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2020 Earthquakes in Croatia: What Lessons Should Be Identified and Learned?

Potresi u Hrvatskoj 2020. godine: Koje lekcije treba prepoznati i naučiti?

Summary: During 2020, Croatia was hit by two major earthquakes and a series of minor earthquakes that caused human casualties and significant material damage, and revealed the state and functioning of the immediate post-disaster response and post-disaster recovery and reconstruction at the local and state level. Earthquakes are not uncommon in Croatia; they are very frequent, as the country lies in an earthquake-exposed area. Therefore, the assumption is that the country should be ready to face the risks of earthquakes and their consequences. However, the 2020 earthquakes revealed certain issues, such as a lack of procedures, slow responses to citizens' needs, difficulties in on-site coordination, and conflicts between institutions regarding jurisdiction during the immediate post-disaster response phase. Although some forms of non-structural recovery began relatively quickly, more comprehensive post-disaster reconstruction processes were significantly delayed, with many still ongoing as of 2025. This poses a serious challenge that needs to be explored and the lessons that need to be identified and learned should be highlighted. Therefore, this research is very relevant for Croatia itself, as well as for other countries that have the opportunity to learn from the Croatian case study as well.

Keywords: earthquakes; Croatia; immediate post-disaster response; post disaster recovery and reconstruction; lessons identified and learned; civil protection.

Sažetak: Tijekom 2020. godine Hrvatsku su pogodila dva velika potresa i niz manjih potresa koji su rezultirali ljudskim žrtvama i značajnom materijalnom štetom, ali i razotkrili stanje i funkcioniranje ranoga odgovora te oporavka i obnove na lokalnoj i državnoj razini nakon katastrofe. Potresi u Hrvatskoj nisu neuobičajeni; oni su vrlo česti jer se Hrvatska nalazi u seizmički izloženom području. Pretpostavka je stoga da bi zemlja trebala biti spremna odgovoriti na rizike potresa i njegove posljedice. Međutim potresi iz 2020. godine pokazali su određene probleme, kao što su nedostatak procedura, spori odgovor na potrebe građana, poteškoće u koordinaciji na terenu te sukob između institucija oko nadležnosti u fazi ranoga odgovora nakon katastrofe.

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Unatoč tome što su neki oblici nestrukturnoga oporavka započeli relativno brzo, širi procesi obnove nakon katastrofe značajno su kasnili, a mnogi od njih još traju i u 2025. godini. To predstavlja ozbiljan izazov koji treba istražiti, ali i nudi lekcije koje treba prepoznati i naučiti. Stoga je ovo istraživanje vrlo relevantno za Hrvatsku, ali i za druge zemlje koje imaju priliku učiti na temelju hrvatske studije slučaja.

Ključne riječi: potresi; Hrvatska; rani odgovor nakon katastrofe; oporavak i obnova nakon katastrofe; prepoznate i naučene lekcije; civilna zaštita

Introduction

Natural disasters present challenges for which appropriate response mechanisms need to be developed and put in place. Due to numerous activities and processes, the modern world is increasingly exposed to the risks of natural catastrophes and their consequences. According to Ritchie, Rosado and Roser, »disasters – from earthquakes and storms to floods and droughts – kill approximately 40,000 to 50,000 people per year. This is the average over the last few decades« (Ritchie, Rosado and Roser). An additional important fact is that natural disasters occurring three times more often than 50 years ago (United Nations Food and Agriculture Organization 12), while economic losses from natural disasters have been increasing in recent decades (Botzen et al. 167). In addition, major disasters often cause cascading effects with significant consequences. A few prominent examples of such disasters, and their additional consequences, include: the 2004 Indian Ocean earthquake and tsunami; the 2005 Hurricane Katrina; the 2008 Cyclone Nargis in Myanmar; the 2010 Haiti earthquake; the 2011 Tōhoku earthquake, tsunami, and Fukushima nuclear disaster; and the COVID-19 pandemic. Significant consequences of these events included the loss of life, the displacement of populations, the destruction of critical infrastructure, long-term economic losses, and environmental degradation. Furthermore, local and national response systems were overwhelmed, while disruptions extended beyond the directly affected regions, impacting global supply chains, public health systems, and overall societal stability.

According to a publication by the Centre for Research on the Epidemiology of Disasters and UN Office for Disaster Risk Reduction publication titled *The human cost of disasters: an overview of the last 20 years (2000-2019)*, the following data should be highlighted: »From the two decades, the years 2004, 2008, and 2010 stand out most, having had over 200,000 deaths each. The largest single event by death toll was the 2004 Indian Ocean Tsunami, which was triggered by a 9.1 Richter earthquake, and resulted in the deaths of 226,400 people in twelve Asian and African countries. The largest death tolls were in Indonesia where 165,708 people died, followed by Sri Lanka with 35,399 deaths. The second largest event occurred in 2010, when a 7.0 Richter earthquake struck Haiti in the middle of the night, killing approximately 222,000 people and leaving millions homeless. Additionally, in 2008, Cyclone Nargis killed over 138,000 people in Myanmar. The average number of deaths world-

wide from 2000 to 2019 was approximately 60,000 deaths per year. Since 2010 there have been no mega-disasters and no single year with over 35,000 deaths« (Centre for Research on the Epidemiology of Disasters and UN Office for Disaster Risk Reduction 13). Additionally, Our World in Data platform reports that cumulative confirmed COVID-19 deaths exceeded 7 million worldwide between the beginning of 2020 and the end of 2024. Due to varying protocols and challenges in the attribution of the cause of death, the number of confirmed deaths may not accurately represent the true number of deaths caused by COVID-19 (Mathieu et al.).

Earthquakes are among the most devastating natural hazards, causing great loss of life and livelihood. Estimates of the effects of earthquakes vary widely. Elnashai and Sarno use the data that on average, 10,000 people die each year due to earthquakes (Elnashai and Sarno xv), Brueck and Kotecki cite the figure that earthquakes kill roughly 20,000 people each year, on average (Brueck and Kotecki), while Kenny cites the following data: »earthquakes account for the majority of deaths from a range of natural disasters, which amounts to about 60,000 people a year worldwide« (Kenny 2). Additionally, annual economic losses are in the billions of dollars and often constitute a large percentage of the gross national product of the country affected (Elnashai and Sarno xv). In addition to the current consequences and losses, earthquakes and other natural catastrophes have a significant impact on the economic growth of the affected regions and countries (Cavallo et al. 7), where less developed countries need much more time to recover from the resulting losses. Earthquakes have multiple direct and indirect impacts. Direct impacts are manifested in structural damage to buildings, infrastructure, roads due to shaking. Secondary impacts include triggered landslides, fires, and tsunamis. In addition to those and the aforementioned human casualties and major material damage, earthquakes also cause the displacement of people and their livestock from the affected area, and if post-disaster recovery and reconstruction has not been carried out within certain objectively acceptable frameworks, some residents permanently leave the earthquake-stricken area. The above poses further challenges in the recovery and revitalization of the earthquake-stricken area.

According to the United States Geological Survey (a scientific agency of the United States government), »earthquakes can strike any location at any time, but history shows they occur in the same general patterns year after year, principally in three large zones of the earth«: a) the world's largest earthquake belt, the circum-Pacific seismic belt, is found along the rim of the Pacific Ocean, where about 81 percent of our planet's largest earthquakes occur; b) the Alpidic earthquake belt extends from Java to Sumatra through the Himalayas, the Mediterranean, and out into the Atlantic. This belt accounts for about 17 percent of the world's largest earthquakes, including some of the most destructive; c) the third prominent belt follows the submerged mid-Atlantic Ridge. The ridge marks where two tectonic plates are spreading apart (a divergent plate boundary). Most of the mid-Atlantic Ridge is deep

underwater and far from human development (U.S. Geological Survey a.d.). The world's most earthquake-prone countries include China, Indonesia, Iran, Turkey, Japan, Peru, the United States, Italy, Afghanistan, and India (Veroutsos). The assumption is that countries located in areas at increased risk of earthquakes develop and have developed a number of preventive and reactive mechanisms and measures to cope with the risks of earthquakes and the consequences when earthquakes occur.

Croatia lies at the crossroads of Central and Southeast Europe and the Mediterranean, and is located on the Alpidic earthquake belt, therefore it is constantly exposed to earthquakes. Croatian seismologists »locate an average of 10,000 to 12,000 earthquakes annually in Croatia and neighboring countries, more than half of which have their epicenters in Croatia« (Ministry of the Interior Directorate of Civil Protection, University of Zagreb Faculty of Civil Engineering, Faculty of Science Seismological Service of the Republic of Croatia 4). This knowledge should condition the way of life, the quality of construction, but also the established and developed mechanisms of immediate post-disaster response and post-disaster recovery and reconstruction in the event of an earthquake.

The **problem** addressed in this research lies in the prevailing belief within Croatian society that the immediate post-disaster response and post-disaster recovery and reconstruction following the 2020 earthquakes were not at an adequate level. The immediate post-disaster response revealed numerous organisational and institutional issues, such as a lack of procedures, slow responses to citizens' needs, difficulties in on-site coordination, and high levels of stress. Moreover, post-disaster structural reconstruction began with numerous challenges, the most significant of which were conflicts between institutions regarding jurisdiction, and has progressed very slowly. The **focus** of this research is the response of Croatian authorities to the two 2020 earthquakes. The **aim** is to examine and analyze the circumstances that contributed to the challenges in response, recovery, and reconstruction, which hindered the effectiveness of the immediate post-disaster response and delayed the progress of post-disaster recovery. The central **research question** is: What lessons should be identified and learned from the 2020 earthquakes in Croatia? The **expected outcomes** of this research include a set of findings and recommendations that could be valuable not only for Croatia but also for other countries facing earthquake risks or other types of disasters.

In order for the research to be carried out, an overview of a number of official documents, academic sources and media coverage will be used. A detailed literature survey will not be conducted because there are not many papers on this topic in Croatian scientific production yet given the relative temporal proximity of the events described and analysed. The paper is organised into four additional units following the *Introduction*. The second unit, called *Methods*, will present the research design of this paper. The following unit, *Results*, will present the key activities of the competent local and state institutions in the phases of immediate post-disaster response

and post-disaster recovery and reconstruction. In the fourth unit, named *Discussion*, an analysis of the actions of the responsible local and state institutions will be carried out and a number of findings and recommendations will be allocated for this specific case study. The last unit, also called *Conclusion*, will sum up the entire research and highlight the most important parts of the research.

Methods

The research design of this analysis uses a qualitative case study of Croatia, focusing on the actions of local and state institutions during the phases of immediate post-disaster response and post-disaster recovery and reconstruction. The analysis is based on desk research of available data sources, interviews with participants directly involved in these phases, and personal observations of institutional responses. The case study method was applied to examine the specific context of Croatia's approach to disaster management, enabling an in-depth understanding of institutional practices and challenges. Primary data collection was complemented by external sources to ensure a comprehensive analysis of the processes and outcomes of institutional actions.

Results

This unit provides an overview of four key frameworks necessary to present the state and situation that Croatia faced during the 2020 earthquakes: a) how Croatia approaches the risk of earthquakes, b) how the system for responding to major accidents and disasters was developed, c) the context of the time in which the earthquakes occurred, and d) the measures and activities undertaken during the phases of immediate post-disaster response and post-disaster recovery and reconstruction.

The first framework concerns the approach towards earthquake risk. According to the *Assessment of the vulnerability of the Republic of Croatia from natural and technical-technological disasters and major accidents Š2009Ć*, the territory of the Republic of Croatia, as part of the Mediterranean-Trans-Asian belt, is characterised by pronounced seismic activity. Earthquakes occur in the contact zones of smaller structural units. In coastal areas, earthquakes are caused by the undercutting of the Adriatic platform under the Dinarides, as a result of the movement of the African Plate towards the Eurasian Plate. In the north-western continental part, earthquakes are caused by compression processes due to the displacement of the Dinarides and the Alps, while in the eastern part of the country, where predominantly marginal parts are active, the masses of individual mountains are caused by different displacements. The data on earthquakes in Croatia go back to the year 361. Two of them were of X^o MCS intensity: the earthquake of 361, which is stated to have made the town of Cissa on the island of Pag collapse into the sea, and the 1667 earthquake,

when Dubrovnik was almost completely demolished (Government of the Republic of Croatia 56). Particularly valuable is the conclusion of the Assessment, which states that: »In the entire territory of Croatia there is a great danger of earthquakes, with the risk of earthquakes VIII^o and IX^o occurring on the surface of more than one third of the country's territory (36.42%), which is inhabited by almost two thirds of the total population. In more than half of the territory of Croatia (56.22%) there is a risk of an earthquake of VII^o, which is home to more than one third of the total population of Croatia. Such a ratio of areas to the number of inhabitants in an earthquake gives primary catastrophic consequences, such as a high percentage of damage to buildings, communication interruptions, backfilled roads, a high number of injured and dead, a high number of evacuees, etc., and secondary catastrophic consequences when the population at risk will increase due to the accompanying accidents that then occur, such as explosions, fires, floods, landslides and rockfalls, uncontrolled release of toxic gases and substances into the environment, and the occurrence of epidemics and epizootics« (Government of the Republic of Croatia 56). In the 2019 *Disaster risk assessment for the Republic of Croatia*, a total of 16 natural, technical-technological and anthropogenic disaster risks were analysed (while the 2015 Disaster risk assessment analyses only 12 of them). Risks were treated on the principle that fifteen of them were analysed and presented as a simple risk, while the sixteenth risk (combination of earthquake and flood in the City of Zagreb) was analysed and presented as a complex risk. After the analysis, the risks were divided into three groups: unacceptable risks, tolerant risks and acceptable risks. In both assessments, the following three were singled out as unacceptable risks: floods caused by spills of inland water bodies; earthquakes; and forest fires (Government of the Republic of Croatia). The information presented above demonstrates that Croatia is aware of the risks posed by earthquakes and their potential consequences.

The second framework to be addressed pertains to the state of the organisation of the system responsible for responding to major accidents and disasters. This section begins with the assertion that disaster risk reduction has been recognised as an important activity by all key stakeholders within the state and society. Based on the *Constitution* (Article 129a), all local self-government units (municipalities and cities) perform tasks that directly meet the needs of citizens, and especially tasks such as civil protection (Croatian Parliament). According to the *Law on the civil protection system*, disaster risk reduction is an integral part of civil protection tasks at all levels in the country and for all actors. The Law states: »The civil protection system is organized at the local, regional and state level, and connects the resources and capabilities of participants, operational forces and citizens into a single unit to reduce the risk of disasters, provide a rapid and optimal response to threats and dangers and mitigate the consequences of large accidents and disasters« (article 5). The participants in the system are the Croatian Government; Ministry of the Interior, as the central state administration body responsible for civil protection matters;

state administration bodies and other state bodies; the Armed Forces of the Republic of Croatia and the Police; units of local and regional self-government (Article 8). The operational forces are: Civil Protection Headquarters; operational fire brigade; operational forces of the Croatian Red Cross; operational forces of the Croatian Mountain Rescue Service; citizens' associations; civil protection units and commissioners; site coordinators; legal persons (Article 20). All Croatian citizens, citizens of the European Economic Area and third-country nationals who have been granted alien status in the Republic of Croatia and stateless persons with regulated status in the Republic of Croatia, aged 18 to 65 are obliged to be engaged in civil protection, and have the right and the duty to participate in civil protection activities (article 43 and 44) (Croatian Parliament). It is important to point out that all political units at the local, regional and state level have risk assessments for major accidents and disasters and plans for action. In addition, there is a civil protection system from the local to the national level that ensures a unified approach and action in risk reduction and response to major accidents and disasters.

The third framework is related to the context of the time in which the earthquakes occurred. It is important to consider whether the earthquakes struck during a period when the state was not burdened by other crises and significant events, or whether they occurred at a time when other crises were being managed, diverting attention and engaging available resources. Before describing the 2020 earthquakes themselves, it is necessary to approximate the context of the time in which they occurred, which partly influenced the immediate post-disaster response phase. The first half of 2020 was a very challenging time for Croatia, »when the country suddenly became simultaneously exposed to several different types of crises: it started presiding over the Council of the European Union for the first time at the moment when the Union was in a deep structural crisis, with Britain withdrawing from full membership and Turkish president Recep Tayyip Erdogan threatening and pushing refugees and migrants towards Europe; several strategic state-owned companies (such as INA – a strategic oil company) were under strong cyber-attacks; the global crisis caused by the COVID-19 pandemic began« (Mikac 36). Throughout the COVID-19 pandemic, Croatia has fared extremely badly with some of the worst global indicators regarding daily new confirmed COVID-19 cases and deaths per 100,000 people. Therefore, these circumstances should also be considered when analysing the response to the 2020 earthquakes.

In 2020, Croatia was struck by two major earthquakes: on 22 March in Zagreb and on 29 December near Petrinja. The first earthquake of $M_L 5.5$ ($M_W 5.3$) magnitude occurred on Sunday morning at 5:24 UTC (6:24 CET) with the epicentre at Medvednica Mountain, in the outskirts of Zagreb, just 7 km to the north of the centre of the Croatian capital. The intensity in the epicentre and the historic centre was estimated at VII EMS. The earthquake struck just a day after public transport was suspended for 30 days, three days after public gatherings of more than five people were forbid-

den, the restaurants, shops (except for groceries, hygienic and other necessary items) and cultural institutions were closed, and six days after the closure of schools and universities. A day after the main event, people were forbidden to leave their city/town/municipality of residence without written permission of the local government. At that time, the Croatian »lockdown« was described as one of the strictest in the EU (Dasović and Herak; Mustać et al. 216; Herak et al.). The second devastating earthquake occurred on Tuesday 29 December 2020 at 11:19 UTC (12:19 CET), and had an $M_L 6.2$ ($M_W 6.4$) magnitude near the town of Petrinja (Central Croatia). It was preceded by magnitude $M_L 5.0$ and $M_L 4.7$ events the day before. These events caused significant damage to buildings in Petrinja and Glina and the surrounding villages within a radius of 50–60 km from the epicentre. The highest volumes were estimated as VIII–IX EMS and seven people lost their lives. This sequence also occurred during the »lockdown« due to the COVID-19 pandemic with strict measures imposed on 21st December 2020, some of which were cancelled after the mainshock (Dasović and Herak; Kušanić 219; Radnić 1110; Ros Kozarić 7).

The Government of the Republic of Croatia, with the support of the World Bank, has prepared an assessment of the damage caused by these two earthquakes. The assessment was based on the work of local experts in the field, who carried out the assessment using the groundwork provided by engineers who conducted building inspections. In addition to the eight fatalities (one in the first earthquake and seven in the second), numerous injured persons, the extent of the damage has been cumulatively estimated at around 17 billion euros, of which 11.5 billion euros are estimated damage related to the first earthquake and 5.5 billion euros for the second (Government of the Republic of Croatia and World Bank 13). In the first quake, 25,000 buildings and houses were damaged (Government of the Republic of Croatia), while data on the second quake suggest that 15,000 internally displaced people were affected, 1.5 million were exposed to the earthquake, and a total of 43,000 structures were damaged. (Government of the Republic of Croatia and World Bank 14). Although the first earthquake damaged fewer buildings, the estimated damages are more than double. The reason for this is that in the first earthquake a number of residential buildings, critical infrastructure and historical heritage buildings were affected, for which rehabilitation is more expensive than family houses and commercial buildings, which were mostly damaged in the second earthquake. Such significant consequences certainly required great effort from local and state institutions during the phases of immediate post-disaster response and post-disaster recovery and reconstruction. This was especially the case because the earthquakes have had a significant impact on the availability of public services, including health care and education, access to drinking water and, to a lesser extent, electricity. In addition, the local population, especially children, the elderly and people with disabilities, suffered major psychological trauma (Government of the Republic of Croatia and World Bank 14). The consequences of the earthquake have, as is often forgotten, also affected a number of operational forces and first responders from the affected areas.

The fourth framework is an overview of the key measures and activities undertaken in the phases of immediate post-disaster response and post-disaster recovery and reconstruction. Regarding the immediate post-disaster response to both earthquakes, all participants were engaged (Croatian Government; Ministry of the Interior, as the central state administration body responsible for civil protection affairs; state administration bodies and other state bodies; The Armed Forces of the Republic of Croatia and the Police; units of local and regional self-government), available operational forces of the civil protection system (Civil Protection Headquarters; operational fire brigade; operational forces of the Croatian Red Cross; operational forces of the Croatian Mountain Rescue Service; citizens' associations; civil protection units and commissioners; site coordinators; legal persons), and numerous volunteers contributed, among whom it is particularly important to highlight those who gathered around the (at the time) informal platform Croatian Center for Earthquake Engineering (Hrvatski centar za potresno inženjerstvo – HCPI). The Union Civil Protection Mechanism was also activated very quickly, after which international assistance was received, which was also received bilaterally from neighbouring countries. Regarding the immediate post-disaster response in case of the second earthquake, according to official data of the Directorate of Civil Protection of the Ministry of the Interior, five cities and ten municipalities were affected by the earthquake. Within eight hours of the earthquake, injured and dead people were located and pulled out of the rubble, and all operational forces from the affected areas were engaged and operated. On the same day, national Civil Protection Intervention Units, police, military, fire department, Mountain Rescue Service, Red Cross, and HCPI experts arrived on-site from other parts of the country. The camp and base of operations of the operational forces were soon established, the sectorisation of the affected area was made, and damage assessment began. In the first 14 days, more than 2,500 rescuers (members of the National Civil Protection Intervention Unit, firefighters, Mountain Rescue Service members from 19 stations, 300 employees and volunteers of the Croatian Red Cross, ambulance teams, police officers, members of the Croatian Army and other persons from the utilities) worked in the field and a total of about 1,700 civil engineers assessed the damage to the facilities. Approximately half of the engineers were mobilized, while the other half were gathered around the then-informal platform HCPIĆ. In addition, the key activities that were being carried out were the care of people and their placement in stable facilities (Power Point presentation of the Directorate of Civil Protection of the Ministry of the Interior).

After considering the scale and consequences of the earthquake, especially considering the latter, the Government of the Republic of Croatia, at its session held on 4 January 2021, adopted the Decision on the declaration of disaster in the area affected by the earthquake for all areas covered by the first and second earthquakes (Government of the Republic of Croatia). Activities in the immediate post-disaster response phase continued and planning of activities in the post-disaster recovery

and reconstruction phase began. The Ministry of Physical Planning, Construction and State Assets has foreseen short-term and long-term goals: »a) Short-term goals – rapid reconstruction of buildings which have lost their minimal earthquake resistance ability taking into account their original date of construction, in order to protect the health and lives of the users of these buildings, but also passers-by; b) Long-term goals – protection of the historical urban totality of the city, total reconstruction of public purpose buildings and culturally protected historic buildings, programs for total reconstruction of the urban totality of the City of Zagreb« (Uhlir 810).

The Government of the Republic of Croatia determined the activities that needed to be carried out within the framework of urgent, medium-term and long-term measures. The emergency measures concerned security, disposal, accommodation and emergency operations. Medium-term measures include the development of a quality legal framework for reconstruction, damage inventory and the establishment of a Reconstruction Fund. Long-term measures include activities to secure funds and the necessary international financial assistance for reconstruction, while simplifying procedures for citizens (Government of the Republic of Croatia). First, the Law on the Renovation of Earthquake Damaged Buildings in the City of Zagreb, Krapina-Zagorje County and Zagreb County was adopted September 2020^Ć, which was later extended, after the second earthquake, to Sisak-Moslavina and Karlovac Counties (Croatian Parliament), and the Programme of Measures for the Renovation of Earthquake Damaged Buildings (Government of the Republic of Croatia) was adopted, the Fund for the Renovation of Earthquake Affected Areas (Fund for the Reconstruction of the City of Zagreb, Krapina-Zagorje County and Zagreb County) was established, significant funds from the European Union Solidarity Fund and a loan from the World Bank and certain European Union banks (Government of the Republic of Croatia and World Bank; Government of the Republic of Croatia) were secured. The basic principles of implementation of post-disaster recovery and reconstruction are also defined, as follows: Sustainable revitalization – through the revitalization of affected areas of investment, it is necessary to focus on areas where economic development can be stimulated; Resilience – related to investments in structural and non-structural measures; Assistance to vulnerable populations and people in need – the reconstruction process should focus on the well-being of the entire community, addressing the needs of different segments of society, the economic sector and local entrepreneurs, especially those social groups that are particularly vulnerable; Coordination and coherence in approach – all short, medium and long-term goals must be complementary and aligned with sectoral reform programmes as well as development plans at national, regional and local levels; Monitoring and evaluation – the recovery process should be monitored in view of the achieved goals and timelines, in consultation with the affected communities and groups (Government of the Republic of Croatia and World Bank).

It is logical that the implementation of measures and activities in the post-disaster recovery and reconstruction phase requires significant time, coordination, and communication, and it will take years to achieve the planned goals. All this is indisputable, but there is always the possibility of working faster and more effectively for the benefit of citizens and society as a whole. In the next unit we will consider certain processes that could have been undertaken more quickly and efficiently.

Discussion

This unit is directly connected to the previous one and builds upon the four frameworks that were introduced and explained there. Here, this section discusses each of these frameworks in greater detail.

The first part of the discussion focuses on the framework that outlines Croatia's approach to earthquake risk. The risk of earthquakes is recognized in national assessments and plans, and is part of activities from the local, through the regional to the state level, as well as part of relevant procedures in different sectors. Although aware of the risk of earthquakes, the state of affairs is not at the required level. Atalić et al. believe that »the Republic of Croatia is among the most earthquake-prone countries in Europe, yet the current activities related to the assessment of potential earthquake risk and its reduction in particular can be characterized as individual and insufficient. For instance, there are currently several existing and ongoing disaster risk assessments in Croatia (conducted by various authors that apply different approaches) and few isolated individual initiatives, which is confusing for the general public and makes the activities aimed at reducing negative impacts aggravating« (Atalić et al. 944). The same authors further state that »Inadequate building inventories are recognized as the main obstacle to reliable seismic risk assessment in Croatia. The situation is additionally complicated by characteristic problems such as widespread illegal construction, undocumented reconstructions and renovations and the lack of some critical attributes such as those related to specific local construction practices, age of the building stock and critical infrastructure facilities, poor system organisation, lack of funding, etc. Despite the often overlooked approach deficiencies and incompatibility of the results, all existing hazard risk assessment studies clearly point to earthquakes as one of the biggest risks for the Republic of Croatia, with possible catastrophic consequences« (ibid). All of the above points to the assumption that destructive earthquakes can very likely »further impair the fragile economic stability of the country, additionally increase current migration trends and, finally, put in jeopardy the social and political fabric of the country« (Calvi et al. in Atalić et al. 944). The **initial findings** highlight a pronounced disparity between Croatia's acknowledgment of earthquake risks and its practical efforts to address them. Although earthquakes are recognized as one of the three most critical risks (alongside floods caused by inland water spills and forest fires), the measures imple-

mented to mitigate these risks remain inadequate. While national assessments and plans formally include earthquake risks, and activities are carried out at local, regional, and state levels across various sectors, the execution of these measures is fragmented, lacking both coordination and a comprehensive, unified approach.

The second part of the discussion is related to the state of organisation of the system that is in charge of reacting to major accidents and disasters. Although the previous unit stated that Croatia has an established civil protection system for prevention, preparedness and reaction to all natural and technological risks and consequences of major accidents and catastrophes, it is necessary to consider the state of the said system. In the 2019 *Disaster risk assessment for the Republic of Croatia*, a document adopted by the Government of the Republic of Croatia, special attention was given to assessing the readiness of certain parts of the civil protection system. In the field of preventive activities, a total of six areas were considered and assessed according to the following: Development of sectoral strategies, normative regulation and the development of assessments and plans of importance for the civil society system – high preparedness; Development of national early warning systems, international exchange of information – high preparedness; State of awareness of individuals, members of vulnerable groups, management and responsible bodies – low preparedness; Assessment of the state of spatial planning, development of spatial and urban development plans, planning land use – high preparedness; Assessment of the fiscal situation and its perspectives – low preparedness; Prevention area – low preparedness. In the field of reactive actions, five areas were considered and assessed in total: Readiness of responsible and management capacities – low readiness; Readiness of operational capacities – high readiness; Civil protection GIS and other sources and databases – low readiness; State of mobility of operational capacities of civil protection systems and communication capacities – high readiness; Area of response – high readiness. Concluding that the preparedness of the overall civil protection system for disaster risk management (prevention area) and for saving all categories of social values exposed to adverse impacts in disasters (response area) is assessed to be low (Government of the Republic of Croatia 171-177). Another official document assesses the ability to manage the analysed risks in Croatia, the *Assessment of Risk Management Capability for the Republic of Croatia*. In this document, »the lowest average rating is the ability to manage earthquake risks. According to the first national disaster risk assessment, earthquakes are a high risk, i.e., they belong to the group of unacceptable risks. Nevertheless, due to the rare occurrence of catastrophic earthquakes, the system is relatively neglected. There is no body in whose jurisdiction the risk of earthquakes lies, there is no unified management of funds to reduce the risk of earthquakes, and the answer is in several sectors« (National Protection and Rescue Directorate 56). The **second finding** of this analysis is such that regardless of the existence of a system dealing with all issues of prevention and reaction to risks and their consequences, key stakehold-

ers of this system – the Government of the Republic of Croatia and the central state administration body responsible for civil protection affairs – assess and evaluate it with a low level of readiness and a fragmented consideration of earthquake risk. The stated insight, which represents the official assessment of the most responsible institutions in the country for this area and is not prominently highlighted in public, shows us that there is a significant gap between expectations and the current state of system preparedness. This reality must be taken into account when evaluating the effectiveness of the earthquake response.

The third part of the discussion is connected to the time in which the earthquakes occurred. In 2020, Croatia faced a series of complex and demanding challenges simultaneously. Among these were its first-ever presidency of the Council of the European Union during a period of deep structural crisis, marked by the United Kingdom's withdrawal from the EU and Turkish President Recep Tayyip Erdogan escalating tensions by pushing refugees and migrants toward Europe. Additionally, several state-owned strategic companies, including INA (a key oil company), were targeted by intense cyber-attacks. At the same time, the global COVID-19 pandemic emerged, exposing Croatia's vulnerabilities as the country recorded some of the world's worst rates of daily confirmed cases and deaths per 100,000 people. This is a mitigating circumstance when considering and analysing the effects of local and state institutions on the earthquake, as all institutions and most experts were already significantly engaged in other activities. But an aggravating circumstance is that Croatia has an extremely large and inefficient public administration, as well as too many local and regional self-government units that have responsibilities for preparing and responding to major accidents and disasters, but most of them do not have sufficient capabilities and resources to act. In addition, Croatia has never developed an integral and effective crisis management system, so the civil protection and disaster response mechanisms were visibly assessed and evaluated by the Government of the Republic of Croatia and central state administration body responsible for civil protection affairs. Also, Croatia has never built an effective public-private-academic partnership in which everyone would work together on the key risks that the state and society face. This should have been resolved by the adoption of the *Law on Homeland Security System* (the Law was adopted in 2017) and the establishment of the Homeland Security System, which was supposed to be a platform of cooperation of all actors in the country and support for the Government in crisis situations (Law on Homeland Security System). However, the Act in question and the Homeland Security System were not activated either in response to the COVID-19 pandemic or for the needs of activities in the phases of immediate post-disaster earthquake 2020 response and post-disaster recovery and reconstruction. The **third finding** is that regardless of certain mitigating circumstances in the context of times and other events when the earthquakes occurred, Croatia has structural and substantive challenges in organizing crisis management and using already available and established mechanisms.

The fourth part of the discussion is related to the consideration of key measures and activities undertaken in the phases of immediate post-disaster response and post-disaster recovery and reconstruction. In the *Results* unit, we have seen the most important activities undertaken, but for the purposes of this research, those that have been listed sufficiently reflect what has been and is still being undertaken. Numerous activities were undertaken, but the general assessment of the media, professional and interested public, academic sector and a large part of the operational forces themselves was that all activities were delayed at all stages. All of the above was particularly evident in the example of the second earthquake. In the immediate post-disaster response phase, the first responders at both locations were volunteers who organized themselves and arrived at the affected locations to help the affected population. These volunteers could broadly be divided into two groups: the first group consisted of skilled professionals, such as engineers who performed damage assessments and provided technical expertise, while the second group included volunteers engaged in clearing debris and providing physical assistance. Although well-intentioned, this influx of volunteers proved to be partial and counterproductive in the first hours and days of the response. The large number of vehicles they arrived in caused traffic jams and bottlenecks, which hindered the swift passage and manoeuvring of organized rescue services.

The next important thing, although the Government of the Republic of Croatia, the central state administration body responsible for civil protection affairs, other state bodies, as well as local and regional self-government employees in the affected areas tried to communicate and give information about the events and the situation on the ground, all of them were not sufficiently visible in the media space, and their crisis communication as a function of crisis and disaster management did not come to light. Thus, the momentum of direct communication with citizens, who have largely monitored, created and exchanged information themselves, has been lost and a certain mistrust of all official institutions has been created.

An example of insufficient organisation on all levels of government is also shown by the fact that it took them several weeks to set up the distribution of hot meals (although dry meals began to be distributed immediately), and this space was filled by volunteers who prepared hot meals on their own, as well as donated food for all the earthquake-affected residents during the second earthquake and operational forces on the ground. This situation has shown that in the example of the second earthquake, local and regional self-government does not have the capacity or sufficient capabilities to respond independently to most needs in these situations and is directly dependent on state support. Therefore, there is also a need to reorganise such a system and approach according to the risks that can be caused by major accidents and disasters.

In addition, Croatia is a highly bureaucratic state, and attempts are being made to resolve this through law. The first earthquake occurred on 22 March 2020, but the

Government, as the drafter and proposer of the Law regulating the process and the manner of reconstruction, which was adopted only in the autumn of the same year, with the Government failing to draft it and propose it to Parliament during the spring and summer when it was still in session, already decided to first call the elections, to see who would win those, and after deal with this topic afterwards. Fate wanted the same political party to be the one to form a majority in the Government during the earthquake and the one that passed the law after the summer recess. This manoeuvre has caused a significant time until the Law was passed to be missed, which could have been used for the rehabilitation of the terrain after the first earthquake. At the stage of the reaction to the second earthquake, the Government itself recognized a number of structural and substantive challenges within a number of systems that need to address the primacy, preparedness and response to major accidents and disasters (Government of the Republic of Croatia and World Bank).

One of the key moments in the immediate post-disaster response phase following the second earthquake was the decision not to activate the Civil Protection Headquarters of the Republic of Croatia. This decision significantly shaped the course of the response and defined the overall direction of the reaction. It has already been said that Croatia is a highly bureaucratic state, which is particularly prominent in security issues and in response to events of national significance. The situation is similar to the reaction to major accidents and disasters. In the case of events that have national significance, the situation is reviewed and managed through the Civil Protection Headquarters of the Republic of Croatia, which then gives guidelines and instructions to all competent departments for their actions. After the earthquake on 29 December 2020, the Headquarters was not convened, nor did it manage the reaction, but all services acted according to their powers, although without strategic coordination between them. This has also led to some of the challenges mentioned earlier. The situation was resolved only after six days when the Government, at its session held on 4th January 2021, adopted the Decision on the declaration of disaster in the area affected by the earthquake for all areas covered by the first and second earthquakes, and formed a new Headquarters with the task of eliminating the consequences of the disaster caused by the earthquake in the areas of Sisak-Moslavina, Zagreb and Karlovac counties (Government of the Republic of Croatia).

The phase of post-earthquake disaster recovery and reconstruction itself was marked by a number of challenges that significantly slowed down all activities, while progress in the years after the first earthquake has been very slow. There are a few things we can single out for this occasion. The first is the lack of procedures for recording and reporting damages; the second is the slowness of public institutions in collecting, recording and evaluating citizen applications; the third the lack of a legal and programmatic framework developed after the earthquake, the fourth is a public quarrel lasting several months between the heads of the ministry in charge of reconstruction and the Reconstruction Fund on who is in charge of which part of the

work. All of the above has made a strong impression on the general public, especially those affected by both earthquakes, that there is a lack of cooperation, coordination and communication at all levels, that public institutions are too slow to solve most of the challenges, and that reforms are necessary at all levels, which have not happened. The **fourth finding** of this research is that, regardless of the awareness of the risk of an earthquake and its catastrophic consequences, exposure to the earthquake risk and the great possibility of an earthquake occurring, Croatia has not made sufficient preparation of systems, institutions, procedures, experts and all citizens to cope with these.

Conclusion

Research has confirmed that earthquakes are one of the most challenging and complex natural challenges and disasters that cause multifaceted and cascading effects both in the affected area and for the state as a whole. Consideration of the earthquake risk itself, preventive and reactive actions require a constant commitment of the entire society and competent institutions from the local to the national level, because the consequences of the earthquake far outweigh the investments aimed at reducing and mitigating its consequences. The research focused on the qualitative research of the Croatian case study with a focus on the analysis of the actions of local and state institutions in the phases of immediate earthquake post-disaster response and post-disaster recovery and reconstruction. Croatia is extremely exposed to the risks of earthquakes on most of its territory and therefore the initial assumption was that it should invest significant resources and political import into this area. However, the analysis showed that regardless of the normative coverage, when this area is investigated in-depth, there is limited knowledge about the overall awareness, actions, responsibilities and activities of the competent institutions related to reducing and mitigating the risk of earthquakes.

Regarding the immediate earthquake post-disaster response and post-disaster recovery and reconstruction, it is evident that the Government and other responsible institutions have taken numerous actions and measures to save lives, care for victims and enable restoration and reconstruction. There has been no breakdown of authority, exploitation of catastrophes for unlawful acts by individuals or groups, neglect of certain parts of the country or groups of people, but the impression remains that many things could and should have been done faster and more efficiently with a greater level of coordination and communication between the operational forces and with citizens. When we look at the overall picture of Croatia, its possibilities, capabilities and limitations, we conclude that the immediate earthquake post-disaster response and post-disaster recovery and reconstruction corresponds to the level of investment, attention and systematic approach that has been invested in the area. So, the answers to the state of the system, knowledge and

resources should not be sought in the present time but in the previous thirty years during which Croatia has become an independent country and had the opportunity to shape its institutions, processes and procedures.

Finally, it is necessary to answer the main research question, which reads: After the 2020 earthquakes in Croatia: What lessons should be identified and learned? Part of these answers can be found in the findings in the previous unit, while part of them will be related to the recommendations provided here. Findings and recommendations are in direct connection. Regarding the first finding, which established that Croatia recognizes the risk of earthquakes as one of the three unacceptable risks, practice shows that it does not do enough to comprehensively reduce this, therefore we recommend a significant shift in the approach to this topic at all levels and in all sectors. Much more attention needs to be paid to research, assessments, structures and non-structural measures to reduce and mitigate the risk of earthquakes and its consequences. The second finding showed that Croatia has a system that deals with all issues of prevention and reaction to risks and their consequences – although it has been framed between different organisations and sectors – the assessment of its readiness is low. Concerning this part, we recommend that in Croatia, regardless of the fact that it does not have large financial capacities, it is necessary and realistically possible to do more by better organisation, greater specialization, more significant use of EU funds, more efficient cooperation of all actors of Croatian society. The third finding is that regardless of certain mitigating circumstances in the context of times and other events when the earthquakes occurred, Croatia has structural and substantive challenges in organizing crisis management and using already available and established mechanisms. The recommendation for this part refers to the need to determine what kind of system of response to major accidents and disasters Croatia wants, the need to complete the crisis management system, and the necessity of investing significant funds in knowledge, education and training of experts in this field at all levels. Most often, we check the actions of operational forces, but this is not necessary because they act almost daily on their jobs, and we almost completely neglect the education and training of decision-makers who are most often unprepared for the challenges they have to face. This is also related to the fourth finding of this research that, regardless of the awareness of the risk of an earthquake and its catastrophic consequences, exposure to the earthquake risk and the great possibility of an earthquake occurring, Croatia has not done sufficient preparation of systems, institutions, procedures, experts and all citizens to cope with these. Concerning that, we recommend that the 2020 earthquakes are viewed as an opportunity to reorganize and reconstruct numerous systems and their procedures that we should not fail to use. We all know who is responsible for initiating reforms and improving the situation.

The final thought of this analysis goes in the direction of how the research identified numerous situations that provide the possibility and needs primarily in Croa-

tia, as well as in countries that are able to learn from others' experiences, to change the situation together for the better.

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One of the authors of the analysis has spent 16 years in various positions within the security sector of the Republic of Croatia (Armed Forces, police, central state administration body responsible for civil protection affairs) prior to his academic career. In the field of civil protection, he performed various duties from operational and tactical to strategic levels. From 2008 to 2010 he was the Head of the State Operational Centre of Civil Protection, and from 2012 to 2015 the Commander of Civil Protection of the Republic of Croatia. This provides him with a deeper insight into the strengths and weaknesses of the entire security system of the Republic of Croatia, and specifically civil protection.

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