual data during the project implementation, appropriate requests for licenses will be sent. Only researchers will access the data collected throughout the project's execution. Due to a data ownership dispute among the project actors, the data will not be available before publication (researchers and institutions). Once the articles are issued, the data will be available for use.

The project's primary goal is to systematise existing knowledge from available academic databases and generate data from quantitative and qualitative research. Indeed, specific publicly available state data will be used (Republic Statistical Office, etc.), while detailed data will be requested in the project implementation process. Data will be safely stored in certified repositories for short and long-term preservation and curation. It will be stored together with the minimum software, metadata and documentation to make them useful on created Project website. In the process of collecting and generating them, the data will be anonymous until they are ready for publication or entry into a public website that will be publicly available. The research results will be stored in the online database and open to all interested researchers, practitioners and the public. The cost of data curation and preservation will be covered via the project budget. The stored data must be helpful to the broader public and usable by non-specialists. Data will be accessible to all interested parties, institutions and organisations during and after the project. We will make our specific data public via Research Data Repository (Figshare – an open access data repository) because it will increase transparency and trust in our Project, as well as allow other researchers to replicate and validate their

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findings, and, as a result, contribute to the speed of scientific discovery by allowing others to reuse and build on top of their data.

5. Dissemination of results

The project involves the use of a wide range of communication and dissemination of information on research results at all stages: a) Public website and social networks (Instagram, Facebook, Twitter, LinkedIn, Research gate, Academia.edu, etc.); b) organized press conferences that will present information about the project, research results and innovative solutions that will be applied in the DRM system; c) Scientific conference, seminars; e) Scientific papers (national journals, international journals) in open access will be published in national and international journals; f) Publications in the form of monographs, reports and reviews of innovative solutions in open access; d) events such as workshops, seminars, trainings, etc.; i) SharePoint will be established to enable the sharing of documents, files, contact lists, deliveries and all other relevant project documents to all researchers and external experts involved; j) Regular telephone conferences between all researchers, as well as among other scientists and experts involved in the project.

At the beginning of the project implementation, communication and dissemination activities will be related to the presentation of the project, its goals and impacts. After that, communication and dissemination activities will be associated with presenting research results (development of analytical frameworks, the realisation of quantitative and qualitative research, etc.). The study's main results will be presented widely through all project communication channels. Communication will be established with key political representatives and other decision-makers in RS relevant to strategic DRM.

Dissemination of the results of scientific research will enable the improvement of the theoretical and empirical fund of scientific knowledge in the field of disaster studies. The research results will provide decision-makers with relevant data necessary to create strategies, plans, and programs for improving CDR. In addition, the results will enable the creation of preconditions for building a more resilient social community to disasters, which will have implications for reducing all future tangible and intangible consequences for people and their property.

MODERSI will transfer research outputs by EU open access practice. In project budgets are established open access publication funds; all results will be available in institutional repositories (6 Websites), projeWebsitesite, through blogs/newsletters. OA results will be available even after the realisation of MODERSI and other beneficiaries to all interested parties on The Scientific-Professional Society for Disaster Risk Management and the International Institute for Disaster Research website. Team members will pay special attention to encouraging young researchers on the project and members of this consortium to publish their results in OA journals. Researchers will use open access (OA) to make published academic publications freely and permanently available online, allowing anyone, anywhere, to read and expand on this knowledge. The peer-reviemanusc will be deposited in a trusted Open Access repository. Also, we will select a reputable Open Access journal for publishing our research. Open access publishing / 'gold' open access will be used, and articles will be immediately published in open access mode.

The project will use a combined communication-dissemination approach to reach out to many stakeholders, including researchers, professionals, policymakers, and others. The project findings will be more widely known due to dissemination efforts, which may positively influence many types of policies and the media. The communication strategy plan outlines key messages, target audiences, and activities related to information dissemination, such as the project website (English and Serbian, the language of the environment); Facebook social network; project brochure (English and Serbian); press conferences, press articles, TV and radio interviews; international and local e-newsletters; and a movie-documentary on the project DVD support that documents main project phases. During the project's execution, the project logo will appear on all public papers, publications, websites, and promotional materials to boost exposure and enable the branding of communication products. The website will be available for the next incoming years on the pages of our Faculties and Institutes and

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the websites of the Scientific and Professional Society for Disaster Risk Management and the International Institute for Disaster Research.

6. Implementation

Project implementation is divided into the following seven work packages (also listed in Table 1): WP1: Project preparations and management, WP2: Development of CDR framework, WP3: Development of SI in disasters framework, WP4: Development of predictive model CDR based on SI factors influence, WP5: Quantitative research on SI impact on building CDR, WP6: Qualitative research on the SI impact on building CDR, WP7: Policy innovations for enhancing CDR from SI perspective and WP8: Dissemination. Project preparations and management (WP1) will be established to develop and prepare detailed implementation, quality control, research coordination, management communication and dissemination, administrative and financial reports, etc. WP2 aims to develop the CDR framework, and WP3 aims to develop the SI framework. The next WP4, based on WP2 and WP3, will be developed as a predictive model of the influence of SI factors on CDR. Based on WP4, quantitative research on SI impact on building social resilience will be implemented WP5 – quantitative research on SI impact on building social resilience. After that, based on WP4 and WP5 will be implemented WP6 – Qualitative research of SI impact on building social resilience. Based on WP5 and WP6 will be implemented WP7. Also, WP8 will disseminate the Project research results. A detailed work description follows, including a list of work packages (WP) (Table 1).

Table 1. Work package description.

Work package number	1	Work package title	Project preparations and management
Objectives: Successful and efficient organization of a kick-off meeting, develop and prepare detailed implementation and control of quality; Develop and implement the Project website and database; Coordination of Project activities and meetings, track progress and outcomes; Management administrative and financial reports, as well as contingency plans; Coordination of all activities and monitoring of Project implementation; Management solutions for Project risk factors and other potential problems; Management of evaluation Project influence on stakeholders, beneficiaries and public.			
Description of work (where appropriate, broken down into sub-activities), and role of the team members A kick-off meeting will be held in the first month (Sub-activity 1.1). The purpose of this meeting is to create processes, discuss implementation, and inform team members about the Project's organisation (PI in coordination with others); Implementing the Project website and social media (Sub-activity 1.2) will provide public access to project-related information (e.g., project reports, publications) and therefore boost Project transparency and visibility, as well as make Project administration easier (All team members); Our team members will prepare thorough implementation, quality control, and dissemination plan throughout the first three months (Sub-activity 1.3). The PI will manage management activities, overseeing the project's overall activities, including results delivery, progress, quality control, contingency planning, project meetings, and dissemination (Sub-activity 1.4).			
Deliverables of the work package (brief description and month of delivery in the project) D1.1. Administrative and financial reports (3, 6, 9, 12, 15, 18, 21, 24); D1.2. Project website presented, social media presentations implemented (2); D1.3. Detailed plans of implementation, quality control and dissemination (3); D1.4. Final report – project successfully evaluated and implemented (24).			

Work package number	2	Work package title	Development of CDR analytical framework
Objectives: Development of the analytical framework of CDR – problem identification, characteristics and conceptualisation of the concept; Identification of gaps in existing analytical frameworks of CDR frameworks; Development of procedures and techniques for identification and selection of dimensions (social structure; social capital; social mechanisms etc.), as well as			

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specific indicators (socio-economic stratification; partnership, gender, age, education, engagement); Development of models and formulations for a general adaptive analytical framework for testing CDR; Development of tool (questionnaire) for assessing the level of CDR.
Description of work (where appropriate, broken down into sub-activities), and role of the team members Identification and conceptualisation (definition → operationalisation → measurement) of terms CDR (Sub-activity 2.1) (PI in coordination with others); Identification of gaps (missing elements or incomplete knowledge) (Sub-activity 2.2) in the existing CDR frameworks using PRISMA (All team members); Identification and selection of dimensions and indicators (Sub-activity 2.3) for the generic adaptable CDR framework using PRISMA (PI and P2 in coordination with others); Development of the CDR assessment tool (questionnaire) (Sub-activity 2.4) (P3 and P1 in coordination with others).
Deliverables of the work package (brief description and month of delivery in project) D2.1. Conceptualisation and operationalisation of CDR (3) D2.2. CDR framework gaps (3) D2.3. Generic adaptable CDR framework (4) D2.4. Developed a tool (questionnaire) for assessing the CDR (4)

Work package number	3	Work package title	Development of SI in disasters analytical framework
Objectives: Development of the analytical framework of SI – problem identification, characteristics and conceptualisation of the concept; Identification of gaps in existing analytical frameworks SI frameworks; Development of procedures and techniques for identification and selection of dimensions as well as specific indicators (social class, disabilities, ethnicity, gender, religion etc.); Development of models and formulations for a general adaptive analytical framework for testing SI; Development of tool (questionnaire) for assessing SI.			
Description of work (where appropriate, broken down into sub-activities), and role of the team members Identification and conceptualisation and operationalisation of terms SI (Sub-activity 3.1) (P4 and P5 in coordination with others); Identification of gaps (Sub-activity 3.2) in the existing SI frameworks using PRISMA (All team members); Identification and selection of dimensions and indicators (Sub-activity 3.3) for the generic adaptable SI in disaster framework using PRISMA (P2 in coordination with others); Development of the SI in disaster assessment tool (questionnaire) (Sub-activity 3.4) (P3 in coordination with others).			
Deliverables of the work package (brief description and month of delivery in project) D3.1. Conceptualisation and operationalisation of SI (5) D3.2. SI framework gaps (5) D3.3. Generic adaptable SI framework (6) D3.4. Developed tools (questionnaire) for assessing the level of SI in disaster (6)			

Work package number	4	Work package title	Development of predictive model CDR based on SI
Objective: Development of research hypothesis and chosen modelling techniques for a predictive model CDR based on SI influences.			
Description of work (where appropriate, broken down into sub-activities), and role of the team members Pre-model exploration, statistical distributions, identification and selection of dimensions and indicators (Sub-activity 4.1) from developed adaptive CDR and SI framework (P3 in coordination with others); Establish the hypothesis (Sub-activity 4.2) and then build the test model, matrix of possible impacts of SI indicators on CDR (All team members); Selecting the correct predictive modelling technique (Sub-activity 4.3), determine whether parametric or nonparametric predictive modelling is the most effective (PI in coordination with others); Recognize methods (Sub-activity			

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4.4) for determining the validity of developed regression models, such as comparing model predictions and coefficients with theory (All team members);
Deliverables of the work package (brief description and month of delivery in project) D4.1. Selected predictors and dependents variables of the predictive model (6) D4.2. A predictive model hypothesis with the matrix of possible impacts (6) D4.3. Determined possible modelling techniques and methods for determining the validity model (7)

Work package number	5	Work package title	Quantitative research on CDR based on the SI influences
Objectives: Developed research schedule, sampling frame, sample size and selection procedures, design of the survey instruments; Pretested the survey instrument and selected and training interviewers; Implemented the quantitative survey and field research, coded the completed questionnaires and computerised the data; Monitored and supervised the interview process; Analyzed and presented quantitative survey results.			
Description of work (where appropriate, broken down into sub-activities), and role of the team members Determining the research schedule, sampling frame, size and selection procedures (Sub-activity 5.1) (PI in coordination with others); Designing the survey instrument (Sub-activity 5.2) based on CDR and SI analytical frameworks and developed matrix (PI in coordination with all members); Pretesting the survey instrument (a pilot pre-test) (Sub-activity 5.3) (P4 and P5 in coordination with others); Selecting and training interviewers (Sub-activity 5.4) (P5 in coordination with others); Implementing the survey, and field research (Sub-activity 5.5). The defined random sample technique must be followed (All team members); Coding the completed questionnaires and computerising the data (Sub-activity 5.5; Monitoring of the interview process (Sub-activity 5.6) (PI in coordination with all members); Analyzing and presenting survey results (Sub-activity 5.7) (All team members).			
Deliverables of the work package (brief description and month of delivery in project) D5.1. Research schedule, sampling frame, sample size and sample selection procedures (7) D5.2. Survey instrument – developed (8) D5.3. A pilot pre-test selected and trained interviews (9) D5.4. Field survey (9, 10, 11, 12, 13) D5.5. Quantitative research analysis results (14, 15)			

Work package number	6	Work package title	Qualitative research on CDR based on SI influence
Objectives: Developed research schedule, sampling frame, sample size and sample selection procedures, design of the survey instruments, and the interview guide; Implemented the qualitative survey – semistructured interviews; Analyzed and presented quantitative survey results.			
Description of work (where appropriate, broken down into sub-activities), and role of the team members Determining interactive model of research design (Sub-activity 6.1) with general research questions regarding CDR based on SI influences factors (PI in coordination with all members); Determining the sampling strategy, context and negotiating access (Sub-activity 6.2) (P6 in coordination with all members); Determining the sample size and participants recruitments (Sub-activity 6.3) – a minimum sample based on the purpose of the study, expected coverage and interests of the researcher (P7 in coordination with all members); Developing the interview guide which will reflect a semistructured interview format (Sub-activity 6.4) – appropriate interview settings and practicalities of conducting interviews; Data collection and preparation (Sub-activity 6.5) – semi-structured conversation with a participant (80) focused on a small set of topics (30-60			

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minutes) (P6 in coordination with all members); Presenting and analyzing survey (data) and constant comparison with theory (Sub-activity 6.6) (All team members).
Deliverables of the work package (brief description and month of delivery in project) D6.1. Qualitative research design with general research questions (15) D6.2. Sampling strategy, sample size, participants recruitments, and the interview guide (15) D6.3. Data collection and preparation – field interviews (16, 17, 18, 19) D6.4. Qualitative research analysis results (20, 21)

Work package number	7	Work package title	Public policy recommendations and innovations for enhancing CDR based on SI influences
Objectives: Development of public policy in the RS with recommendations for improving the level of CDR based on SI influence.			
Description of work (where appropriate, broken down into sub-activities), and role of the team members Developing the public policy, identifying the issue to be addressed by the proposed policy, formulation of the policy (Sub-activity 7.1) (P5 in coordination with others); Identifying the specific objectives and policy options (Sub-activity 7.2). Defining the goals and guiding how to improve CDR based on SI factors (P5 in coordination with others); Identifying key activities (Sub-activity 7.3) for strengthening public policy and institutional arrangements for enhancing the level of CDR-based; Drafting public policy with recommendations (Sub-activity 7.4) (legislation, management, security prevention measures etc.) for improving the level of CDR based on SI. Validation process that includes workshops, online meetings, working group meetings (All team members); Policy evaluation (Sub-activity 7.5) (policy content, implementation and impact evaluation) and impact assessment: systematic collection and analysis of information to make judgments about contexts, activities, characteristics regarding CDR (All team members); Presentation of the public policy to a widen audience via conferences, meetings etc. (All team members).			
Deliverables of the work package (brief description and month of delivery in project) D7.1. Policy agenda and specific objectives and policy options (21) D7.2. Key activities for strengthening policy (22) D7.3. The drafted policy paper and evaluated policy (23,24) D7.4. Public policy for improving CDR based on SI (24)			

Work package number	8	Work package title	Dissemination
Objectives: Enhance the Project's visibility and open access to its results, improve international scientific engagement and mobility among Project partners, and ensure impact beyond the Project's term.			
This activity aims to disseminate project research results. According to the budget, team members will have the opportunity to participate in various international conferences, such as International Conference on Natural Hazards and Disaster Management and the International Disaster and Risk Conferences IDRC. The results will also be published in open access journals.			
Deliverables of the work package (brief description and month of delivery in project) D.8.1. Papers published in journals and conference proceedings, and monographs during the Project D8.2. International conference: DRM: Research, Theory and Practice			

7. Risk analysis

Feasibility (technical, budget, legality, risk, operational and time) of the Project implementation is at a high level, considering the competencies of selected scientific researchers with many years of research experience. In addition, the PI has conducted several multimethod research aimed at developing predictive models in disaster studies. Regarding technical capability, all NIOs are equipped with the necessary equipment to implement research and have sufficient financial

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resources to implement projects with the help of the Science Fund. All legal preconditions for the realisation of the project have been met, and with the help of rich experience, all risks and ways of overcoming them have been identified. The project can be realised without any delays in 24 planned months.

The main risks related to the Implementation plan are related methodology, work packages, deliverables and milestones, members of the project team and SROs, procurement, budgetary issues and other risk. During the implementation, it may happen that citizens are not motivated enough to participate in interviews, that work packages are not implemented efficiently enough, some of the research members give up, or the realisation of field research is difficult, etc. Indeed, for each of the mentioned risks, there are appropriate solutions. Risk management analysis is further elaborated in Table 2. For each risk category, potential risks are listed, and planned risk mitigation measures are indicated. Also, we developed a contingency plan with activities designed to help us respond effectively to a significant future event or situation that may or may not happen.

Table 2. Risk management.

Risk assessment	Description of the risk	Risk mitigation measures to be undertaken by members of the Project team or SRO	Risk level: high/medium /low
Methodology risk	Description of the risk	The realisation of field research is difficult due to the low interest of citizens in cooperation.	low
	Actions to be undertaken	Keeping in mind the rich experiences of researchers, creative solutions (printed flyers) will be found to motivate citizens to cooperate.	
Work packages, deliverables and milestones	Description of the risk	Insufficiently efficient implementation of planned work packages slows down the start of other work packages (just two work packages) if there is an emergency.	low
	Actions to be undertaken	Considering that specific work packages overlap, realising other work packages that the previous ones do not directly condition will begin.	
Members of the project team and SROs	Description of the risk	Some team members might leave the team or not work efficiently enough.	low
	Actions to be undertaken	Bearing in mind that all researchers are engaged during the entire period, they will be able to take on responsibilities until a new researcher is involved. With its management experience on previous projects, PI has a replacement for each. The qualifications will be identical to the replaced members.	
Procurement	Description of the risk	There are risks that certain procurements may slow down the realisation of certain parts of the research.	low
	Actions to be undertaken	Keeping in mind the complementarity of the research, if certain parts of the study are slowed down, other realistically feasible ones will be accelerated at that moment.	
Budgetary issues	Description of the risk	Payments from the competent authority or institution are delayed.	low
	Actions to be undertaken	Due to these delays, there may be changes to the distribution plan and delays in researcher pay, but there will be no halt in research activity.	
Other risks	Description of the risk	The emergence of an emergency would complicate field research.	low
	Actions to be undertaken	Given the experience of researchers, a creative solution would be found to conduct research online or in other	

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possible ways. We have 5% reserve municipalities for conducting research.

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