ESPON

EUROPEAN UNION

Co-financed by the European Regional Development Fund

Inspire Policy Making with Territorial Evidence

APPLIED RESEARCH SPIN-OFF //

SUPER – Sustainable Urbanization and Land-use Practices in European Regions

Croatia - Spin-off

Annex IIb – Technical Report // April 2021

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Abbreviations

EMS	European macroseismic scale
ERDF	European Regional Development Fund
ESPON	European Spatial Planning Observation Network
EU	European Union
GDP	Gross Domestic Product
GVA	Gross Value Added
HAZU	Croatian Academy of Sciences and Arts
HNK	Croatian National Theatre
ISPU	Physical planning information system
IT	Information Technology
ITI	Integrated Territorial Investments
MCS	Mercalli-Cancani-Sieberg scale
OG	Official Gazette
RDNA	Rapid Damage and Needs Assessment
RES	Renewable energy sources
SUPER	Sustainable Urbanization and land-use Practices in European Regions

Executive summary

The ESPON SUPER project produced evidence on how to promote sustainable urbanization and land use in European regions. Among other activities, 11 case studies were carried out, including one for Croatia. This results and policy recommendations of the project were then bundled for decision makers and policy makers in the SUPER *Guide to Sustainable Urbanisation and Land use*. In order to evaluate the ability to implement these recommendations and to increase the national, regional, and local relevance and application of ESPON's evidence in policy processes and developments at different scales, a SUPER spin-off was created to conduct new research at the request of the Croatian Ministry of Physical Planning, Construction and State Assets. This study seeks to apply the results and recommendations of the SUPER project, particularly the Guide, to post-earthquake reconstruction in Croatia.

A first step in the process was to understand the territorial and institutional context. This was done by performing a literature review of legal, academic, and other sources, including the SUPER Croatian case study. In addition, quantitative research was conducted to describe and understand the main socio-economic, territorial, and morphological land-use transformations occurring over the last two decades. Using SUPER data on land use, a series of maps, tables and charts were produced that display the socio-territorial transformation of the country and identify key trends. This analysis revealed, for example, that Croatia faces serious demographic, economic and environmental, and land-use challenges, but also that the study area generally has a more favourable territorial development with respect to the country as a whole. Together with Ministry officials, key actors from different sectors and planning levels were identified as potential interview partners.

The main work of the Croatian spin-off study focused on the development of the legal and financial framework for reconstruction planning after the March 2020 earthquake in Zagreb and December 2020 earthquake in Petrinja. The first earthquake hit the Croatian capital, resulting in enormous damage to vital public services and public institutions. The damage area of the first earthquake includes the City of Zagreb, Krapina-Zagorje County and Zagreb County, which coincides with the area of Zagreb Urban Agglomeration, established for the implementation of the Integrated Territorial Investment (ITI) mechanism. The overall process of reconstruction is complex and therefore a customized legal framework was needed to provide the best response. The process of post-earthquake reconstruction is managed by the Act on the Reconstruction of Earthquake-damaged Buildings in the Territory of the City of Zagreb, Krapina-Zagorje County and Zagreb County. During the development of this study, in late December 2020, a new, even stronger earthquake occurred in nearby Sisak-Moslavina County (Petrinja) with devastating effects. As the study was in its final stages, in February 2021, the Act on Reconstruction was amended to include new affected area after the second earthquake. This new Act was not included in the study due to territorial differences (rural, underdeveloped, etc.) and the fact that the interviews had already been conducted. However, the recommendations should apply to the newly affected area as well.

The Act on the Reconstruction of Earthquake-damaged Buildings was not developed to manage land management or development process, but to provide financial and management framework for the post-earthquake reconstruction process. The Act is not directly related to spatial planning but to rehabilitating buildings. The renovation of damaged buildings itself will deal with the immediate problem, but the wider environmental, social and economic issues in urban areas remain unresolved, as this is the task for spatial and strategic planning. Given that the Act was recently adopted and the reconstruction process has only just begun, its effectiveness can only be seen after some time. On the basis of similar events in the EU in the past, reconstruction can be time-consuming.

This spin-off resulted in numerous conclusions and recommendations for integrating sustainable urbanisation and land-use instruments for future natural hazards. To ensure resilience and preparedness, both pre-event as well as post-event recommendations are provided. These were drawn up by linking together general recommendations of the ESPON SUPER project, the conclusions derived from the Croatian case study and the insights gained from the conducted interviews (five in-depth interviews and one multi-sector focus group). These recommendations are structured as a list of potential interventions and policies for decision makers and policy makers at the national and local levels.

For national decision makers on the national level, the research offered the following recommendations: (1) adapt a legal framework to support reconstruction, (2) strive for better coordination of the spatial and strategic planning system, (3) ensure a stable financial mechanism for post-earthquake reconstruction, (4)

identify financial resources for a broader process of integrated urban revitalisation, (5) promote coordination during post-earthquake reconstruction and revitalisation process, (6) bolster political will in multilevel governance and to (7) establish a more efficient framework to manage cultural heritage and cultural assets. Policy makers on the national level were urged to: (1) promote knowledge transfer and capacity building and (2) engender cooperation and coordination between sectors.

For decision makers at local and county level, the study produced the following recommendations: (1) promote long-term post-earthquake reconstruction planning through integrated urban revitalisation, (2) think multidimensional, (3) adopt an integrated approach in decision-making and (4) strengthen the participative approach in urban development projects. For policy makers at the local and regional levels, the study gave the following suggestions: (1) adapt spatial plans, (2) conduct continuous and efficient land management, (3) rehabilitate neglected and illegal areas to create resilience, (4) improve hazard resistance of public and private buildings and spaces, (5) assure safety as priority, (6) focus on plan implementation for post-earthquake reconstruction and integrated urban revitalization, (7) implement interventions that ensure the sustainability of urbanisation and land-use, (8) apply good practices regarding green infrastructure and circular management of buildings and spaces, (9) strive for densification and regeneration, (10) preserve cultural heritage and (11) ensure public participation of citizens and private stakeholders during the post-earthquake reconstruction process and integrated urban revitalisation.

Many urban areas in Europe, especially in the Mediterranean areas, could learn a lot from this case study. Earthquakes are infrequent, unpredictable, so they are often not seriously considered during urban development planning. But when they do happen, they cause great physical damage as well as undermine urban functions and services. It is therefore important to emphasize at the EU level the need to strengthen resilience to earthquakes and other natural hazards in order to preserve sustainable urbanisation and sustainable land-use.

1 Introduction

The ESPON Sustainable Urbanization and land-use Practices in European Regions (SUPER) project provides recommendations on how sustainable land use can be promoted and unsustainable urbanization can be avoided, reduced and/or compensated in Europe. More in particular, the project:

- provided a conceptual framework to understand urbanization and land-use dynamics;
- gathered and analysed evidence on urbanization and land-use developments within the ESPON space in the 2000-2018 period;
- gathered and analysed evidence on policy interventions, including EU policies, and their relative success and sustainability;
- gathered and analysed evidence on how interventions affect land-use practices through case study research within a wide diversity of territorial contexts;
- drew up a comprehensive sustainability assessment framework and applies this to three urbanization scenarios for 2050 (compact, polycentric, and diffuse).

1.1 Aim and scope of the spin-off

This SUPER spin-off study was conducted at the request of the Ministry of Physical Planning, Construction and State Assets of the Republic of Croatia. The original intent was to integrate the knowledge presented in the *SUPER Guide to Sustainable Urbanization and Land Use* in their policymaking. Croatia was already a location of one case study during the SUPER project implementation. That case investigated the effect of the Protected Coastal Area (PCA) within the Physical Planning Act on development practices; the case study report can be found on the ESPON website as Annex 3.7.

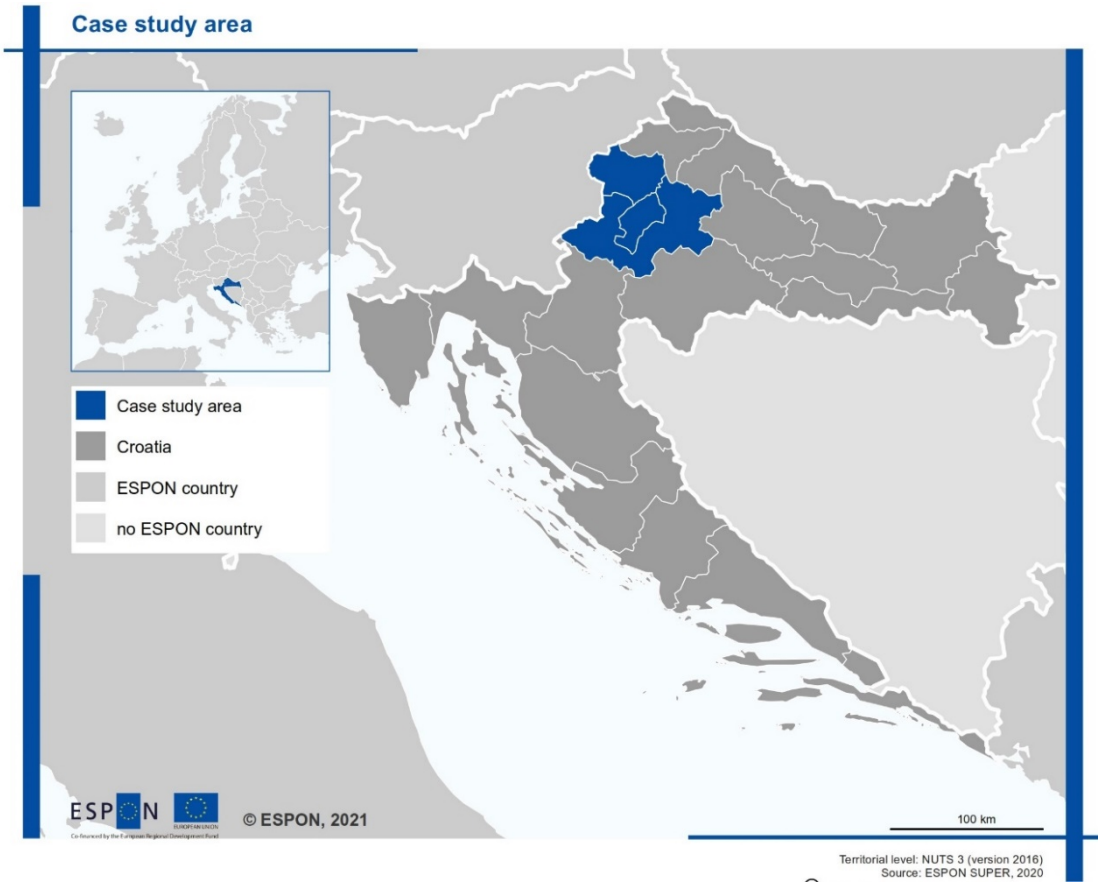
In the meantime, in 2020 the area of Central Croatia was hit by a devastating earthquake (5.5 on the Richter scale) which caused great damage to Zagreb and its surrounding counties as well as Krapina-Zagorje. The rebuilding process will be guided by the new Act on the Reconstruction of Earthquake-damaged Buildings in the Territory of the City of Zagreb, Krapina-Zagorje County, Zagreb County, Sisak-Moslavina County and Karlovac County. This comprises as one of the most important acts affecting the urbanization of Croatia's capital and its environs. At the initiative of the Ministry of Physical Planning, Construction and State Assets of the Republic of Croatia, the spin-off research activities were shifted towards this Act. As a result, the primary goal of this spin-off became more implementation-oriented: the provision of guidance and recommendations to support the implementation of the Act while promoting a more sustainable use of land. The main policy questions identified by Croatian representatives were:

- What does the current Croatian land use look like?
- Which externalities play a significant role in the Croatian context?
- Do the interventions regarding earthquake reconstruction adequately address sustainable urbanization and land-use aspects?
- Which interventions hold potential to promote sustainable land use at the regional and local level?
- How could the national programmes 'green infrastructures in urban areas' and 'circular economy of spaces and buildings' provide added value towards sustainable urbanization and land-use?
- What lessons can be drawn from interventions put in place elsewhere at various territorial levels?

The study area within this SUPER spin-off is the area affected by the post-earthquake reconstruction process in Croatia: the City of Zagreb, Zagreb County and the Krapina-Zagorje County (Map 1.1). These areas were included in the first version of the Act on Reconstruction of Earthquake-damaged Buildings in the Territory of the City of Zagreb, Krapina-Zagorje County and Zagreb County following the 2020 Zagreb earthquake. Unfortunately, during this project lifetime, in late December 2020, another devastating earthquake (2020 Petrinja earthquake) hit the area of Sisak-Moslavina and Karlovac County (two counties south of the case-study area). In February 2021, the Reconstruction Act was amended into the Act on the Reconstruction of Earthquake-damaged Buildings in the Territory of the City of Zagreb, Krapina-Zagorje County, Zagreb County, Sisak-Moslavina County and Karlovac County (Official Gazette, 102/20, 10/21).

The area of the amended Act has different spatial structure than the first (more rural and sparsely populated), but the approach to the reconstruction process was the same. Due to the considerable differences in spatial structure, this study only focused on the area affected by first earthquake. Still, the recommendations should be valid for both areas and could be extended to other earthquake affected areas in Europe.

Map 1.1
The scope of study area



Source: authors' own elaboration

The overall report is structured in eight sections:

- *Section 1 – Introduction, aim and scope*
- *Section 2 - Methodology* – approach taken (steps, objectives, activities and outputs);
- *Section 3 - Definition of needs and priorities* – how the research aims were identified;
- *Section 4 - Sustainable land-use trends and perspectives* – territorial analysis of urbanization and land-use trends of the study area since 2000 using ESPON SUPER data;
- *Section 5 - Institutional context* – description of the spatial planning system and institutional factors in the study area (planning actors, responsibilities and main instruments that have impact on post-earthquake reconstruction process);
- *Section 6 – Overview of land-use changes and policy orientations* – a qualitative overview on the urbanization processes based on expert opinion, intervention analysis and a literature review;
- *Section 7 – Selecting interventions from the SUPER Guide* – filters out examples, lessons and warnings within the ESPON intervention database and Guide and links this to the spin-off's aims;
- *Section 8 - How to achieve sustainable urbanization* – reviews lessons learned and elaborates policy recommendations.

2 Methodology

Based on the protocol drawn up to test and apply ESPON SUPER outputs in selected European contexts (Annex 1), this section outlines the main activities conducted for developing the Croatian spin-off.

2.1 Steps and objectives

The methodological analysis consists of different phases and activities (Figure 2.1).

Step 1 – Definition of territorial policy needs and priorities

Objective: identification of territorial and policy needs and priorities as precondition for the application of the SUPER guide.

STEP 2 – Qualitative and quantitative analysis

Objectives: exploration of the institutional context; elaboration of quantitative data analysis, analyses of ESPON SUPER guide and interventions database

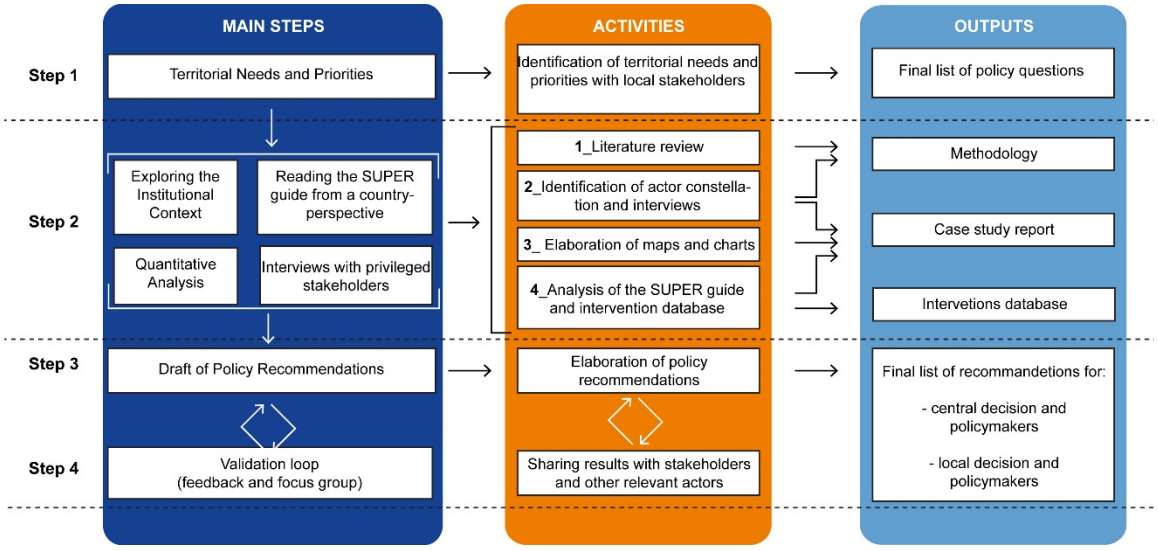
Step 3 – Elaboration of recommendations: Identify solutions

Objectives: to identify and set up recommendations in line with policy needs and priorities identified in Step 1. The recommendations are a synthesis of: (i) government policy requirements and suggestions; (ii) qualitative and quantitative data indications; (iii) lessons learned and pitfalls derived from a critical understanding of SUPER Guide and intervention database; (iv) a combination of key opinions and suggestions of key actors. The recommendations concern not only the Croatian case, but all earthquake-affected areas in Europe.

Step 4 - Final set of recommendations: Understanding transferability potentials and pitfalls

Objective: together with the project support team, the recommendations were validated to guarantee coherence and consistency with expectations, country ambitions and institutional settings. This final step was performed via a dedicated focus group workshop organised on 5 March 2021.

Figure 2.1
Methodological protocol



Source: authors' elaboration

2.2 Main activities conducted

Each step foresees the implementation of a series of operative activities.

2.2.1 Step 1 - Identification of main territorial needs and priorities

Between May and July 2020, the ESPON EGTC, the service provider and the Ministry of Physical Planning, Construction and State Assets of the Republic of Croatia identified a series of policy objectives to be further investigated during the research activity, which started officially in September 2020. Based on the agreement made, the objective of the Croatian spin-off was the analysis of the sustainability of the reconstruction process of the earthquake that hit Zagreb and Central Croatia in March 2020. The results should be valid for the study area as well as other earthquake-affected area in Europe. In late December 2020, a new earthquake occurred and new areas were integrated into post-earthquake reconstruction policy, but this area was not included in the analysis since the damage and needs assessment was ongoing. Still, the recommendations should be valid for the new earthquake-affected areas as well.

2.2.2 Step 2 - Qualitative and quantitative analysis

Literature review

The analysis of the urbanization process and post-earthquake reconstruction process within the study area started with an overview of the institutional context. The review consisted of:

- an analysis of the main literature available, such as book chapters, articles, conference papers and statistical data;
- an analysis of the ESPON COMPASS country reports on Croatia as well as the SUPER case study report. This comprised the starting point for understanding the institutional framework of the spatial planning and territorial governance system;
- Analysis of regulations, act and amendments concern land use in the counties, as well as strategic documents that have an impact on the topic;
- A discussion with main actors concerning the model of the post-earthquake reconstruction process conducted in Croatia.

The result of this activity is included in Section 5 of this report – Exploration of the institutional context.

Identification of stakeholders' constellation and interviews

Together with the Ministry of Physical Planning, Construction and State Assets, service provider identified key stakeholders from different sectors and planning levels. The definition of stakeholders' constellation has been carefully conducted in order:

- have a heterogeneous sample – aiming at presenting a multiplicity of voices and evidence;
- have a balanced point of view (public servants, private experts etc.)
- cover different of post-earthquake reconstruction levels (from central to local)

The Ministry and service provider agreed on the final list of potential interviewees. The results of the interviews are reported in Section 6 of this report. The interviews have been conducted using an interview protocol (see Table 2.1).

Table 2.1
Interview protocol and list of questions

Interview Protocol
Part A – Spatial planning actors and responsibilities
Who are the main actors at the national, regional and local level in Croatia that have the power to address (sustainable) urbanization within the framework of earthquake reconstruction?

Interview Protocol
Are there additional actors directly or indirectly responsible for spatial planning at the national level with respect to post-earthquake redevelopment? If so, what kinds of responsibilities do they have?
Are there additional actors directly or indirectly responsible for spatial planning at the regional and local level with respect to post-earthquake redevelopment? If so, what kinds of responsibilities do they have?
Part B – Post-earthquake reconstruction instruments
What are the main instruments for post-earthquake reconstruction at the national, regional, and local level in Croatia (laws, spatial planning)? What role do they play in the promotion and management of sustainable urbanization processes during post-earthquake reconstruction?
Are there other noteworthy documents, strategies or sectorial programmes at the national, regional or local level with evident spatial implications. If so, which ones and why?
Do the bodies involved in planning of post-earthquake reconstruction adequately address sustainable land use? If yes, how?
Part C - State of art and policy orientations
Do you think that land use in Croatia (specifically in the study area: City of Zagreb, Zagreb County and Krapina-Zagorje County) has been sustainable so far? Why? What are the main drivers acting against sustainable urbanization?
According to your experience, have all dimensions of sustainability (e.g. economic, social, environmental, temporal and institutional) been adequately addressed by post-earthquake reconstruction planning in Croatia? If not, why?
Based on your experience, is there something that can or should be done differently?
Which kind of priorities (e.g. containment, densification, regeneration) should the country prioritize in order to achieve more sustainable urbanization trends within the scope of post-earthquake reconstruction (please, in your answer take into account all dimensions of sustainability- environmental, economic, social)?
How and through which kind of instruments (e.g. visions and strategies, regulations and laws, spatial plans, incentives' programmes or *ad hoc* projects) should sustainable land use be addressed with respect to post-earthquake reconstruction?
Do you have any examples of successful interventions promoting sustainable urbanization and land use in Croatia?
Do you have any examples of unsuccessful intervention, or of interventions deliberately counter to sustainable urbanization and land use in Croatia?
What are the main improvements and lessons learned regarding the promotion of sustainable urbanization?
What are the lessons learned during the process of post-earthquake reconstruction that could be integrated in sustainable land use and urbanization in the future?

Source: authors' elaboration

Elaboration of maps and charts

Parallel to the institutional analysis, a series of quantitative analyses were conducted to present the main socioeconomic, territorial and morphological transformations occurring since 2000. Based on data collected in the SUPER project, a series of maps, tables and charts were produced that display the socio-territorial transformation of the study area. The results are presented in Section 4.

Elaboration of the Intervention database

As a result of desk-research and interviews, this spin-off study identified 13 interventions that somehow deal with the sustainability of post-earthquake reconstruction process in Croatia. Interventions were selected on the basis of their impact on sustainability of land-use. Four methods of data collection were employed: (1) inputs provided directly by the Croatian Ministry of Physical Planning, Construction and State

Assets, (2) an analysis of the ESPON SUPER and COMPASS national project reports, (3) suggestions provided during the interviews, (4) literature review and targeted searching. The fourth method provided the most results, while the third method provided additional important information necessary to fill in the gaps and to evaluate the aspect of sustainability.

The research also focuses on interpreting the SUPER Guide and intervention database from the perspective of Croatian post-earthquake reconstruction. The objectives are: (i) to highlight if the country land-use developments are in line with the main European trends; (ii) to select a preliminary set of examples – both interventions and instruments that can be useful to be considered; (iii) identify a series of potentials and warnings. The results are presented in Section 7 of this report. This has been particularly helpful for identifying recommendations and suggestions for promoting sustainable land use.

The 13 selected interventions were grouped according to:

- **Basic information**: (1) Name of the intervention, (2) Year (or time frame), (3) Location, (4) Country, (5) Scale (on the basis of NUTS classification), (6) Type(s) of EU territory involved (Urban, Rural, Functional area, Costal area, Mountain region, Peripheral border, Cross-border, scarcely populated, Other), (7) Urban typology (if urban: Monocentric, Polycentric, Dispersed, Linear, Coastal);
- **Characteristics**: (1) Intervention inspired by the EU (Yes/No), (2) Type of intervention (Densification; Containment; Regeneration of unused/problematic sites; Governance; Sectoral Policy – Transport; Sectoral Policy – Environment; Sectoral Policy – Rural development; Side effects) (3) Type of instrument (Legal device, Land-use regulation, Strategy, Programme, Project), (4) Status (Statutory and mandatory, Statutory and non-mandatory, Non-statutory), (5) Level of coercion (Non-binding; Self-binding; Binding for public actors; Binding for all actors);
- **Effects**: (1) Side effect versus direct impact, (2) Description (scope and goals), (3) Description (how it works), (4) Degree of success with respect to the intervention's goal, (5) Degree of success with respect to sustainable urbanization (6) Temporal sustainability: does the intervention prevent economic, social or environmental costs from being passed on to future generations? (7) Thematic sustainability: does the intervention advance values in the economic, social or environmental dimension without sacrificing those in other dimensions? (8) Institutional sustainability: is the intervention financially and politically sustainable over time? (9) Implementation quality with respect to traditional evaluation criteria (is the intervention efficient – extent to which resources are well-spent, effective - extent to which goals were achieved, and relevant - for identified needs and problems?).

Finally, the number of interventions identified were assessed according to a list of sustainability indicators identified by ESPON SUPER. The objective of this assessment is to show that interventions that address land use can be heterogeneous but none of them is either fully sustainable or unsustainable per se.

2.2.3 Step 3 - Elaboration of recommendations: Identify solutions

SUPER guide and intervention database analysis

This spin-off applies the SUPER guide and database to a specific country. The objectives are: (i) to highlight if the country's development is in line with the main European trends; (ii) to select a preliminary set of examples of interventions that can be useful for the elaboration of recommendations (iii) to identify opportunities and warnings. The results are presented in Chapter 7 of this report - Analysis of the *SUPER Guide to Sustainable Urbanization and Land Use*. This exercise was helpful to craft and select recommendations and suggestions for promoting sustainable land use. This analysis resulted in the selection of 25 salient interventions from the SUPER intervention database.

2.2.4 Step 4 - Final set of recommendations: Understanding transferability potentials and pitfalls

For the purposes of testing and discussing the policy recommendations an online focus group was conducted on 5 March 2021. Participants had the opportunity to express their opinion and advance proposals for modification and adjustments. Their valuable feedback was integrated into the final version.

3 Definition of needs and priorities

On 22 March 2020, one day before the national lockdown due to COVID-19, two massive earthquakes hit the area of Central Croatia, with the epicentre in Markuševac near Zagreb. The strength of the first earthquake measured 5.5 on the Richter scale and the intensity as VII on the MCS scale. The strength of the second earthquake was 5.0 on the Richter scale, occurring only 40 minutes after the first. Over the next few months, over 1,000 smaller earthquakes occurred. The earthquake that hit the City of Zagreb, Krapina-Zagorje County and Zagreb County caused enormous damage to private and public property (Government of the Republic of Croatia, 2020a).

The process of reconstruction is complex and therefore a legal framework was needed to provide the best response. In the Fall of 2020, the Act on the Reconstruction of Earthquake-damaged Buildings in the Territory of the City of Zagreb, Krapina-Zagorje County and Zagreb County (Official Gazette, 102/20)[1] was adopted as well as many linked documents and sub-acts. This intervention and its effect on the sustainability of urbanization and land use is the focus of this Croatian spin-off project. A secondary focus was put on the integrated urban revitalization during the post-earthquake reconstruction.

3.1 The earthquake and its damage

On March 22, 2020, at 6:24 AM local time, seismologists from the Seismological Service of the Republic of Croatia recorded a very strong earthquake with the epicentre in Markuševac near Zagreb (Map 3.1). The magnitude of the earthquake was 5.5 on the Richter scale, and the intensity of the epicentre was VII on the MCS scale (Mercalli-Cancani-Sieberg scale). The earthquake was felt throughout Croatia. The earthquake caused significant damage throughout the Central Croatia. At 7:01 AM local time, a subsequent earthquake of 5.0 followed. Many residents left their homes despite the cold weather, but still managed to adhere to social-distancing measures recommended by the Croatian Institute of Public Health due to the COVID-19 epidemic. One person died and 26 were injured. Over the next month, the same area was hit by over 1,000 minor earthquakes.

The earthquake zone coincides with the area of the Zagreb Urban Agglomeration. Due to the earthquake on 22 March 2020, the City of Zagreb declared '*a state of natural disaster - an earthquake'* on 23 March for the area of the City of Zagreb. On 24 March, Krapina-Zagorje County declared '*a state of natural disaster - an earthquake'* for the area of the City of Donja Stubica and the Municipality of Gornja Stubica, while Zagreb County declared '*a state of natural disaster - an earthquake*' for the municipalities of Jakovlje, Luka, Klinča Sela, Orle, Križ and Stupnik and the cities of Sveti Ivan Zelina, Sveta Nedelja and Velika Gorica. On 27 March, Zagreb County declared '*a state of natural disaster – an earthquake*' for the municipalities of Bedenica, Bistra, Brdovec, Brckovljani, Dubrava, Dubravica, Farkaševac, Gradec, Krašić, Kravarsko, Kloštar Ivanić, Marija Gorica, Pisarovina, Pokupsko, Preseka, Pušća, Rakovec, Rugvica and Žumberak, and for the cities of Dugo Selo, Ivanić-Grad, Jastrebarsko, Samobor, Vrbovec and Zaprešić.

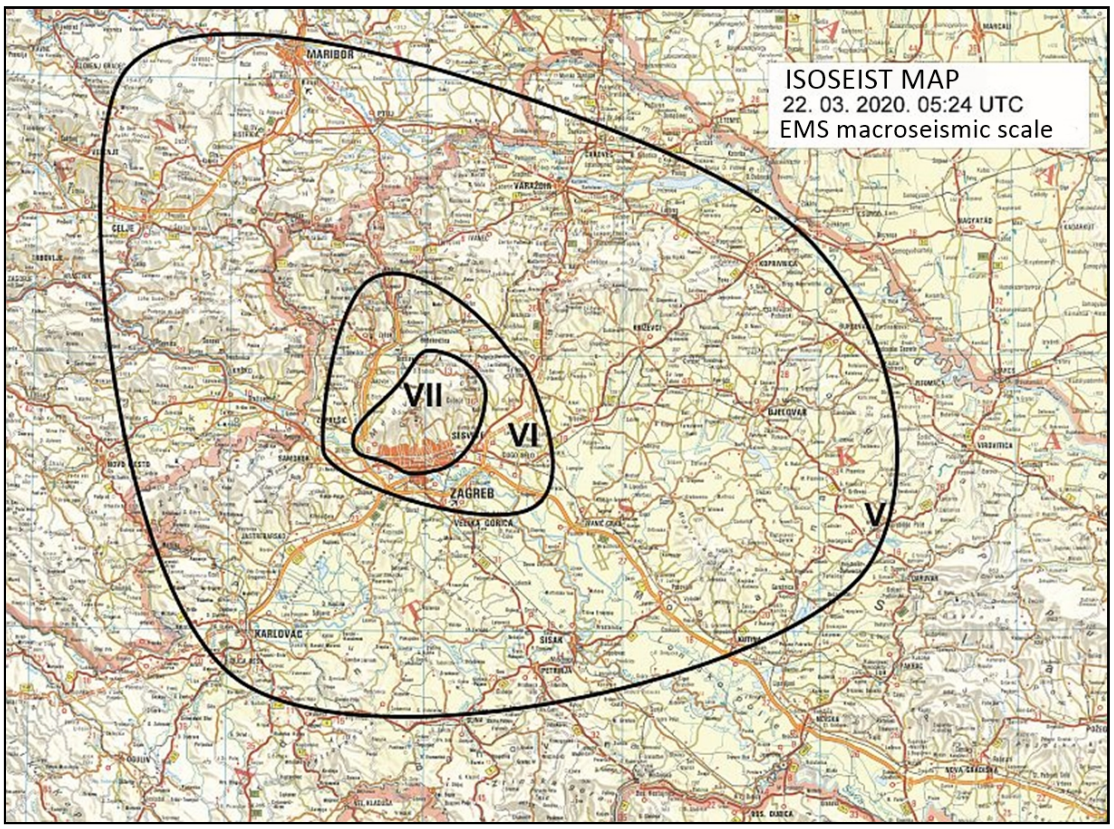
Most of the damaged buildings are located in the city centre of the City of Zagreb. Residential buildings were damaged, as well as buildings of great importance for cultural heritage. The damage from the earthquake is great and structural. Substantial damage was incurred to major state institutions (the building of the Croatian Parliament and the Government) and the functioning of hospitals was limited or impossible. The earthquake caused significant damage to most buildings in the historic urban area of the City of Zagreb (Government of the Republic of Croatia, 2020a).

Given the extent of the damage, a significant share of hospitals, schools, kindergartens, theatres, churches, museums, apartment buildings and family homes would have to be demolished. Long intervals between catastrophic earthquakes (the last was in 1880) make it easy to forget the need for appropriate

[1] The area affected by the second earthquake was not included in the case study since it occurred during the analysis and because it has considerable differences in spatial structure. Nevertheless, the recommendations should be valid for both areas since the approach to post-earthquake reconstruction process is steered by the same Act and principles – the Act on the Reconstruction of Earthquake-damaged Buildings in the Territory of the City of Zagreb, Krapina-Zagorje County, Zagreb County, Sisak-Moslavina County and Karlovac County (OG 102/20, 10/21).

reinforcement of buildings for earthquakes. The aseismic construction of new and renovation of old buildings is now one of the important priorities of the future (The first Programme of measures for the reconstruction of buildings damaged by the earthquake in the City of Zagreb, Krapina-Zagorje County and Zagreb County (Official Gazette, 119/20).

Map 3.1
Earthquake intensity map (isoseismal map – EMS scale) which coincides with the area of the Zagreb Urban agglomeration



Source: Government of the Republic of Croatia, 2020a

In late December 2020, Croatia was struck again, this time even worse. On 28 December 2020, only nine months after the first event, two strong earthquakes hit the area of the City of Petrinja (approx. 50 km southeast of Zagreb) with a magnitude of 5.2 (06:28 AM) and 5.0 (07:49 AM) on the Richter scale respectively. The next day, the same area was hit by another devastating earthquake of 6.2 on the Richer scale at 12:19 PM (local time) (intensity of VIII-IX per EMS scale) (Seismographic Service within Geophysics Department of the Faculty of Science, 2020). Seven people died and many were injured. The damage was shocking: images of collapsed buildings were broadcast throughout the world. Rapid Damage and Needs Assessment commenced, and the first reports showed colossal damage. Although the 2020 Petrinja Earthquake is highly relevant, due to the ongoing damage assessment process and the timeframe with respect to this research, it was excluded from the analysis. Still, interviewed stakeholders replied on the topic of both earthquakes and the necessity of coordinating actions and interventions.

3.2 Approach to post-earthquake reconstruction

Post-earthquake reconstruction is a long-term process that includes the first responses to save lives, preparation of emergency housing, damage assessment, preparation of measures, development of remediation and reconstruction plans, implementation of material damage remediation, reconstruction of buildings (for cultural heritage detailed restoration included) and seismic reinforcement of buildings to reduce the consequences of future potential earthquakes (a measure to strengthen resilience).

Immediately after the 2020 Zagreb Earthquake, rapid damage and needs assessment commenced (RDNA) (Table 3.1). Damage assessment is the first step of the RDNA process on the basis of the usability of affected objects/property:

- N1 – Unusable due to external influence – High possibility of the collapse of major parts of neighbouring buildings. Not recommended to stay in such a building.
- N2 – Unusable due to damage – High possibility of collapse of major parts of the damaged building. Not recommended to stay in such a building.
- PN1 – Temporarily unusable (whole or part) – Detailed examination required. The building has moderate damage and is in no danger of collapse. The load-bearing capacity of the building is partially impaired. It is not recommended to stay in the building, so citizens stay in such a building at their own risk. A construction expert makes recommendations to eliminate hazards.
- PN2 – Temporarily unusable and requires emergency intervention measures (usable after short-term interventions). The building has moderate damage without the risk of collapse. It cannot be used due to a potential danger of collapse of certain elements of the building itself. The construction expert identifies emergency intervention measures and gives instructions to users. Until the measures are implemented, the building or parts of it is not usable.
- U1 - Usable without restrictions - The building can be used. The building has no damage or has little damage that does not pose a danger to the load-bearing capacity and usability of the building.
- U2 – Usable with recommendation - the building may be used in accordance with the intended purpose, except in certain parts where there is an immediate danger to a part of the building. The construction expert gives recommendations for the removal of hazards and recommendations regarding temporary restriction of residence to certain parts of the building. Once the danger has been removed, the building can be used without restrictions (Government of the Republic of Croatia, 2020a).

According to the methodology of the Faculty of Civil Engineering in Zagreb, about 25,000 buildings were inspected and marked, and an estimate was made in the following table.

Table 3.1
Damage assessment (August 2020)

Category	City of Zagreb	Krapina-Zagorje County	Zagreb County	Total
Unusable (red label)	1,272	28	11	1,311
Temporarily unusable (yellow label)	4,814	53	29	4,896
Usable (green label)	14,992	328	470	15,790

Source: The first programme of measures for the reconstruction of buildings damaged by the earthquake in the City of Zagreb, Krapina-Zagorje County and Zagreb County, OG 119/20

After the RDNA process, in order to structure and organize the reconstruction of earthquake-damaged areas (which includes the entire area of the Zagreb Urban Agglomeration), the Act on the Reconstruction of Earthquake-Damaged Buildings in the Territory of the City of Zagreb, Krapina-Zagorje County and Zagreb County (Official Gazette, 102/20) and the First Programme of Measures for the Reconstruction of Buildings Damaged by the Earthquake in the City of Zagreb, Krapina-Zagorje County and Zagreb County (Official Gazette, 119/20) were prepared and adopted. In October 2020, the Fund for the Reconstruction of the City of Zagreb, Krapina-Zagorje and Zagreb County was established. The role of the Reconstruction Fund will be to perform professional and other tasks of preparation, organization, and implementation of the reconstruction of buildings damaged by the earthquake and monitoring the implementation of the Programme of reconstruction measures. In September 2020, the Expert Council for Reconstruction was es-

tablished, which performs advisory and, if necessary, other tasks related to professional issues in the implementation of the Act on Reconstruction.

As stated, at the end of 2020, another major earthquake hit the area of Sisak-Moslavina and Karlovac County. To include this area into legal framework, amendments were made in February 2021 resulting in the new name: Act on the Reconstruction of Earthquake-damaged Buildings on the Territory of the City of Zagreb, Krapina-Zagorje County, Zagreb County, Sisak-Moslavina County and Karlovac County (Official Gazette, 102/20, 10/21). In late February 2021, the First Programme of Measures was also amended to cover the newly affected area. Again, as stated, the focus of this spin-off is only on the Act on the Reconstruction of Earthquake-Damaged Buildings in the Territory of the City of Zagreb, Krapina-Zagorje County and Zagreb County (Official Gazette, 102/20) and its effects on sustainability of urbanization and land use at the earthquake-affected area (which coincides with the Zagreb Urban Agglomeration).

3.3 Urban revitalization

Many European cities (especially those cities affected by transition from a state to free market system) are facing problems of urban decline. Urban space is a 'living tissue' that is constantly changing due to numerous factors such as technological progress, demographic change, the need for residential and commercial space, the development of architectural styles, etc. Just like any living organism, urban space experiences birth, growth, and decay. Urban decay does not only have negative morphological or structural elements, but also entails negative socio-economic, cultural, and economic processes. More specifically, there is demographic decline, a change in demographic structure, socio-economic decline and a loss of attractiveness for economic investment. In order to avoid the final scenario of complete decay and decline of urban space, it is necessary to implement measures of urban revitalization.

In Croatia, there are areas that once had intensive economic or social functions, but today are experiencing severe challenges. After World War II, the City of Zagreb and its environs experienced intensive urban, economic and demographic development, which is why today there is a large number of areas which require integrated urban revitalization (especially brownfield areas). This need is recognized by the Zagreb Urban Agglomeration Development Strategy (2017), the main strategic document for the area of agglomeration which consists of the City of Zagreb and the parts of the Zagreb County and Krapina-Zagorje County. The spatial scope of the urban agglomeration is coincidentally also the area affected by the 2020 Zagreb Earthquake. However, the need for urban reconstruction, renovation, regeneration, and revitalization was a 'hot' topic many years before the catastrophic event.

Before the earthquake, many authors emphasized the necessity of revitalization of the historic urban fabric of Zagreb. Jukić et al (2020) stressed the same need following the 2020 Zagreb Earthquake, and offered a model for managing the process of urban revitalization. The steps are the following:

- Return of residents to their original homes as soon as possible;
- Return of pupils and students to educational institutions;
- Renovation and rehabilitation of buildings along public-transport lines so that the public transport can function normally;
- Complete arrangement and reconstruction of all public buildings of national interest (e.g. HNK, University, Cathedral, HAZU, Museum of Arts and Crafts);
- Renovation of all public buildings;
- Restoration of the narrowest part of the historic core (the area of the centre of the Lower and Upper Town);
- Reconstruction of buildings along the pedestrian zone in the city centre visited by most tourists (tourist promotion for economic activity of tourism).

The idea of integrated urban revitalization is in line with the principle of sustainability, which is emphasized throughout the Croatian legal system, especially in the acts and documents connected with strategic and spatial (physical) planning. Specifically, the principle of sustainability is well integrated in Act on the System of Strategic Planning and Development Management of the Republic of Croatia (Official Gazette, 123/17), which steers national the strategic planning system, and through the Physical Planning Act (OG 153/13, 65/17, 114/18, 39/19, 98/19), which steers the national spatial (physical) planning system. Every spatial plan, strategic document or other type of document linked to these topics must integrate measures

for achieving sustainability of spatial development. As the top-hierarchy document in Croatia, the *National Development Strategy until 2030* sets the first development pathway as 'Sustainable economy and society'. Another important strategic direction is 'Green and digital transition' which, among the other aspects, promotes the need for sustainable land management, including the need for brownfield regeneration, green infrastructure and nature-based solutions, circular management, renewable energy sources, ecological awareness, climate neutrality, local food producing and many other sustainable concepts. The full overview of strategic and planning framework is included in Section 5.

Brownfields in many Croatian cities offer great potential for urban renewal and regeneration. The Zagreb Urban Agglomeration Development Strategy (2017) recognized this potential and encourages the revitalization of brownfield areas through measure '*3.4.3. Restoration of brownfield sites'*. To assist brownfield revitalization, the City Office for Strategic Planning and Development of the City developed the publication 'The Overview of brownfield areas of Zagreb Urban Agglomeration' (City Office for Strategic Planning and Development of the City, 2020). Consequently, 84 sites comprising 529.24 ha were identified as brownfield sites and/or neglected areas within the Zagreb Urban Agglomeration. Given this basis, the following priorities have been set:

- Location is well or excellently located in terms of location in the settlement, visibility and accessibility to major traffic routes, importance for protection, restoration and sustainable use of cultural heritage;
- Location has the potential to attract more visitors and users, therefore, its renovation would catalyze revitalization of a wider contact area (improve the quality of life, local and regional growth and development);
- Location requires an urgent intervention in the form of pollution reduction or removal/stabilization of ruined structures that pose potential hazards;
- Proposed projects should achieve smart and innovative approaches to urban regeneration, support local creativity and social inclusion and/or demonstrate the principles of green building and implement solutions that support nature (such as green infrastructure and Nature-Based Solutions);
- Future land use is well programmed and spatially elaborated, and meets the development needs established by the acts of strategic planning;
- Proposed projects envisage activities to mitigate gentrification risks, weakening of social cohesion and negative demographic trends.

Interest in the renovation of brownfield sites is confirmed by the fact that by 2020, a large part of ITI funding was earmarked for this activity. However, this was not guided according to any structured strategic plan, rather it was focused on individual objects whose renovation was co-financed by EU funds or private capital (ITI mechanism in Zagreb Urban Agglomeration). There is an obvious lack of a planned approach to urban renewal and planned revitalization of brownfield areas. Planned and structured brownfield revitalization is important from a broader aspect of urban renewal. It is a process that includes physical reconstruction and renovation of buildings and urban spaces, factors of general economic, socio-economic, social and environmental development. It is necessary to take into account the wider conditions that generate urban stagnation such as economic transitions (4th industrial revolution driven by the IT sector), urban lifestyles, dilapidation of buildings, neglect of housing (often related to the socio-economic consequences of deindustrialization), changes in the use of existing buildings, economic unsustainability of urban areas or housing, conversion and introduction of new facilities in brownfield locations and modernization of infrastructure. Jukić et al (2020) emphasized that integrated urban revitalization in the Zagreb Urban Agglomeration can be considered through the objectives of designing city centres, rebuilding neglected areas, improving housing conditions, solving traffic problems, building new public facilities, strengthening urban identity, circular management and the application of SMART solutions.

Before the COVID-19 pandemic and during the beginning of Croatian Presidency of the Council of EU, Croatian policy makers, headed by the Ministry of Physical Planning, Construction and State Assets and supported by the Faculty of Architecture Zagreb, started the drafting of two national programmes that address important spatial policies: the National Programme for the Development of Circular Management of Space and Buildings for the period of 2021-2030 and the National Programme for the Development of Green Infrastructure in Urban Areas for the period 2021-2030. These two programs were developed in

accordance with the guidelines of the European Union and based on knowledge gathered by the ESPON programme. The idea that prompted their development is to open opportunities for financing and to promote sustainable urbanization and land-use in both urban and rural areas. The need for these programmes was emphasized during the activities of the City of Zagreb in the Partnership on Sustainable Use of Land & Nature-Based Solutions within the EU Urban Agenda. These two concepts (green infrastructure and circular management of buildings and spaces) have a long tradition in Croatian spatial planning and they are integrated in many spatial plans, but the idea of these programmes is to structure the approach for preparing projects linked to this topics, as well as to develop a financial programme that would serve as an incentive for a more sustainable urbanization and land use.

The Programme for the Development of Circular Management of Space and Buildings aims to develop sustainable, inclusive, safe and resilient cities by encouraging the reuse of buildings and spaces, extending the durability of existing structures, defining construction guidelines according to the principles of circular economy, encouraging construction waste management (reducing construction waste, encouraging recycling), measures to increase energy efficiency, the use of renewable energy sources (RES) and the reuse of existing construction products and materials. The concept of circular management of space and buildings implies the reuse of built-up areas to preserve natural space and recycle urban resources. The basic guidelines for the development of circular space and building management projects are:

- Renovation of abandoned or neglected spaces and buildings, and extension of their durability;
- Planning of new buildings in accordance with the circular economy concept;
- Increasing the energy efficiency of buildings;
- Reduction of the amount of construction waste (Ministry of Physical Planning, Construction and State Assets, Faculty of Architecture, 2020).

In parallel with the development of this Programme, the Ministry of Physical Planning, Construction and State Assets, in cooperation with the Faculty of Architecture within the University of Zagreb, is in the process of developing a National Programme for Green Infrastructure in Urban Areas in 2021-2030, which aims to establish sustainable, resilient, pleasant and safe cities and municipalities in Croatia. It will create preconditions for a better quality of life and public health and contribute to sustainable social, economic and spatial development. According to the definition of the Green Deal (European Commission, 2019), green infrastructure is a strategically planned network of natural and semi-natural areas with other environmental features, designed and managed to provide a wide range of ecosystem services such as water purification, air quality, recreational space and adaptation and resilience to climate change. The network of green (land) and blue (river, lake, etc.) areas can improve environmental conditions, and thus the health and quality of life for citizens (Ministry of Physical Planning, Construction and State Assets, Faculty of Architecture, 2020)..

Both programs are in the process of being developed and are in a high stage of readiness. Stakeholders stressed the importance of integrating these programs into the earthquake reconstruction process, but also into future sustainable urban development and land use. Most cities in Croatia have problems with the lack of green infrastructure and public green areas, whose development is recognized as a national priority through the *National Development Strategy until 2030* (Government of the Republic of Croatia, 2020b). The issue of brownfield areas is highlighted in many Croatian cities, including the Zagreb Urban agglomeration. For most Croatian cities, this is both a problem and a potential for future development. This topic is highlighted in the Spatial Development Strategy (Spatial Development Strategy of the Republic of Croatia, OG 106/17) but also in the *National Development Strategy until 2030* (Government of the Republic of Croatia, 2020b). The need to revitalize brownfield areas and revitalize neglected and abandoned urban areas must be integrated with the needs of the post-earthquake reconstruction as they contribute to the regeneration of urban fabric and address many urban issues at the local and national level.

In addition to the need for revitalization of brownfield and derelict areas, the Zagreb Urban Agglomeration noted a significant lack of public green areas and excessive air pollution and heat islands (City Office for Strategic Planning and Development of the City, 2017). Green infrastructure offers a wide range of ecosystem services to this end, such as increasing air quality, creating space for recreation, as well as adaptation and resilience to climate change. Integrating green infrastructure into urban revitalization projects could have multiple benefits for the population and sustainability. Since the EU's focus in the new multiannual financial framework was put on green and digital transition, the Zagreb Urban Agglomeration should use the opportunity and integrate those measures to achieve more sustainable urbanization and land use.

4 Sustainable land-use trends and perspectives

Analysing the state of art of the Croatian land use (especially within the focus area of the City of Zagreb, Zagreb County and Krapina-Zagorje County) will allow us to identify the correlations and interrelations between the drivers of land-use change and the morphological transformation of urban structure. This is an important precursor for analysing the possible effect of post-earthquake reconstruction process on urbanization and land-use trends in future. Especially because no measurable changes can be seen from the post-earthquake reconstruction efforts, which have just begun. This section presents the main changes of Croatian land use, with a focus on the study area.

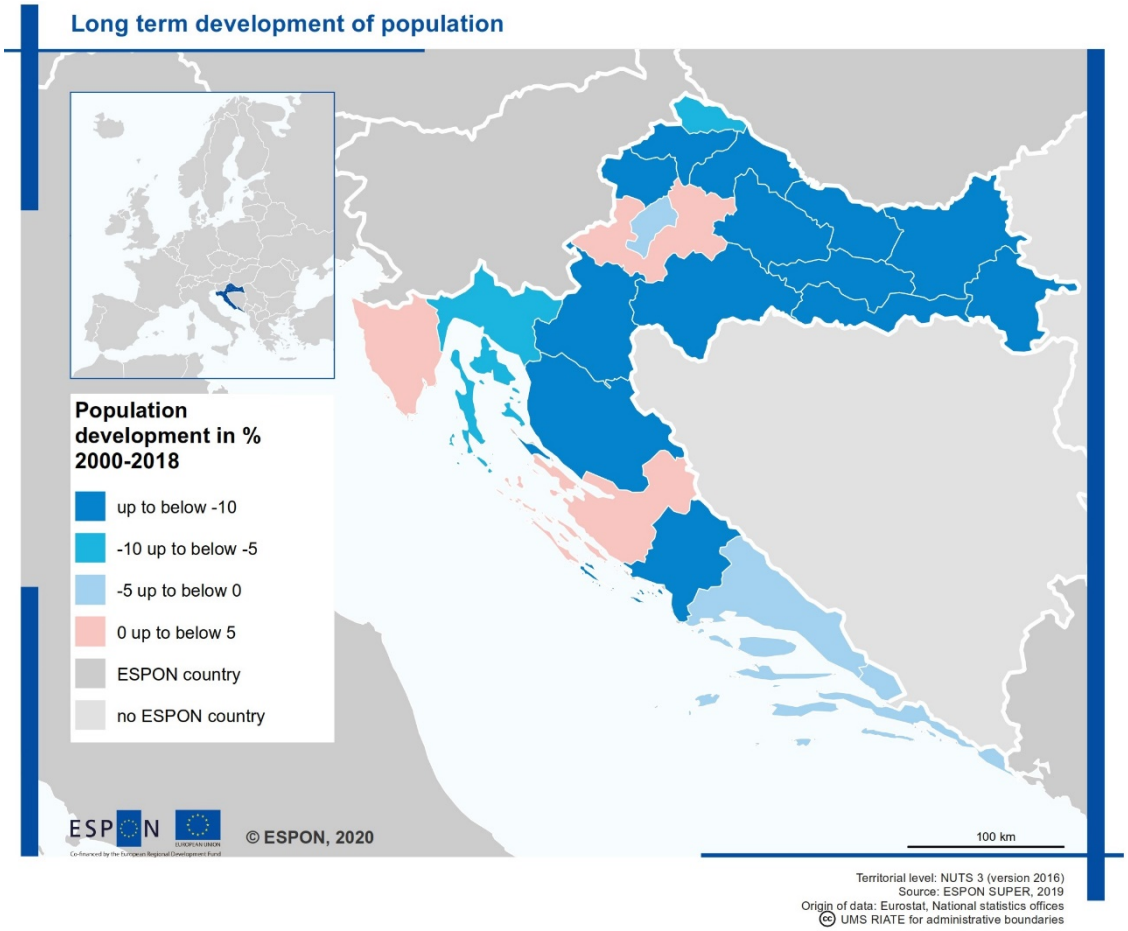
4.1 Structures and trends of drivers of land-use changes

Population change, level of economic growth and (un)employment are the main drivers that are used in this analysis. These drivers were identified as the most influential for sustainability of land-use and urbanization.

4.1.1 Population

Demographic fluctuations are one of the main drivers for land-use change. The population of Croatia is declining and ageing rapidly (see Map 4.1). The proportion of people over 65 years of age is rising, and the number of children and working-age population is falling (World Bank, 2019). Depopulation has been highlighted as an important national challenge (Government of the Republic of Croatia, 2020b). At the regional level (NUTS3), only three counties in Croatia have gained population (but no more than 4%): Zagreb County, Zadar County and Istria County. The study area has slightly better demographic indicators than other parts of the county, mostly due to the socioeconomic advantages of the capital city of Zagreb. Still, in the 2000-2018 period, the City of Zagreb experienced a slight population decline of -0.34%, while Zagreb County, the immediate suburban area surrounding the capital, grew by a modest 0.43%. This indicates demographic stagnation which, as we shall see, is caused by migration. Natural population change continues to indicate decline (World Bank, 2019), so the main type of demographic growth is due to migration (City Office for Strategic Planning and Development of the City, 2017). On the other side of the spectrum, Krapina-Zagorje County, located in the rural north of the capital (behind the mountainous area of Medvednica) had a strong population decline in the 2000-2018 period with -13.98%. This indicates strong depopulation, mostly in rural areas. According to 2011 Census records, the area of Zagreb Urban Agglomeration (smaller than the three county area) contains nearly a quarter of the Croatian population (Croatian Bureau of Statistics, 2011).

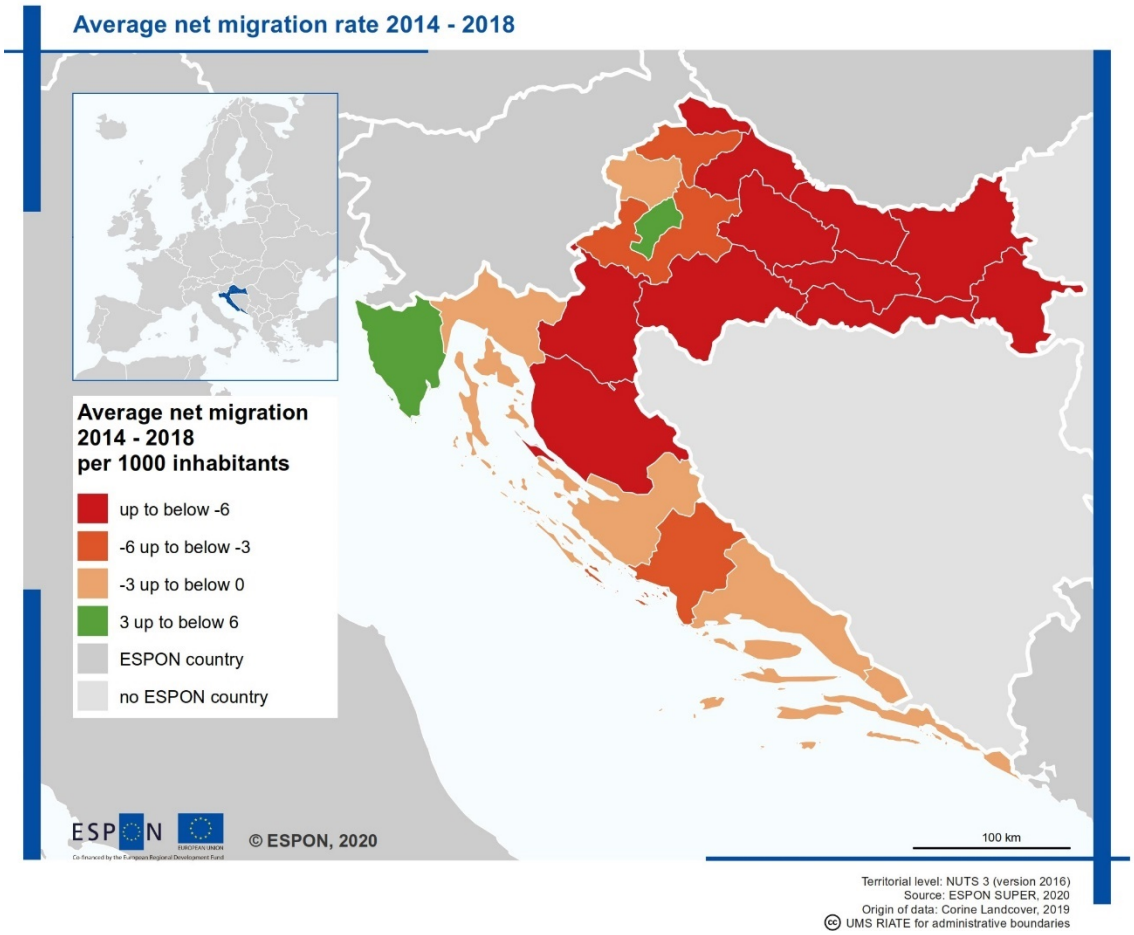
Map 4.1
Population change in Croatia in 2000-2018



Source: authors' elaboration

In addition to natural development, internal migration is an important factor. ESPON SUPER data collected information on average net migration rate during the 2014-2018 period. As seen in Map 4.2, only two counties recorded positive net migration rates: the City of Zagreb and Istria. The Croatian coast is highly influenced by tourism, while continental Croatia struggles with negative migration (Spatial Development Strategy of the Republic of Croatia, OG 106/17). Due to its economic growth and employment possibilities, the study area scores slightly better than other parts of continental Croatia (City Office for Strategic Planning and Development of the City, 2017). The City of Zagreb's average 3% net migration rate in 2014-2018 offsets its negative natural population change. It is mostly younger and working-age population who migrated (World Bank, 2019). On the other hand, Zagreb County experienced -3.5% net migration and Krapina-Zagorje County -2.9%. Migration directly affects the need for housing (City Office for Strategic Planning and Development of the City, 2015), and therefore impacts urbanization. The area of these three counties is also highly influenced by school and work commuting (City Office for Strategic Planning and Development of the City, 2017)..

Map 4.2
Average net migration rate 2014-2018 in Croatia

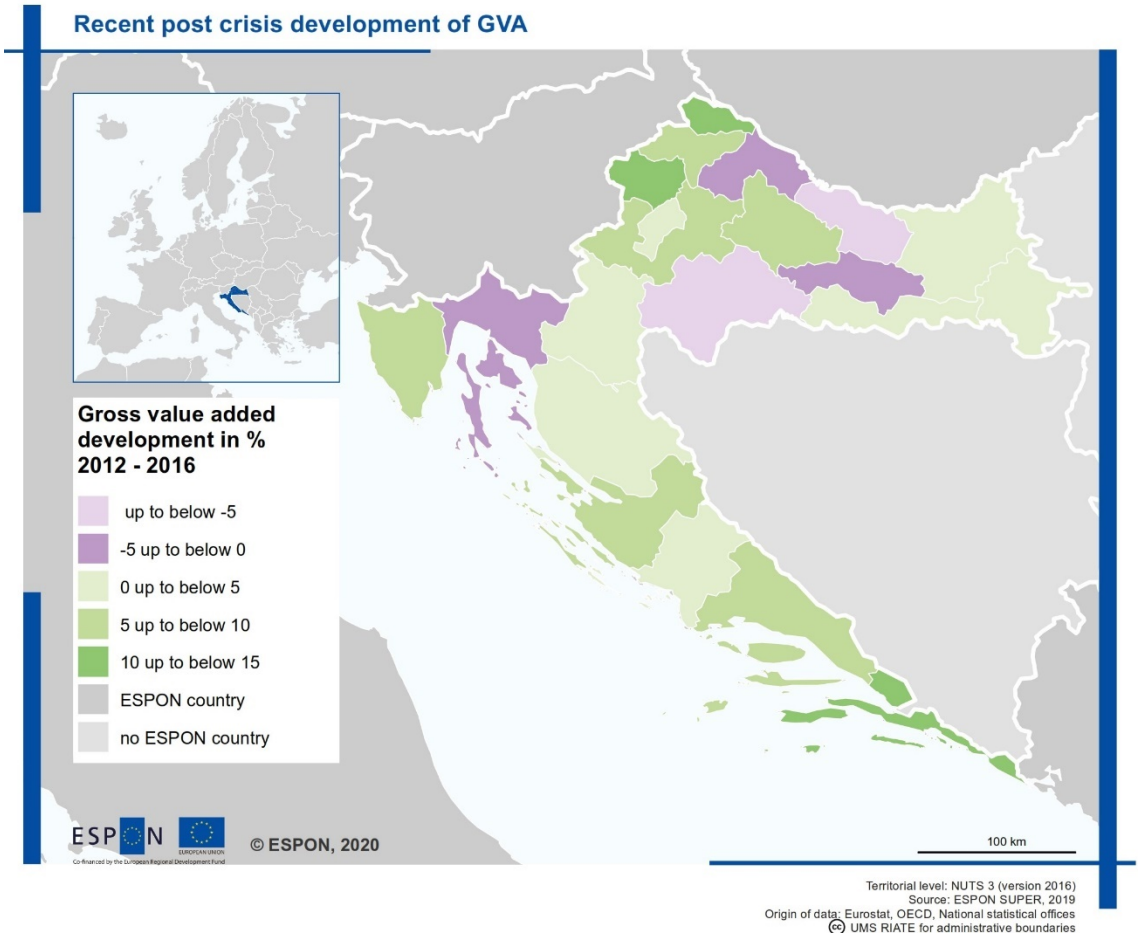


Source: authors' elaboration

4.1.2 Economy

One of the main drivers of urbanization is economic development, which creates demand for industrial areas, warehouse spaces, shops, offices, but also influences socioeconomic developments that drive housing demand (Arbaci, 2007). Based on postcrisis development of Gross Value Added (GVA), Croatia performed well compared to most European countries, thanks to tourist-sector growth and European Union membership in 2013. As the crisis hit the country differently, county performance in GVA is also diverse (see Map 4.3). Coastal counties and north-continental counties had very positive GVA development in 2012-2016, while Central Croatia decreased (mostly rural and agrarian counties marked by industrial decline). The study area was one of the most prosperous areas in this period. Krapina-Zagorje County had the best national results: a GVA increase of 13.7%. Zagreb County as a direct suburban area of the City saw an increase of 7.4%, while the City of Zagreb increased by 4.1%. The City of Zagreb is the strongest economic centre of Croatia, where nearly one third of national GDP is concentrated. According to the Zagreb Urban Agglomeration Development Strategy (2017), the main economic sectors of the study area are trade, manufacturing, building (construction sector) and agriculture. This analysis indicates positive economic indicators that helped attract population, and with it demand for urban uses.

Map 4.3
GVA development in Croatia in period 2012-2016 (post-2008-crisis)

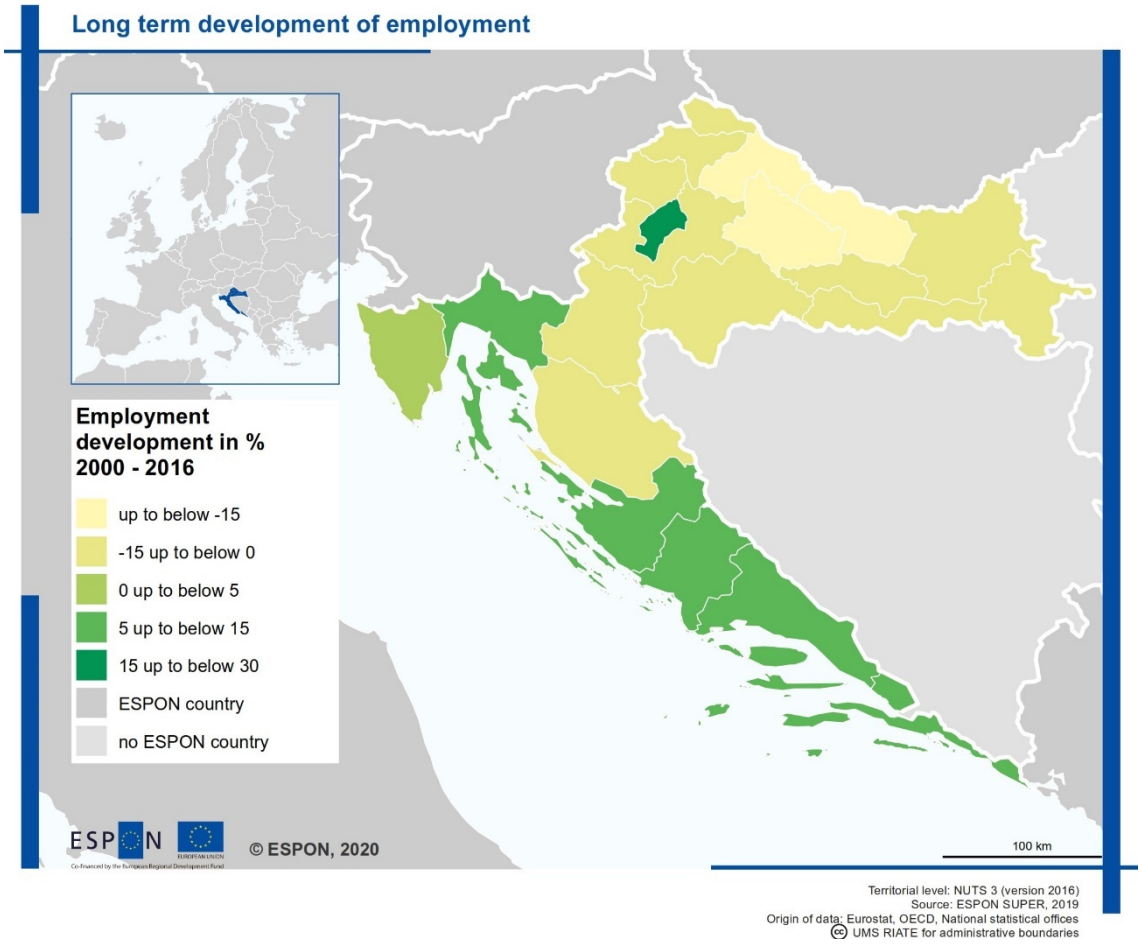


Source: authors' elaboration

4.1.3 Employment

Employment is one of the most important socioeconomic factors driving housing demand (Arbaci, 2007). In the 2000-2016 period, Coastal Croatia recorded the highest employment increases, due mainly to tourism and associated activities like construction and manufacturing (Spatial Development Strategy of the Republic of Croatia, OG 106/17), while Continental Croatia struggled with employment decline (see Map. 4.4). During this period, Zagreb saw the highest growth in employment with 17.0% more employed in 2016 than in 2000. In the same period, the number of jobs in Zagreb County shrunk by -3.5%, and in Krapina-Zagorje County by -2.8%. Most of Continental Croatia fared even worse, as jobs are affected by demographic trends. In the study area, population aging, especially in Zagreb, is noticeable. At the same time, pressure on the urban infrastructure and demand for jobs due to immigration is still increasing. This can be read in increased differences in population density of the Zagreb urban agglomeration area (City Office for Strategic Planning and Development of the City, 2017).

Map 4.4
Employment development in Croatia in 2000-2016



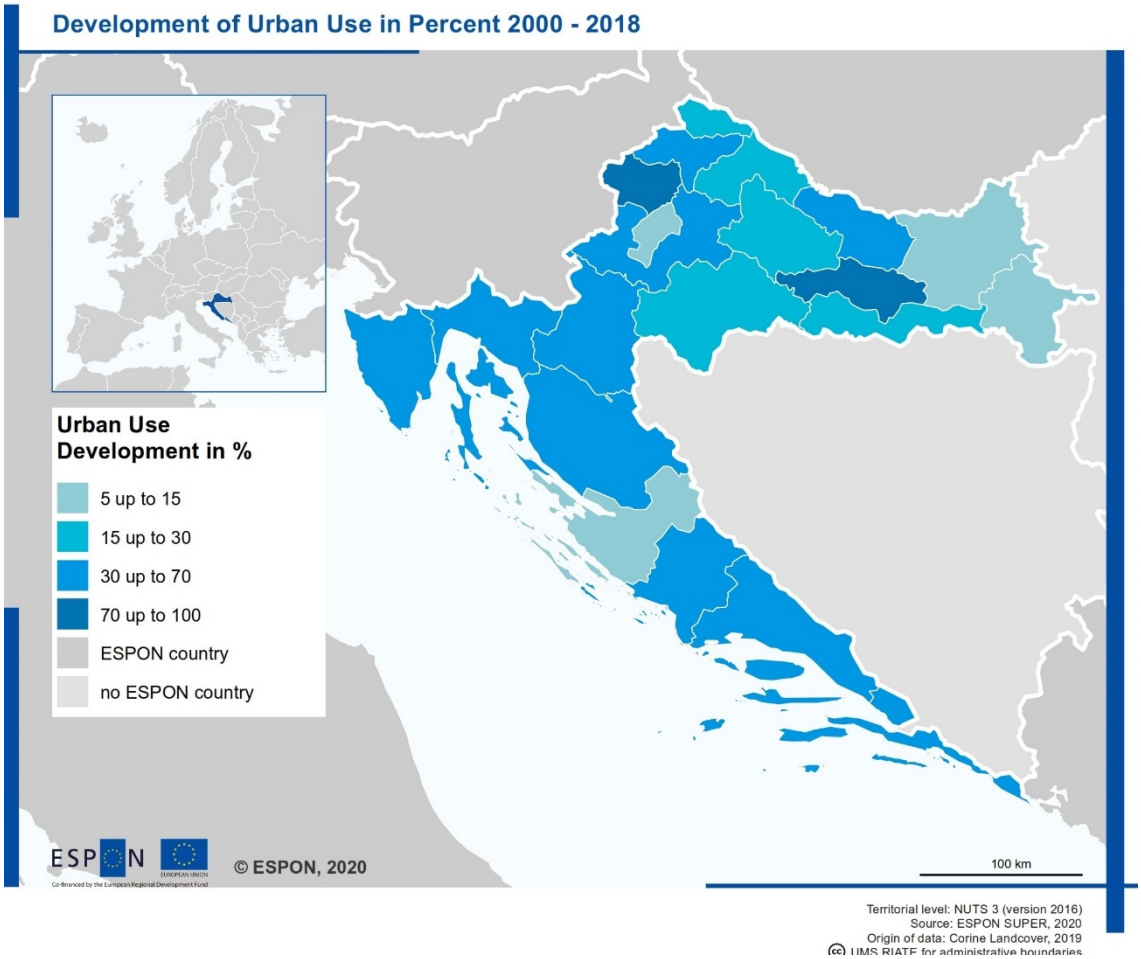
Source: authors' elaboration

4.2 Land-use change according to Corine Land Cover

Corine Land Cover data allows us to 'see' the changing landscape over the period 2000-2018 which can enable analyses on how the land is being converted. The dataset for this analysis of land-use change was developed for the purpose of the ESPON SUPER project and adapted for the Croatian case.

The development of urban use in the 2000-2018 period increased throughout Croatia (Map 4.5 and 4.6). Coastal and Northern Croatia urbanized more than Central or Eastern Croatia, and the highest growth was found in Krapina-Zagorje County: 93.2%. This county was traditionally rural, but due to its proximity to the capital, the effects of urban agglomeration, transport development and orientation to Central Europe, it started to urbanize rapidly. Urban use in Zagreb County increased by one third (34.0%) and the City of Zagreb grew by 8.5%. The City of Zagreb grew the most between 2000 and 2006, while for Krapina-Zagorje County and Zagreb County this was between 2012 and 2018, corresponding to Croatia's entry into the European Union and the recovery from the 2008 crisis.

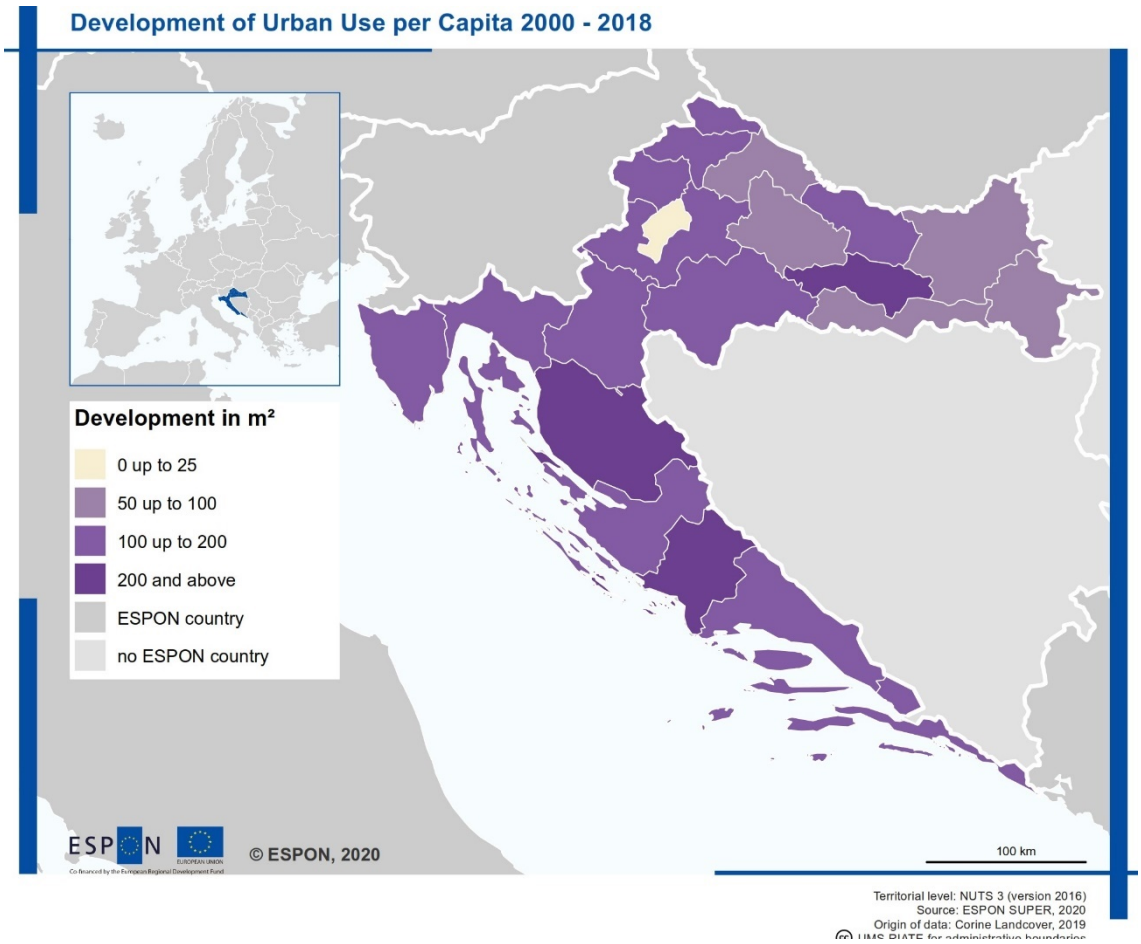
Map 4.5
Urban use development in Croatia in period 2000-2018



Source: authors' elaboration

In the 2000-2018 period, Croatia saw a high increase of urban use per capita. However, this indicator should be seen through the lens of depopulation: urban use did increase, but the negative population change was more significant. In the study area, the City of Zagreb grew by 17.9 m^2 per capita, Zagreb County by 126.8 m^2 per capita, while Krapina-Zagorje County recorded 136.5 m^2 per capita growth.

Map 4.6
Urban use development per capita



Source: authors' own elaboration

4.3 Morphological analysis

4.3.1 Change in urban form

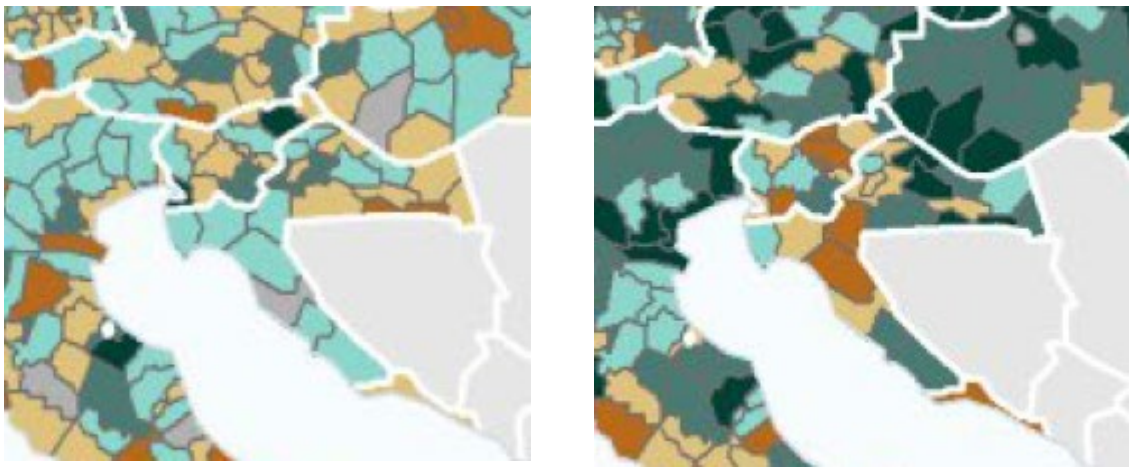
Not only the magnitude of urbanization is important for sustainability, but also the way this physically occurs, its morphology. To investigate this, the SUPER project assessed urban form according to five development models (compact, compact/polycentric, polycentric, polycentric/diffuse and diffuse). This morphological analysis was carried out manually for all NUTS 3 regions in the ESPON space using expert judgement for both the situation in 2018 as well as with respect to changes over the 2000-2018 period. The analysis was performed at two levels:

- The 'main urban structure' regards the predominant urban morphology in each territory on the basis of the shape of the largest agglomerations in the region (compact-monocentric, compact-linear, polycentric, polycentric-diffuse, diffuse).
- The 'urban substructure' regards the urban morphology residing outside of the main structure (no urbanization, compact-little urbanization, compact-more urbanization, polycentric, polycentric-diffuse, diffuse-scattered).

According to this methodology, the Croatian main structure is highly heterogeneous (see Map 4.7), but leans towards more compact modes. Looking at the change to the main structure since 2000 (see Map 4.8), it is worth noting that this has occurred in a more polycentric manner, indicating that the Croatian main urban structure is becoming slightly more scattered. This is most pronounced in Zagreb County,

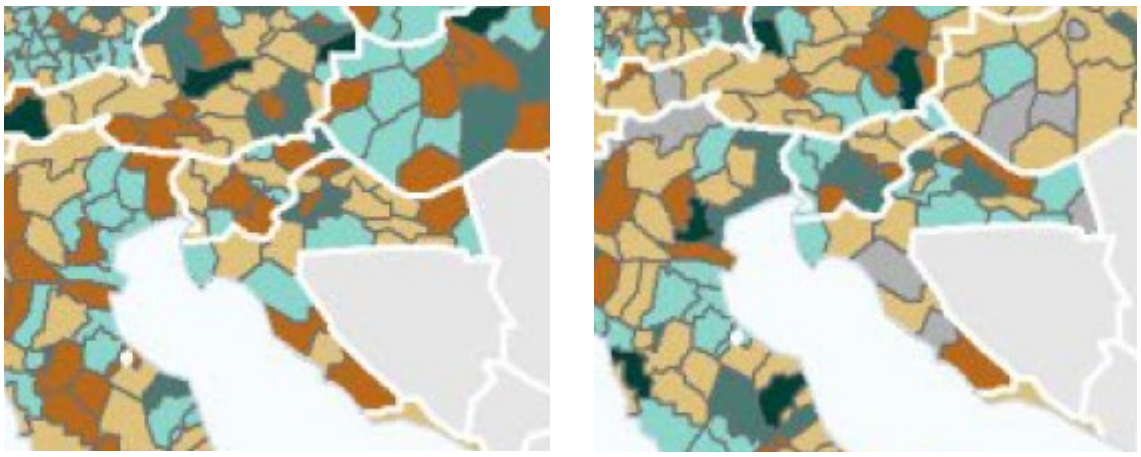
which was already more diffuse than most of the country. The next section will examine the study region in more detail.

Map 4.7
Main urban structure (l) and substructure (r)



Source: authors' elaboration based on ESPON SUPER project 2020

Map 4.8
Changes to main structure (l) and substructure (r)



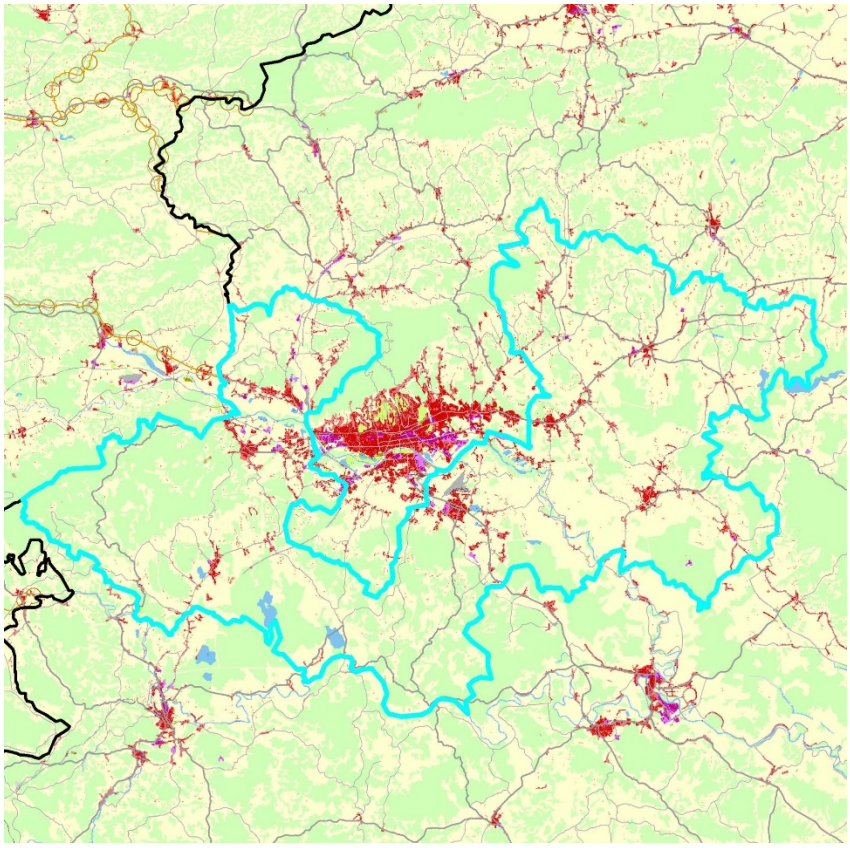
Source: authors' elaboration based on ESPON SUPER project 2020

4.3.2 Morphological analysis

Zooming into the study region comprising the City of Zagreb, Zagreb County and Krapina-Zagorje County, there is a clear distinction between the structure and development of the three counties. Map 4.9 shows more clearly how the main structure of the City of Zagreb has the 'compact-monocentric' characteristics. The northern parts of the City of Zagreb are contained by the mountains, steering development to the foothills and the Sava river banks (City Office for Strategic Planning and Development of the City, 2018). The main urban structure of Zagreb County (polycentric-diffuse) is the result of the development of many satellite cities for the City of Zagreb running along the main transport routes to other parts of Croatia. The substructure of Zagreb county is relatively compact, however, with much of the rural areas near the city still intact (City Office for Strategic Planning and Development of the City, 2018). The main morphological structure of the Krapina-Zagorje County is 'compact linear' due to the hilly terrain with urbanization occur-

ring in the valleys along the main transport routes towards Central Europe. The substructure is more polycentric due to its historical development as a traditionally agrarian county, with villages on the hilly terrain.

Map 4.9
Main morphological structure and sub-structure

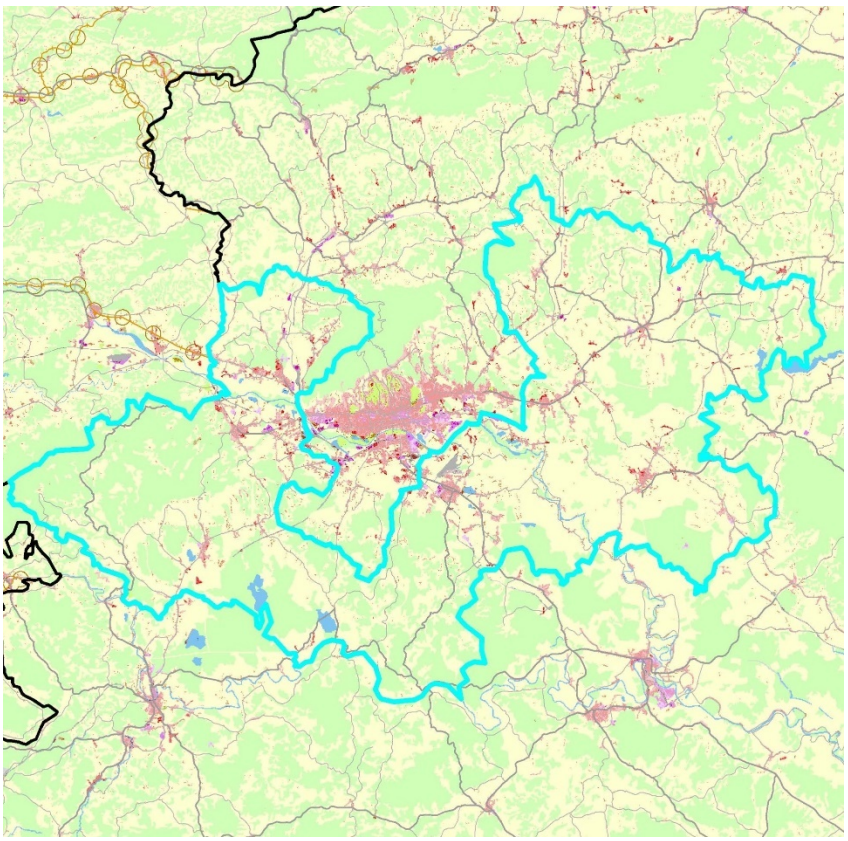


Source: authors' elaboration based on data of ESPON SUPER 2020
Note: blue boundary shows Zagreb County

4.3.3 Changes in morphological structure

Map 4.10 provides a closer view of the changes in both the main structure and substructure of the study area. Here, it is evident how urbanization in the City of Zagreb since 2000 occurred at the edges of the urban fabric, categorized in the SUPER project as 'compact – in edges'. New housing and economic activities were generally built contiguously. Zagreb County on the other hand is under suburbanization pressure, so the changes in the main and substructure are more diffuse, falling into the categories 'polycentric – new cores' and 'polycentric – in edges'. New, small-scale projects are realized in villages in this metropolitan region, transforming traditionally rural areas to suburban ones. The changes in Krapina-Zagorje County exhibit 'ribbon development' characteristics due to the hilly terrain and linear urbanization along transport routes.

Map 4.10
Changes in morphological structure and sub-structure



Source: authors' elaboration based on data of ESPON SUPER 2020
Note: blue boundary shows Zagreb County

5 Institutional context

European integration has prompted many European researchers to conduct comparative studies on European spatial planning systems to identify the potential for the alignment and coordination between EU Member States. In 1997, the European Commission published the *Compendium of Spatial Planning Policies and Systems in the European Union*, in which spatial planning systems are grouped into four categories according to the planning tradition:

- *Regional approach to economic planning* - Strategically oriented planning at the regional level focused on a wide range of social and economic goals, based on sketched models;
- *Comprehensive integrated approach* - Based on the systematization and hierarchy of spatial plans from the national to the local level and is more focused on spatial planning and coordination than on the economic development;
- *Land-use management* - Narrowly focused on controlling changes in land use at the strategic and local level;
- *Tradition of urbanism* - A system focused on the architectural level that is oriented to urban development, city management and construction control.

This classification was updated in 2006 by ESPON project 2.3.2. Previous categorizations of planning systems are useful for comparison of the existing European spatial planning systems. Depending on the criteria used for categorization, it is possible to identify various planning systems, but it is difficult to make a clear distinction due to the many factors involved. Nadin and Stead (2008) state that there is a convergence of today's planning systems due to social changes and Europeanization. This is especially true for the countries of Central, South-eastern, and Eastern Europe.

The Croatian spatial planning system is determined by the Physical Planning Act (Official Gazette, 153/13, 65/17, 114/18, 39/19, 98/19) and its bylaws. Following the principle of an integrated approach based on a comprehensive view of the use and protection of space and an organized hierarchical system (national, regional, and local spatial plans), in theory the Croatian spatial planning system can be considered as a model of a *comprehensive integrated approach* (it had not yet been classified in the ESPON 2.3.2. project). In practice, it is a *land-use spatial planning* which, under the influence of ESIF, steers towards the *comprehensive integrated approach*, but it is not completely matured and settled.

Defining a spatial planning system helps to understand the links between spatial planning, sustainable land use and the specific interventions deployed to address the aftermath of the March 2020 earthquake that affected the wider Zagreb area (Zagreb Urban agglomeration). The following chapter shifts the focus to the institutional context, and more specifically the national acts and documents related to the post-earthquake reconstruction. Relevant stakeholders and their jurisdictions will be identified as well as the expected outcomes of post-earthquake measures relevant to sustainable urbanization and land use.

5.1 Main administrative arrangement

The Republic of Croatia is a unitary democratic parliamentary republic. The administrative division includes 21 counties (regional level – 20 counties and the City of Zagreb as a special unit with county-level authorities) and 555 local administrative units (local level – 428 municipalities and 127 cities).

The most important framework for this case is the Act on Reconstruction of Buildings Damaged by Earthquakes in the Area of the City of Zagreb, Krapina-Zagorje County and Zagreb (Official Gazette, 102/20), managed by the Ministry of Physical Planning, Construction and State Assets of the Republic Croatia.[2]

[2] The area affected by the second earthquake was not involved in the case study since it occurred during the analysis and since it has huge differences in spatial structure. Recommendations are valid for both areas since the approach to post-earthquake reconstruction process is steered by the same Act and principles – the Act on the Reconstruction of Earthquake-damaged Buildings in the Territory of the City of Zagreb, Krapina-Zagorje County, Zagreb County, Sisak-Moslavina County and Karlovac County (OG 102/20, 10/21).

The same authority manages the Physical Planning Act (Official Gazette, 153/13, 65/17, 114/18, 39/19, 98/19), which is the fundamental law for overall spatial planning system and its activities. From the aspect of strategic planning, Ministry of Regional Development and funds of European Union is competent body for The Act on the System of Strategic Planning and Development Management of the Republic of Croatia (Official Gazette, 123/17) and Regional Development Act (Official Gazette, 147/14, 123/17, 118/18). Spatial. Spatial (physical) planning and spatial development is structured on three levels: state, regional and local level. Each level has spatial plans that manage the areas and functions defined by the legal framework. Strategic development is directed by the Regional Development Act (Official Gazette, 147/14, 123/17, 118/18), while the settings of strategic planning documents are determined by the Act on the System of Strategic Planning and Development Management of the Republic of Croatia (Official Gazette, 123/17). These two systems are connected. Act on the System of Strategic Planning and Development Management of the Republic of Croatia (Official Gazette, 123/17) stipulates that strategic planning acts and spatial plans at all levels must be harmonised (Table 5.1).

Table 5.1
Main legislative acts for physical/spatial planning, strategic planning and the earthquake reconstruction response

Sector	Name	Institution
Physical/spatial planning	Physical Planning Act (OG 153/13, 65/17, 114/18, 39/19, 98/19)	Ministry of Physical Planning, Construction and State Assets
	Regional Development Act (OG 147/14, 123/17, 118/18)	
Strategic planning/development	The Act on the System of Strategic Planning and Development Management of the Republic of Croatia (OG 123/17)	Ministry of Regional Development and funds of European Union
Post-earthquake reconstruction	The Act on Reconstruction of Buildings Damaged by Earthquakes in the Area of the City of Zagreb, Krapina-Zagorje County and Zagreb County (OG 102/20[3])	Ministry of Physical Planning, Construction and State Assets

Source: authors' elaboration

5.1.1 Physical/spatial planning

The Physical Planning Act of Republic of Croatia (Official Gazette, 153/13, 65/17, 114/18, 39/19, 98/19) regulates the spatial planning system. This includes its objectives, principles and topics, monitoring, conditions as well as the adoption of the Spatial Development Strategy of the Republic of Croatia, spatial plans including their development and adoption procedure, implementation of spatial plans, planning construction land, property institutes of construction, land management and supervision. There are 16 main objectives listed in the Act and together they represent a comprehensive picture of the sustainable development of Croatia with an aim towards more social equity and preserving the environment. The spatial planning system is linked to the territorial organization and constitutional powers for spatial management, except for

[3] The area affected by the second earthquake was not involved in the case study since it occurred during the analysis and since it has huge differences in spatial structure. Recommendations are valid for both areas since the approach to post-earthquake reconstruction process is steered by the same Act and principles – the Act on the Reconstruction of Earthquake-damaged Buildings in the Territory of the City of Zagreb, Krapina-Zagorje County, Zagreb County, Sisak-Moslavina County and Karlovac County (OG 102/20, 10/21).

specific areas of special spatial values (natural, cultural, historical, etc.) for which the specific spatial plans are made.

The Act is the legal framework for the implementation of spatial planning as a multidisciplinary profession. The integration of activities and competing demands for space is the common responsibility of myriad professions, sectors, and policies. Integration is carried out through:

- Solutions developed by planners based on spatial analyses (directly);
- Data from individual sectors incorporated in their strategic documents or expressed as requirements/proposals in the process of spatial planning (indirectly).

According to the Act, there are three main levels on which planning decisions are made. There is a differentiation between stakeholders responsible for efficiency, stakeholders responsible for expertise and stakeholders whose responsibility is to make sure the spatial plans are enforced as it is agreed upon. Stakeholders that oversee adoption of spatial plans and their efficiency are the Parliament and the Government of the Republic of Croatia. Stakeholders responsible for expertise are found among the Ministry of Physical Planning, Construction and State Assets, national administration bodies, professional governing bodies such as physical planning institutes of the cities or counties and as well legal entities and licensed architects. Lastly, putting plans in action is under surveillance of the Ministry of Physical Planning, Construction and State Assets.

On the regional or local level, the Ministry oversees the respective representative bodies. In terms of expertise, again, it is legal entities and licensed architects along with the institutes for physical planning of the cities or counties. The relationship between the spatial planning system and other administrative areas (sectors) is regulated by special laws which makes it challenging to establish effective vertical and horizontal cooperation. Although individual sectors participate in the process of drafting and adopting spatial planning documents, they draft their own sectoral strategic documents independently as well. When drafting spatial plans, sectoral strategic documents already in force are examined for their spatial relevance.

5.1.2 Strategic planning/development

The Regional Development Act of the Republic of Croatia (Official Gazette, 147/14, 123/17, 118/18) regulates: the objectives and principles of regional development management of Croatia, regional development policy planning documents, bodies responsible for regional development management, assessment of the level of development of local and regional self-government units, manner of determining urban and assisted areas, encouraging the development of assisted areas, implementation, monitoring and reporting on the implementation of regional development policy in order to make the most efficient use of European Union funds. The Act's main objective is to contribute to the socio-economic development of Croatia in accordance with the principles of sustainable development, by creating conditions that will enable all parts of the country to strengthen competitiveness and realize their own development potentials.

The Act on the System of Strategic Planning and Development Management of the Republic of Croatia (Official Gazette, 123/17) regulates the system of strategic planning of Croatia and the management of public policies e.g. preparation, drafting, implementation, reporting, monitoring of implementation and effects, and evaluation of strategic planning acts for formulation and implementation of public policies prepared, adopted and implemented by public bodies. The system is based on the principles of accuracy and completeness, efficiency and effectiveness, responsibility and focus on results, sustainability, partnership, and transparency. These two acts and their linked by-laws are the most important fundaments for strategic planning in Croatia. The connection of physical (spatial) planning and strategic planning framework is ensured during the process of drafting the spatial and strategic documents. One must be in line with other, as set with this legal framework, which stipulates that strategic planning acts and spatial plans at all levels must be harmonised.

5.1.3 Post-earthquake reconstruction

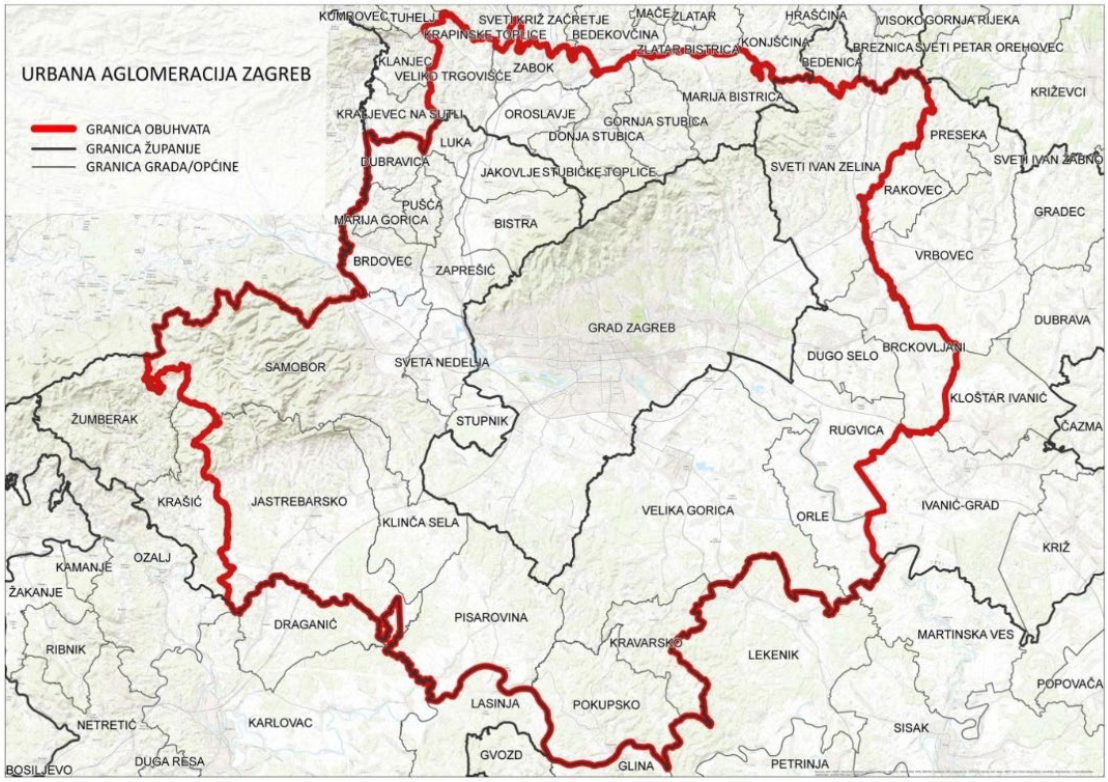
The Act on Reconstruction of Buildings Damaged by Earthquakes in the Area of the City of Zagreb, Krapina-Zagorje County and Zagreb County (Official Gazette, 102/20)[4] regulates how reconstruction or removal of buildings damaged or destroyed in the earthquake of 22 March 2020. It regulates the construction of replacement homes and for housing people affected by the disaster, defines competent authorities, and deadlines for actions. Other issues relate to the protection of human life and health, animals, property, the environment, nature and cultural heritage and the creation of conditions to allow a normal life to return in affected area. In order to define the activities related to this Act in more detail, the following bylaw documents were adopted: Decision on the adoption of the First Programme of Measures for the reconstruction of buildings damaged by earthquake in the area of City of Zagreb, Krapina-Zagorje County and Zagreb County (Official Gazette, 119/20) and the Decision on the establishment of the interdepartmental working group for monitoring of the implementation of grants from the European Union Solidarity Fund indented for financing reconstruction.

5.2 Main spatial planning authority and responsibility

The main spatial planning institution in Croatia is the Ministry of Physical Planning, Construction and State Assets which develops and coordinates the development and implementation of the National Spatial Development Strategy and other plans adopted by the Parliament and the Government, managing and developing the Physical planning information system (ISPU), performance of expert tasks and assistance in the development of physical plans in cooperation with different national administration bodies. In addition, it collaborates with the lower levels of government (counties and cities/towns) and their offices dealing with physical plans (Official Gazette, 153/13, 65/17, 114/18, 39/19, 98/19).

[4] The area affected by the second earthquake was not involved in the case study since it occurred during the analysis and since it has huge differences in spatial structure. Recommendations are valid for both areas since the approach to post-earthquake reconstruction process is steered by the same Act and principles – the Act on the Reconstruction of Earthquake-damaged Buildings in the Territory of the City of Zagreb, Krapina-Zagorje County, Zagreb County, Sisak-Moslavina County and Karlovac County (OG 102/20, 10/21).

Map 5.1
Boundary of the Zagreb Urban Agglomeration



Source: Zagreb Urban Agglomeration Development strategy, 2016

The development of a spatial plan begins with a decision on its initiation made by a competent authority. Topics contained in the draft decision include: a report of the spatial survey, objectives/priorities of strategic development documents, interests of individuals, groups and/or updates of the legislative and strategic framework. The decision is then forwarded to the sectors that can submit requests or offer input. Sectors are also involved in the preparation of the draft spatial plan proposal through meetings/consultations, which is not determined by regulations and is left mainly to the discretion of the plan initiator. Sectors are reengaged during the public hearing when they can give their assessment on whether their requirements have been properly incorporated. For national-level plans, the Rules of Procedure of the Government of the Republic of Croatia grants sectors another opportunity to give opinions/remarks on the final draft plan before it is sent to Parliament for adoption. After processing the remarks from the public debate and a Strategic Environmental Assessment, the proposal is finalized and sent to the representative body for adoption. For the purpose of combating the earthquake damage, the new Act on Reconstruction of Buildings Damaged by Earthquakes concerns the wider area of City of Zagreb, which included parts of Zagreb and Krapina-Zagorje county, also known as the Zagreb Urban Agglomeration in the strategic planning sector (Map 5.1).

5.2.1 Authorities involved in earthquake reconstruction

Reconstruction and related measures will be carried out in accordance with the programs of measures and reconstruction activities adopted by the Government at the proposal of the Ministry of Physical Planning, Construction and State Assets (Table 5.2). The Ministry prepares proposals for the programme of measures in cooperation with the Expert Council for Reconstruction, and, if necessary, with other public bodies and persons.

The Expert Council has a president appointed by the Government, two vice presidents, 20 members and 20 deputies. One deputy is appointed from the Office of the Prime Minister of the Republic of Croatia, and the other from the officials or employees of the City of Zagreb. One member and his deputy are appointed

from the experts of the Ministry, the Ministry responsible for culture, experts from the University of Zagreb - Faculty of Civil Engineering, Faculty of Architecture, Faculty of Law, members of the Croatian Chamber of Civil Engineers, Croatian Chamber of Architects, Croatian Chamber of Mechanical Engineers, Croatian Chamber of Engineers of Electrical Engineering, Croatian Chamber of Commerce, Croatian Chamber of Trades and Crafts, Croatian Association of Employers, Croatian Association of Civil Engineers, Society of Architects of Zagreb, Croatian Engineering Association, Institute of Art History, City Institute for the Protection of Cultural and Natural Monuments of the City of Zagreb, Department of Geophysics in Zagreb, the Institute of Economics, and the Reconstruction Fund.

The founders of the Reconstruction Fund are the Republic of Croatia with a founding share of 70%, the City of Zagreb with a founding share of 20%, Krapina-Zagorje County with a founding share of 5% and Zagreb County with a founding share of 5%. The Reconstruction Fund will be headed by the Director and the Governing Board, which will have nine members, five of whom will be representatives of the State, two of the City of Zagreb and one from each county. Reconstruction (i.e. removal of damaged buildings, construction of replacement family houses and housing of persons affected by the earthquake, according to the Reconstruction Act), is carried out on the basis of a decision issued by the Ministry.

Table 5.2
Stakeholders in post-earthquake reconstruction process

Stakeholders	Duties
Ministry of Physical Planning, Construction and State Assets	- Strategic planning - Normative guidance - Making decisions about the rights
Reconstruction Fund	- Operational planning - Organization - Follow ups and reporting - Control of reconstruction
Coordinators	- Coordination - Follow ups and reporting on the work of reconstruction participants
Supervision	- Individual implementation of restoration
Performers	- Individual implementation of restoration
City of Zagreb / Zagreb county / Krapina-Zagorje county	- Spectrum of activities determined by the Act

Source: authors' elaboration

With respect to participation, requests can be made to the competent authority by building managers and/or representatives of co-owners for apartment and commercial buildings, owners of family houses or authorized proxies of the applicant, provided that the power of attorney is attached.

5.2.2 The City of Zagreb

Activities performed by the Department for Physical Planning of the City of Zagreb are circumscribed by the Physical Planning Act and the Decision on the establishment of the Institute for Physical Planning of the City of Zagreb. These activities include (City Office for Physical Planning, Development of City, Construction, Utility Service and Traffic, 2020): coordination of development and monitoring of the implementation of spatial plans of the City level - Spatial Plan of the City of Zagreb, General Urban Plan of the City of Zagreb, General Urban Plan of Sesvete and urban development plans, preparation of a report on the situation in the City of Zagreb, managing spatial planning information systems, preparation of the starting point for the development (e.g. repealing spatial plans of the City level Zagreb, monitoring the implementation of spatial planning documents of the City of Zagreb, providing professional advisory assistance

in the development of urban development plans, performing professional analytical work in the field of spatial planning if requested by the mayor or ministry in charge of spatial planning and other activities in accordance with the Act, the Decision and the Statute.

The functions of each city office are as follows:

- *City Office for Physical Planning, Development of City, Construction, Utility Service and Traffic*: transportation, building and sanitation of damaged objects for social activities and housing objects, physical planning and construction, utilities and public spaces, building utility infrastructure and maintenance of public transport areas, public objects and public lightning, legal and financial affairs, work on protection and preservation of cultural goods, communal and traffic wardens, public local roads;
- *City Office for the Strategic Planning and Development of the City*: strategic planning, spatial and urban planning, strategic information and research, development of the City;
- *City Office for Economy, Energetics and Environment protection*: economy, entrepreneurship, tourism and investments, environment protection and sustainable waste management, energy and climate, legal and economic-financial affairs (City of Zagreb, 2020);
- *City office for culture*: culture, economic-financial affairs;
- *City Office for Property Affairs*: administrative and legal affairs, real estate valuation;
- *City Office for the Management of City Assets*: legal affairs, managing city assets, civil property records, financial affairs, preparation of procedures for the protection of city property;
- *City Office for Cadastre and Geodetic activities*: land and real estate cadastre, geodetic-cadastral change, geodetic and cadastral databases, infrastructure cadastre and spatial records, legal and general affairs (City of Zagreb, 2020).

The main document in local spatial planning is the Spatial Plan of the City of Zagreb (Official Gazette of the City of Zagreb, 8/01, 16/02, 11/03, 2/06, 1/09, 8/09, 21/14, 23/14, 22/17), while within its area is the Nature park Medvednica which is managed by the national level plan due to its special features. Since Zagreb is the largest city and the capital of Croatia which has multiple settlements within, there is differentiation among which parts of the city are under which local plan. Therefore, the Spatial Plan of the City of Zagreb has all the requirements needed for a regional plan, but as well including elements of local plans. Zagreb and Sesvete (part of the City) have separate General urban plans, while some areas are shown in more detail under the Urban development plan. The General urban plan is adopted for the construction area of the settlement and the separated construction area outside the settlement, and determines the undeveloped part of the settlement, the area planned for the urban transformation and spatial coverage of lower-order plans. In other words, the General urban plan of the City of Zagreb (City of Zagreb, 16/07, 8/09, 7/13, 9/16, 12/16) is a spatial planning document and part of the urban strategy of the City of Zagreb which determines the basic organization of space, protection of natural, cultural, and historical values, use and purpose of areas, urban rules for spatial planning of certain parts of Zagreb. It determines the requirements for physical planning of the city, prudent use, purpose, formation, redevelopment and land decontamination, environmental protection as well as protection of cultural and natural heritage. The urban development plan is directed at unbuilt sites slated for urban development or transformation and revitalization and prescribes the requirements for any actions in the plan area. This plan is used for smaller areas and it can have the function of a General urban plan or implementation of the document, which is in the case of a city of Zagreb. For the City of Zagreb, another document named ZagrebPlan (City of Zagreb, 2017) was drawn up as a vision and contains strategies and objectives for city development.

5.2.3 Zagreb County

The activities of the Institute for Physical Planning of Zagreb County are defined in the Physical Planning Act. In accordance with the Ministry, this includes: coordination of the development and monitoring of the implementation of spatial plans at the regional level, preparation of survey reports, management of spatial planning information systems, setting principles for the development or repeal of detailed spatial plans, providing expert advice regarding the development of local plans, development of spatial plans of cities and municipalities, General urban plans, Urban development plans of importance for the County (i.e. the County and performing professional analytical work in the field of spatial planning, as requested by the

competent Ministry or the County, and other activities in accordance with the Physical Planning Act and the Statute of the institute) (Institute for Physical Planning of Zagreb County, 2020).

Moreover, there is the Administrative Department for Physical Planning, Construction and Environmental Protection within the county administration, which performs administrative and professional tasks of physical planning, construction, environmental and nature protection, property appraisal and legal affairs. The administrative department consists of four sections: Department of Physical Planning and Construction, Department of Environmental Protection, Real Estate Appraisal Department and Department of Property Legal Affairs (Zagreb County, 2020).

5.2.4 Krapina-Zagorje County

The Institute for Physical Planning of Krapina-Zagorje County has the same duties as those mentioned for Zagreb County. The activity of the Institute is: drafting and monitoring the implementation of spatial planning documents at the regional level, preparation of a report on the situation in the county, keeping a data register within the spatial planning information system, setting principles for the development or repeal of spatial plans of narrower areas, issuing opinions in the process of drafting and adopting spatial planning documents, preparation of spatial plans of cities and municipalities, preparing urban development plans and performance of professional analytical work in the field of spatial planning if the development of these plans or performance of these tasks is entrusted to it by the competent Ministry or the County Governor (Institute for Physical Planning of Krapina-Zagorje County, 2020).

Additionally, on a county level, there is the Administrative Department for Physical Planning, Construction and Environmental Protection. Its duties include administrative and professional tasks in the field of physical planning and construction, environmental and nature protection, activities related to the issuance of building permits, permits for change of use of buildings, decisions determining building plots and other activities in accordance with Act, such as professional and administrative tasks related to the development of spatial plans (Krapina-Zagorje County, 2020).

5.3 Main interventions to address sustainable land-use

The focus of this study is the Act on Reconstruction of Buildings Damaged by Earthquakes in the Area of the City of Zagreb, Krapina-Zagorje County and Zagreb County.[5] This will be evaluated for its effects in sustainability of land use and urbanization.

5.3.1 The Act on Reconstruction of Buildings Damaged by Earthquake

The main purpose of the Act is stated in article 1 (Official Gazette, 102/20, 10/21)[6] as the following: *"This Act regulates the approach and procedure of reconstruction or removal of buildings damaged or destroyed in the natural disaster declared in the City of Zagreb, Krapina-Zagorje County and Zagreb County pertaining to the earthquake on 22 March 2020, construction of replacement family houses and housing for those affected. In the event of an accident, the competent authorities, deadlines for action and other related issues shall be determined to protect human life and health, animals, property, the environment, nature and cultural heritage and create conditions for normal life in the affected area."* (Official Gazette, 102/20, 10/21). The earthquake damaged more than 25,000 buildings, of which over 6,000 were deemed vital public buildings such as kindergartens, primary schools, secondary schools, colleges, institutes, scientific institutions and cultural institutions. These were permanently or temporarily unusable. On 29 October 2020, the First programme of measures of reconstruction of buildings damaged by the earthquake was

[5] The area affected by the second earthquake was not involved in the case study since it occurred during the analysis and since it has huge differences in spatial structure. Recommendations are valid for both areas since the approach to post-earthquake reconstruction process is steered by the same Act and principles – the Act on the Reconstruction of Earthquake-damaged Buildings in the Territory of the City of Zagreb, Krapina-Zagorje County, Zagreb County, Sisak-Moslavina County and Karlovac County (OG 102/20, 10/21).

[6] The full name after the second earthquake is: Act on Reconstruction of Buildings Damaged by Earthquakes in the Area of the City of Zagreb, Krapina-Zagorje County, Zagreb County, Sisak-Moslavina County and Karlovac County (OG 102/20, 10/21)

adopted by the Croatian government. The main objectives of the Act are divided into short-term/urgent measures and long-term/comprehensive objectives. Short-term means structural reconstruction of buildings with reinforcement of structural elements so that damaged buildings can withstand future earthquakes, and to provide swift protection from further damage to buildings as well as the life and health of people who use these buildings or are in their vicinity, and the return of the residents to their homes. All procedures in the execution of works on the renovation of buildings are subordinate to the stated urgent fulfilment of the basic objective (Ministry of Physical Planning, Construction and State Assets, 2020a):

- Due to the impaired constitution and stability of structures, it is necessary to act urgently to prevent further deterioration of buildings that may endanger human life and health. This implies: shortening of procedures and procedures, providing emergency assistance to citizens, urgent temporary building protection measures, urgent structural renovation of buildings with enhanced resilience and stability;
- Protection of the historic urban fabric of the city;
- Complete renovation of buildings with the status of cultural property which are in public and private ownership;
- Effective spending of public funds with maximum control and public oversight.

The main post-earthquake interventions of the City of Zagreb, Zagreb County and Krapina-Zagorje County related are listed in two different articles of the Act (Official Gazette, 102/20, 10/21). These include the following, but not limited to: co-financing the implementation of reconstruction and co-signing/arranging Agreement with the Government of Croatia, Krapina-Zagorje and Zagreb County as well as giving a preliminary opinion for the adoption of Programme of Measure to the Government and participation in the work of the Expert Council for Reconstruction. These public bodies also must develop the Programme of complete reconstruction of the historic urban core of the City of Zagreb with the Institute for Physical Planning of City of Zagreb and ensure the removal and disposal of damaged objects. In terms of residents' rights, Decisions must be made by the administrative management body of housing regarding: (1) providing appropriately sized rental apartments until the end of the renovation of the building/construction of a replacement family house and as well arranging private accommodation on own expenses. In cases of demolition, renting an apartment of appropriate size for an indefinite period or fixed period until 1 September 2023. Also, it allows funding and rights to provide temporary accommodation or land for the construction of these types of buildings if needed by the Ministry and on behalf of the Republic of Croatia.

Article 28 states that the replacement family house should be built on the same site of the removed house, except in cases of a landslide, in which case it is elsewhere within the City of Zagreb, Krapina-Zagorje County and Zagreb County. If a replacement family house is built on a new location on land owned by the City of Zagreb, Krapina-Zagorje County and Zagreb County, the owner of the removed house is obliged to donate the land under the removed house to the City of Zagreb or the County.

The Act on the Reconstruction of Earthquake-Damaged Buildings in the Territory of the City of Zagreb, Krapina-Zagorje County and Zagreb County (Official Gazette, 102/20, 10/21) focuses on defining the scope and procedure of the post-earthquake reconstruction process. In its first article, the Act defines its objectives: (i) reconstruction or removal of damaged or destroyed buildings; (ii) construction of replacement family houses; (iii) securing the housing possibilities for affected population; (iv) determining the competent bodies, activities, deadlines and other related issues to protect human life and health, property, environment, nature and cultural heritage while creating conditions for the establishment of normal life in the affected area. In order to achieve these objectives, the Act prescribes:

- Reduction and simplification of documentation required for reconstruction, reduction of costs and time needed for drawing up documentation. This is co-financed by the Republic of Croatia and the City of Zagreb, Zagreb County and Krapina-Zagorje County;
- Establishment of the Reconstruction Fund;

- Organization and implementation of renovation of damaged buildings through: structural repair, structure reinforcement (*seismic retrofitting*[7]), complete renovation, repair of non-structural elements and removal of destroyed buildings. This is co-financed by the Republic of Croatia and the City of Zagreb, Zagreb County and Krapina-Zagorje County;
- Construction of replacement family houses. This is financed by the Republic of Croatia and the City of Zagreb, Zagreb County and Krapina-Zagorje County (financial assistance for building);
- Securing financial assistance for the necessary temporary protection of buildings (from rain, snow, etc.), removal and retention of dangerous parts of buildings that could endanger human life or health, repair of replacement of chimneys and gable wall, and repair of stairs and elevators;
- Securing financial assistance for the execution of works on the reconstruction of damaged buildings for owners and co-owners who renovate buildings themselves;
- Securing the possibility for owners and co-owners to perform seismic retrofitting above the level of renovation at their own expense or paying the difference in costs for carrying out a complete renovation of the building;
- Temporary and permanent shelter for persons affected by the disaster by giving the rental or ownership of the apartments.

The First Programme of Measures for the Reconstruction of Buildings Damaged by the Earthquake in the City of Zagreb, Krapina-Zagorje County and Zagreb County (Official Gazette, 119/20) gives more detailed measures and instructions for the reconstruction of buildings damaged or destroyed by the earthquake. The prioritization in reconstruction is carried out according to a parametric analysis according to the hierarchy of importance. Buildings will be renovated according to established priorities, with possible overlaps. The parameters for determining priority are the following:

- Purpose of building;
    - Degree of damage
    - Location
- Available financial resources;
- Engineering and construction capacities.

The highest priority is given to public buildings vital to the community, such as health-care buildings, public services (emergency, firefighting, etc.), government buildings, telecommunications, energy, etc. The second priority are given to buildings of cultural and recreational importance, educational buildings and other public buildings not covered by the highest level of priority. The third level of priority is given to public buildings with slight damage, family houses, residential and mixed-use buildings (residential-business), commercial buildings. The lowest priority are buildings which are less important for public safety. By the degree of damage, priorities are scaled by the categories from Table 3.1. ranging from the most damaged to the least damaged buildings. By the location parameter, the highest priority are given to buildings in the historic centre of Zagreb (cultural protection zone A and B since it is the highest concentration of public buildings and damage per residents) and along the most important traffic corridors.

5.3.2 Physical Planning Act of Republic of Croatia

The objectives of the spatial planning in Croatia are stated in Article 6 of the Physical Planning Act (Official Gazette, 153/13, 65/17, 114/18, 39/19, 98/19):

- Sustainable spatial development in balance with economic, social and ecological values;

[7] *Seismic retroffitting* regards a series of modifications carried out on existing buildings to make them more resistant to seismic activities and associated changes in the ground. The purpose is to improve the safety of building users (protecting human lives, ensuring a safe stay in buildings), increasing the building durability (increasing stability, avoiding possible collapse and greater material damage), increasing the functionality of buildings, etc. (Egbelakin et al., 2011).

- Spatial sustainability in relation to the rational use and preservation of space on land, sea and under water;
- Connecting the national territory to the European spatial planning systems;
- Nurturing and developing regional spatial features;
- Harmonized and complementary distribution of human activities while protecting intrinsic spatial assets;
- Reasonable use and protection of natural resources, nature conservation, environmental protection and prevention of pollution risks;
- Protection of cultural goods and assets;
- Well-organized distribution and arrangement of land for construction;
- Quality and humane development of urban and rural settlements, development of green infrastructure and a healthy, socially functional living and working environment;
- The integrity of valuable coastal ecosystems and the quality of the sea for bathing and recreation;
- Appropriate transport system, especially public transport;
- Supply, functional accessibility and use of services and buildings for the needs of different groups of the population, especially children, the elderly and people with disabilities;
- Quality, culture and beauty of spatial and architectural design;
- Creation of high-quality urban space with respect for local specificities and the natural and urban landscape and cultural heritage, especially regarding recreational and tourist areas in the coastal and mainland area with the protection of the narrower coastal zone from construction;
- Spatial conditions for economic development;
- National security and defence of the State and protection against natural and other disasters.

One of the main principles *is the principle of spatial sustainability of development and quality of construction*. The Act states that spatial planning supports sustainable development by monitoring, analysing and evaluating the development of individual activities and spatial sensitivity, ensuring the quality of living and working environment, uniformity of landscaping standards, efficiency of energy, land and natural resources management and preserving spatial personality and long-term protection of space as the basis of common good. Article 42 touches upon building sites: settlements can be planned only in designated construction areas, and, this may not lie in an area of special water protection, or areas designated for the construction or expansion of buildings for waste management of national and county significance.

According to Solly et al. (2020) which researched planning interventions in Europe, the Physical Planning Act from 2014 is considered effective because it limited the construction of new built-up areas, but on the other side it lacks implementation interventions of subsidies and incentives, e.g. housing arrangements.

In regard of spatial plans and interventions, the most important ones are:

a) General Urban Plan of City of Zagreb

The plan ensures the rational use and protection of space via the following measures: setting boundaries on city expansion and the renewal of existing urban spaces and development urban programmes at the city edges, determination of differentiated urban rules appropriate to the character of specific urban areas, purpose of space and preservation of forest areas within the city, arranged parks and planned arrangement of new green areas, ensuring the sustainable development of the city of acceptable land-use intensities related to spatial characteristics and urban typologies, determining the minimum share of natural soil in landscaping, measures for the protection of areas of protected cultural assets and natural areas, way of reproducing the city that ensures that large undeveloped areas are not arranged in individually interventions, but by complete urban elaboration, formal interpretation and time-determined during implementation (City of Zagreb, 16/07, 8/09, 7/13, 9/16, 12/16).

b) Spatial Plan of the City of Zagreb

The spatial plan envisages the basic conditions for determining the purpose of areas, as follows: basic features of the space of the City of Zagreb, the principle of rational use of space and increase of its value, sustainable use and quality of space and environment, valorization of the existing situation, rational use of infrastructure systems, existence of natural, built and human resources, encouraging the development of individual micro spaces, improving the quality of life, and increase in the number of jobs (Official Gazette of the City of Zagreb, 8/01, 16/02, 11/03, 2/06, 1/09, 8/09, 21/14, 23/14, 22/17).

c) Spatial Plan of Krapina-Zagorje County

The Spatial Plan of Krapina-Zagorje County (Zagreb County, 3/02, 6/02, 8/05, 8/07, 4/10, 10/11, 14/12, 27/15, 31/15) is the basic document which regulates the purpose and use of the space, while determining the conditions of spatial planning. The objectives are to stop negative demographic trends, achieve functional capacity of the infrastructure network, conduct a settlement policy of underdeveloped and sparsely populated areas, adapt to economic conditions and establish intervention measures for a certain form of economic activity in areas with spatial disadvantages.

d) Spatial Plan of Zagreb County

The Spatial Plan of Zagreb County is the basic spatial planning document which regulates the purpose and use of the space. It is a specific plan because it surrounds the area of the City of Zagreb, which is the main transport, economic and infrastructural hub.

5.3.3 Regional Development Act of the Republic of Croatia

This act is harmonized with the provisions of the 2014-2020 EU cohesion policy which obliges members to allocate ERDF funds towards sustainable urban development. The aim of regional development policy is to contribute to the socio-economic development of Croatia in accordance with the principles of sustainable development by creating conditions that will enable all parts of the country to strengthen competitiveness and realize their own development potentials (Official Gazette, 147/14, 123/17, 118/18).

5.3.4 The Act on the System of Strategic Planning and Development Management of the Republic of Croatia

This law regulates the system of strategic planning. The principle of sustainability is a main point of departure. The most important strategic planning documents for the earthquake affected area are:

- *National Development Strategy* – The most important strategic document in Croatia which sets objectives for overall national development up to 2030. It was adopted in February 2021;
- *Spatial Development Strategy* - Strategic document guiding the spatial planning system of Croatia, which is based on sustainable land use as a horizontal principle;
- *ZagrebPlan (Development Strategy of Zagreb)* - There are six objectives in this strategy, of which objectives 3 (Environmental protection and sustainable management of natural resources and energy) and 4 (Improving the spatial qualities and functions of the city) are the most relevant;
- *County Development Strategy for Krapina-Zagorje County* – There are three main objectives: 1. Competitive economy; 2. Human potential development and increasing the quality of life; 3. Sustainable development of space, environment and nature;
- *County Development Strategy for Zagreb County* - There are three main objectives: 1. Increase competitiveness and socially responsible economy; 2. Improve infrastructure and quality of life by sustainably managing natural resources and cultural goods; 3. Develop human resources and improve development management;
- *Zagreb Urban Agglomeration Development Strategy* – This sets three main goals: 1. Improve the quality of life, public and social infrastructure, and human resources; 2. Develop a competitive and sustainable economy; 3. Improve the management of the environment, nature, and space;

Also, in terms of revitalization, several national programmes are relevant:

- *National programme for the development of circular management of space and buildings* – This programme focusses on urban revitalization through re-use of brownfield sites, neglected urban areas and urban renewal. It is in accordance with objectives of sustainability;

- *National programme for the development of green infrastructure in urban areas* – This programme aims to establish sustainable, resilient, pleasant and safe cities and municipalities in Croatia. It seeks to create preconditions for a better quality of life and health and contribute to sustainable social, economic and spatial development.

6 Overview of land-use change and policy orientations

This chapter gives insight into planning practices and discourses by focusing on the main formal and informal instruments that currently influence the post-earthquake reconstruction process in Croatia, and with it, urbanization and land use. The chapter presents interventions dealing with land-use management during the post-earthquake reconstruction process and offers some examples of successful (or unsuccessful) practices of addressing the reconstruction process in Croatia.

6.1 Examples of interventions that address the post-earthquake reconstruction process and its sustainability in Croatia

As a result of desk-research and interviews, this spin-off study identified 13 interventions that somehow deal with sustainability of post-earthquake reconstruction process in Croatia (see Table 6.1 and Figure 6.1). Interventions were selected according to their impact on sustainability of land-use. Four methods of data collection were employed: (1) inputs provided directly by the Croatian Ministry of Physical Planning, Construction and State Assets, (2) an analysis of the ESPON SUPER and COMPASS national reports, (3) suggestions provided during interviews, (4) literature review and targeted searching. The fourth method provided the highest number of results, while the third method was useful for filling gaps and evaluating sustainability. Finally, each intervention was assessed according to success on sustainable land-use goals/dimensions (see Table 6.2).

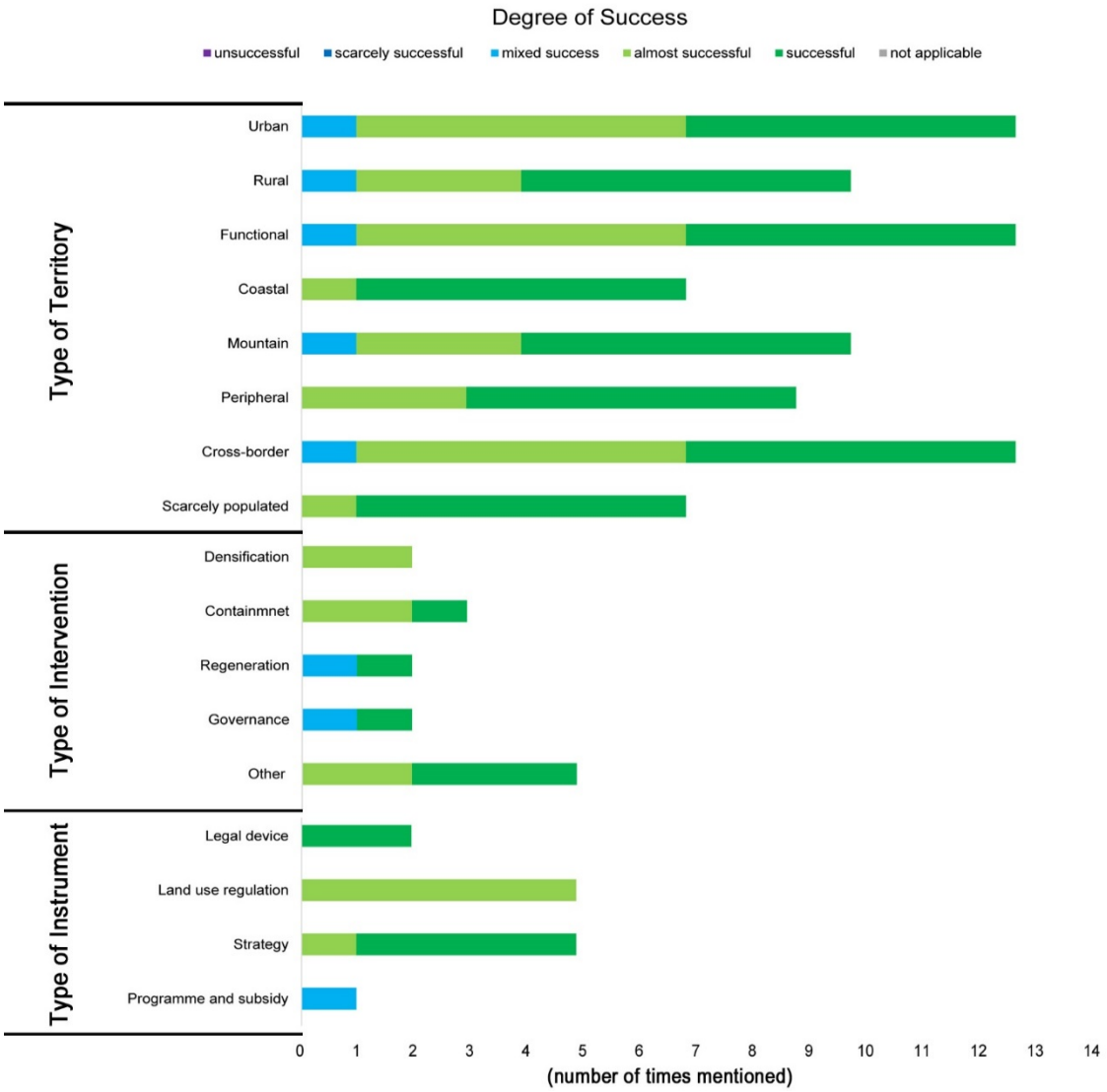
Table 6.1
Number of interventions per analytical category

Scale of interests/geographical distribution			Type of territories			Type of interventions			Type of instruments		
	Type	n.		Type	n.		Type	n.		Type	n.
	NUTS0	0		Urban	13		Densification	2		Legal device	2
	NUTS1	7		Rural	10		Containment	3		Land-use regulation	5
	NUTS2	4		Functional	13		Regeneration	2		Strategy	5
	NUTS3	2		Coastal	7		Governance	2		Programme and subsidy	1
	LAU 1	0		Mountain	10		Spatial quality	0		Project	0
	LAU 2	0		Peripheral	9		Transport	0			
				Cross-border	0		Environment	0			
	Other	0		Scarcely populated	7		Rural development	0		Other	0
				Other (nation)	4		Other	5			
	Total	13		Total	163*		Total	14*		Total	13

* the total varies because each intervention may be classified in more than one category.

Number of interventions per analytical category (source: authors' elaboration)

Figure 6.1
Degree of success of the interventions for analytical category



Source: authors' elaboration

6.1.1 Visions and strategies

Based on the evidence within the SUPER one of the characteristics of successful visions and strategies is establishing ambitious, future-oriented goals but, even more importantly, that these goals are realistic (ESPON, 2020a). Five strategies in Croatia were identified as relevant to post-earthquake reconstruction:

- *Spatial Development Strategy* - The Spatial Development Strategy is the main national document for steering spatial development and planning in Croatia. The priorities of spatial development are: 1) sustainability of spatial organization; 2) preservation of the identity of the space; 3) transport connectivity; 4) energy system development; and 5) resilience;
- *Zagreb Urban Agglomeration Development Strategy for the period up to 2020* - This document sets strategic development actions and priorities of development for the area of Zagreb Urban Agglomeration. It served as the basis for ITI mechanism implementation in Croatia. The strategy pinpoints three main goals: 1. improve the quality of life, public and social infrastructure, and human resources; 2. develop a competitive and sustainable economy; 3. improve the management of the environment, nature, and space;

- *National Programme for the Development of Circular Management of Space and Buildings for the Period 2021-2030* (draft) - The strategy is currently under development but will serve as the main guiding principle for circular management of space and buildings. It provides a framework for the implementation of projects related to the circular management of buildings and spaces. Through its goals, it sets the framework for future project financing. In addition, it identifies pilot projects that will test the implementation of various projects;
- *National Programme for the Development of Green Infrastructure in Urban Areas for the Period 2021 to 2030* (draft) – The strategy is currently under development but will serve as the main guiding principle for green infrastructure and nature-based solutions. It aims to establish sustainable, resilient, safe, comfortable and orderly cities and municipalities in Croatia. It seeks to create preconditions for a quality of life and health and contribute to sustainable social, economic and spatial development. The programme was developed in accordance with the European Green Infrastructure Strategy and the European Green Deal. It provides a framework for the implementation of projects related to the development of green infrastructure in urban areas and future project financing. In addition, it identifies pilot projects that will test the implementation of various projects;
- *National Development Strategy until 2030* – the strategy that steers the country's development until 2030 at the top of the hierarchy. In the context of sustainable land use, the most important points are: (3) efficient and effective judiciary, public administration and management of state assets; (8) green and energy transition for climate neutrality; (10) sustainable mobility; (12) development of assisted areas and areas with development specifics.

As stakeholders stated during the interviews, every successful regeneration initiative needs a well-structured and organized long-term vision and development strategy, which should be drafted together with the local community and relevant stakeholders to ensure the achievement of needed economic, environmental, social and temporal objectives. This helps avoid functional specialization and the creation of monofunctional blocks which ultimately be less resilient. The Croatian case does not have a comprehensive long-term vision for the post-reconstruction process, rather the focus was put on immediate reconstruction to save lives and to develop a legal framework for state support. Many stakeholders raised the need for a more integrated approach to the revitalization of the affected area.

Moreover, there is a lack of integrated urban revitalization and strategic ideas in the system of spatial planning to support the development of urban design, and thus a stronger integration of sustainable urbanization and land-use measures. In this sense, the need for a new strategy of Zagreb Urban Agglomeration Development has been identified, which is also foreseen for the new financial period because the current version was intended for the 2014-2020 period, in accordance with the EU financial framework. This territorial strategy is the basis for ITI implementation. As such, a mechanism does exist that contributes to the development of awareness of the need to restore brownfield areas and elements of cultural heritage, but also other urban elements.

6.1.2 Rules and legal devices

Sustainable land use can be addressed by instituting specific legal devices, such as binding laws and bylaws, to create a supportive institutional framework (ESPON, 2020a). The nature of initiatives is very diverse as well as their level of implementation and impact on land use.

The Act on the Reconstruction of Earthquake-damaged Buildings in the Territory of the City of Zagreb, Krapina-Zagorje County, Zagreb County, Sisak-Moslavina County and Karlovac County can be placed in this category, but, since it provides the framework for financial support for reconstruction, it will be treated in Section 6.1.4. Programmes. Therefore, in this category there are two legal devices:

- *The Act on the System of Strategic Planning and Development Management of the Republic of Croatia* - This Act regulates the system of strategic planning, identifying the principle of sustainability as a point of departure. Its objective is to manage the structure of strategic plans, which indirectly affects the post-earthquake development process through strategic planning;
- *Regional Development Act* - The Regional Development Act of the Republic of Croatia regulates the objectives and principles of regional development in Croatia, regional development policy planning documents, bodies responsible for regional development management, etc. The main objective is to contribute to the socio-economic development of Croatia, in accordance with the

principles of sustainable development by creating conditions to enable all parts of the country to strengthen competitiveness and realize their own development potentials.

As the interviewed stakeholders stated, the most important stakeholder on the national level is the Ministry of Physical Planning, Construction and State Assets. The management of the post-reconstruction process should be interdisciplinary, intersectional and interdepartmental including other ministries, especially: Ministry of Economy and Sustainable Development, Ministry of Culture and Media, Ministry of Justice and Public Administration, Ministry of Labor, Pension System, Family and Social Policy and Ministry of Agriculture, and Ministry of Finance. The main vehicle is the Fund for the Reconstruction of the City of Zagreb, Krapina-Zagorje County, Zagreb County, Sisak-Moslavina County and Karlovac County (or simpler: Reconstruction Fund). Stakeholders also stated the importance of involving stakeholders on the regional and local level, especially their bodies responsible for spatial and sustainable development. On the regional level, county institutes for physical planning and county conservation departments should be involved, while at the local level, administrative departments dealing with spatial development, construction and sustainable development issues should be involved. During the reconstruction process, it is necessary to integrate the ideas of experts from national departments (architects, civil engineers, mechanical engineers, electrical engineers, geodesy engineers, etc.) and experts from scientific institutions (Faculty of Architecture, Faculty of Civil Engineering, Faculty of Mechanical Engineering and Naval Architecture, etc.). Some stakeholders pointed out the problems visible in connecting the two basic pillars of spatial development - spatial (physical) planning and strategic planning. The establishment of an efficient apparatus for the adoption of legally binding instruments often improves the success of containment interventions. Interviewees pointed out that spatial plans should have greater implementation power. In conclusion, a structured and systematic approach to overall post-earthquake revitalization is needed and this should be supported by adequate spatial and strategic planning tools and legal devices.

6.1.3 Land-use regulations

Land-use regulations establish binding principles, usually through zoning, that define how land can or cannot be transformed (ESPON, 2020a). Main interventions in Croatian context are:

- Physical Planning Act – As mentioned, this is the main Act which regulates the spatial (physical) planning system in Croatia;
- General Urban Plan of City of Zagreb - The plan ensures the rational use and protection of space. It covers the urban area of Zagreb (local-level spatial planning);
- Spatial Plan of City of Zagreb - The City of Zagreb has a special jurisdiction according to Croatian law, with powers similar to that of a county. It is competent for the whole administrative area of the City of Zagreb (local-level spatial planning);
- Spatial Plan of Krapina-Zagorje County - The Spatial Plan of Krapina-Zagorje County is the basic document regulating land use and sets the conditions for county level spatial planning in Krapina-Zagorje;
- Spatial Plan of Zagreb County - The Spatial Plan of Zagreb County regulates land use and sets the conditions for county level spatial planning in Zagreb County (county surrounding the City of Zagreb).

Stakeholders state the need for better regulation of the cadastre land registry system, which serves as the basis for reconstruction and revitalization activities. The revision of spatial plans should be preceded by a consideration of individual cultural assets and protected units (urban and rural) and the technological, technical and financial possibilities, economic aspects and the likelihood of real-time implementation. Stakeholders state the need to adjust and revise spatial plans for earthquake-affected areas in order to continue the process of reconstruction of individual buildings and develop a framework of targeted urban policy, which would enable the promotion and management of sustainable urbanization and land-use. Many interviewed stakeholders highlighted problems regarding spatial plans with little implementation power, the lack of a land consolidation (reparcelling) mechanism (the problem of land fragmentation) and the problem of frequent changes of spatial plans. It is necessary to speed up the resolution of property rights issues that are currently form an obstacle for the implementation of the reconstruction programme.

The spatial planning system in Croatia is relatively successful with respect to the containment of natural and rural areas. Great emphasis is put on the preservation of valuable natural areas and the entire nation-

al territory is covered by spatial plans. A broader system of spatial design and planning has been developed. Spatial plans control urbanization by designating urbanization zones, i.e. construction and building areas. A few areas within the City of Zagreb present a delicate problem, particularly areas where illegal buildings have been legalized, but has not been systematically rehabilitated and regulated. Such construction permanently degrades the space, while subsequent repairs and attempts to 'introduce order', ensure adequate transport, communal, social, green and other infrastructure are very demanding because there is usually not enough space left. Regeneration seems very successful when the concepts of reuse and integrated sustainable development are included. This implies the integration of circular management of buildings and spaces, green infrastructure, energy efficiency and different socioeconomic measures into the process of reconstruction. This also helps to promote the sustainability of reconstruction process. In addition, revitalization of urban and rural areas that have problems with illegally constructed (but in the meantime legalized) buildings is vital as well as setting mandatory spatial standards for disaster risk reduction (planning of public areas, evacuation routes, collapse zones, etc. - following the example of the former Ordinance on natural disasters) and creating a framework for the selection of safe locations for construction (creation of spatial layers - fault maps, revised maps of seismic areas, maps of potential landslides) and planning an adequate construction typology.

6.1.4 Programmes

Programmes are policy packages aiming at a particular objective. They can be used to create economic conditions (financial schemes, direct investments, allocation of developing funds etc.) for sustainable land use (ESPON, 2020a).

Even if it is the main legal device for post-earthquake reconstruction, the Act on the Reconstruction of Earthquake-damaged Buildings on the Territory of the City of Zagreb, Krapina-Zagorje County, Zagreb County, Sisak-Moslavina County and Karlovac County should more rightly be viewed as a programme since it sets the framework for financial support in the reconstruction process. The Act regulates the manner and procedure of reconstruction or removal of buildings damaged or destroyed in a natural disaster declared in the City of Zagreb, Krapina-Zagorje County and Zagreb County affected by the earthquake on 22 March 2020, construction of replacement family houses and housing those most affected. The Act strives to protect human life and health, animals, property, environment, nature and cultural heritage and create conditions for normal life in the affected area. The main objectives are divided into short-term/urgent and long-term/comprehensive objectives. Short-term objectives include structural reconstruction of buildings with reinforcement of structural elements to allow them to withstand future earthquakes, and to provide immediate protection from further damage. Other objectives are protection of the historic urban fabric of the city, renovation of public buildings and buildings protected as cultural property and to purposefully spend public funds with maximum control and public oversight. After the new Petrinja 2020 earthquake in February 2021, the Act was extended to Sisak-Moslavina and Karlovac County. The Act prescribes: 1) reduction and simplification of documentation required for reconstruction, reduction of costs and shortening of time needed for preparation; 2) establishment of the Reconstruction Fund; 3) organization and implementation of renovation of damaged buildings, repairing structure, complete renovation of building; 4) construction of replacement family houses; 5) financial assistance for the necessary temporary protection of buildings and to provide its secure functionality; 6) financial assistance for the execution of works on renovation of damaged buildings for owners who renovate buildings themselves; 7) temporary and permanent housing care for persons affected.

The Act on Reconstruction of Earthquake-damaged Buildings in the City of Zagreb, Krapina-Zagorje County, Zagreb County, Sisak-Moslavina County and Karlovac County (Official Gazette, 102/20, 10/21) primarily organizes assistance for owners of objects and institutions that have recorded damage and was not intended to manage the processes of urbanization and land use. Unfortunately, as seen by interviewed stakeholders, the process of drafting the Act was not sufficiently assisted by the spatial planning community and other experts, even though is important to achieve good cooperation and coordination between all governance levels due to direct involvement of multiple counties. Most stakeholders believe that the Act created the necessary financial mechanism to help the affected areas from the national level, with help from the regional level. Stakeholders emphasize that the idea of the Act is to restore the condition of buildings to their original condition before the earthquake, while the decision on how to improve the condition of these buildings is up to the owners themselves. The priority is primarily on seismic resilience, which is a prerequisite for safe housing in earthquake-prone historic cores. Emergency remediation should be carried out in a way that does not conflict with future development plans. When reconstructing and/or adapting

existing buildings and proposing new buildings, it is necessary to consider modern needs and challenges (adequate quality of life, environmental sustainability, impacts of the climate change, etc.) and potential future disasters and hazards, with a special emphasis on earthquakes. The steps to implement the recovery programme need to be simplified. One interviewee stated the idea that the activities of the newly established Reconstruction Fund should have been divided into two parts: (i) all activities currently clearly provided by Act; (ii) integrated reconstruction planning activities that would cover a wider range of sustainability and development components of individual projects.

Stakeholders agree that the historic core of the City of Zagreb and the northern suburbs suffered the most damage. They confirm that the Act envisages the development of the Programme for the Complete Reconstruction of the Historical Core of the City of Zagreb, which will bring together an interdisciplinary group of experts to examine the state of the area in detail from each sectoral aspect and provide integrated reconstruction activities. This process requires the development of a conservation plan. It is necessary clarify the approach to cultural heritage, for example, with respect to the preservation of original forms versus the development of modern forms as well as finding a model of creative management of cultural heritage. However, there is no Programme of restoration of other important historical urban ensembles and valuable urban areas in other counties.

6.1.5 Projects

Projects are *ad hoc* initiatives with a given timeframe. They can be used for the implementation of permanent or provisional of transformations of sites with the aim to foster sustainability (ESPON, 2020a).

During the research, stakeholders mentioned only one specific project. Stakeholders highlighted the Badel block project as a brownfield near the city center of Zagreb. Badel block represents a complex of a former alcohol factory and refinery and is viewed as cultural property, without clearly designed urban structure and purpose. International tender for project ideas was held and following that, there were already regeneration plans prepared.

6.1.6 Assessment of interventions

As illustrated above, no intervention type is fully sustainable or unsustainable (Solly, Berisha, Cotella, & Janin Rivolin, 2020b). Using the sustainability assessment framework developed in the ESPON SUPER project, each identified intervention in Lithuania was assessed according to a number of indicators measuring the economic, the ecological and the social dimensions of sustainability. More specifically, the economic dimension of sustainability takes into consideration: the GDP and wealth, the public finance, jobs, accessibility, the development of business areas, the quality of housing demand, the transportation costs as well as the energy consumption. The ecological dimensions used the following indicators: reducing mobility (by car), reducing pollution (including CO_2), green urban areas, biodiversity, land consumption, natural hazards, climate change, consumption of resources, renewable energy, space for future water retention and circular economy. The indicators used for the social dimension of sustainability are: health, affordable housing, equity/inclusion, public and recreational space, variety (high-rise, suburban, etc.), mixed-use areas and satisfaction with home environment. The assessment of the interventions was made on the basis of expert judgement and placed on a Likert scale (ESPON, 2020d):

- Double minus (- -): strong negative impact (with respect to the indicator)
- One minus (-): negative impact
- +/- means conflicting impacts
- One plus (+): positive impact
- Double plus (+ +): strong positive impact
- n.a. – not applicable/available (e.g. insufficient data to evaluate impact).

Based on the assessment presented in Table 6.3, the National Development Strategy until 2030 seems to score well on most indicators of sustainability. On the other hand, The Act on the System of Strategic Planning and Development Management of the Republic of Croatia seems to have some clear trade-offs between dimensions of sustainability, denoting the possibility of side effects. From the perspective of sustainable indicators, land consumption seems less considered by the selected Croatian interventions, implying that land-use issues are not always taken into account or that the impacts are generally negative.

Table 6.2
Dimensions of Sustainability for selected interventions

Interventions	Dimensions of Sustainability																								
	Economic Sustainability								Ecological Sustainability											Social Sustainability						
	GDP, wealth	Public finance	Jobs	Accessibility	Business areas	Housing demand	Transportation costs	Energy consumption	Reducing mobility (by car)	Reducing pollution, including CO2	Green urban areas	Biodiversity	Land consumption	Natural hazards	Climate change	Consumption of re-sources	Renewable energy	Space for future water retention	Circular economy	Health	Affordable housing	Equity/inclusion	Public and recreation-al space	Variety (high-rise, suburban, etc.)	Mixed-use areas	Satisfaction with home environment
The Act on Reconstruction of Buildings Dam-aged by Earthquakes in the Area of the City of Zagreb, Krapina-Zagorje County and Zagreb County	+/-	+	+	+	n.a.	++	n.a.	n.a.	n.a.	+/-	+/-	n.a.	+	++	+/-	+/-	+/-	+/-	+/-	n.a.	+	++	+/-	+	+	+
The Act on the System of Strategic Planning and Development Management of the Republic of Croatia	n.a.	+	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	+/-	+/-	n.a.	+	+/-	n.a.	+/-	n.a.	n.a.	+	+/-	+	n.a.	n.a.
Regional Development Act	++	+	+	+	+/-	+/-	+/-	+/-	+/-	+/-	+	+/-	+/-	+/-	+/-	+/-	+/-	n.a.	+/-	+/-	+/-	+	+/-	+/-	+/-	+/-
General Urban Plan of City of Zagreb	+	+	+/-	++	++	+	+/-	+/-	+/-	+/-	++	+	-	+	+/-	+	+	++	+/-	+	+/-	+	++	++	++	+/-
Spatial Plan of City of Zagreb	+	+	+/-	++	++	+	+/-	+/-	+/-	+/-	++	+	-	+	+/-	+	+	++	+/-	+	+/-	+	++	++	++	+/-
Spatial Plan of Krapina-Zagorje County	+	+	+/-	++	++	+	+/-	+/-	+/-	+/-	++	+	-	+	+/-	+	+	++	+/-	+	+/-	+	++	++	++	+/-
Spatial Plan of Zagreb County	+	+	+/-	++	++	+	+/-	+/-	+/-	+/-	++	+	-	+	+/-	+	+	++	+/-	+	+/-	+	++	++	++	+/-
Spatial Development Strategy	+	+	+	+	+	+	n.a.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+/-
Zagreb Urban Agglomeration Development Strategy for the period up to 2020	+	+	+	+	+	+	+/-	+/-	+/-	+/-	+/-	+/-	-	+	+/-	+/-	+	+/-	+/-	+/-	+	+	+	+	+	+/-
National programme for the development of circular management of space and buildings for the period 2021-2030 (draft)	n.a.	+	+	+	+	+	n.a.	++	n.a.	++	+	n.a.	++	+	+	++	++	n.a.	++	+	+	+	++	n.a.	++	+
National programme for the development of green infrastructure in urban areas for the peri-od 2021 to 2030 (draft)	n.a.	+	+	+	n.a.	n.a.	n.a.	+	n.a.	++	++	+	+	++	++	++	+	n.a.	+	++	n.a.	n.a.	++	n.a.	+	+
National Development Strategy until 2030	++	++	++	+	+	+	n.a.	+	+/-	++	+	+	+/-	+	+	+	+	+/-	+	++	+/-	++	+	+	+/-	+
Physical Planning Act	n.a.	n.a.	n.a.	n.a.	+	n.a.	n.a.	n.a.	n.a.	n.a.	+	+	+	+	n.a.	+	+	+/-	+	+	+/-	+	+	+	+	+

Source: authors' elaboration

6.2 Current land-use practices in Croatia

This section gathers together the opinions of key actors interviewed. It examines the unsolved issues regarding land use in Croatia and identifies main drivers and direction of land-use change.

Institutional factors: responsibilities and instruments

The City of Zagreb has problems with neglected urban spaces, while Krapina-Zagorje County has a problem with fragmented construction areas. The interviewees indicated there is a room for improvement of the spatial planning of these areas in the context of sustainability, especially in the direction of transport development, green infrastructure and brownfield redevelopment. Some stressed the need to integrate (currently draft versions of) the Programme for the Development of Green Infrastructure in Urban Areas and the Programme for the Development of Circular Management of Space and Buildings in the area of City of Zagreb, Krapina-Zagorje and Zagreb counties as it would provide higher spatial quality and greater social, environmental and economic benefits, while the post-earthquake reconstruction process would achieve activities of sustainable land-use. Support of strong, stable and effective political will is needed since the spatial effect of containment and regeneration initiatives usually takes time to be seen. The knowledge, data and technical capacity is important factor for sustainable urban development.

Another important warning could be seen in the lack of territorial awareness which is often due to a shortage of knowledge, data and technical capability. There is a need for additional training, but also for strengthening the management structure of public administration needed to achieve sufficient cooperation. The interviewees also stated the importance of involving stakeholders on the regional and local level, especially those responsible for spatial and sustainable development issues. Warnings for policy makers and decision makers in terms of regeneration include the scarcity of stakeholder involvement and a lack of financial mechanisms. A participative approach with citizen and stakeholders is necessary to obtain a well-tailored intervention. It is also important to integrate private (corporate or individual) and public priorities. It would be good to link financial mechanisms to involvement of citizens and the community, precisely with the aim of strengthening capacity and cooperation, as well as the constructive contribution to urban development and community building. At the national level, the Environmental Protection and Energy Efficiency Fund is important as it provides the possibility of (co-)financing green and sustainable construction.

Cultural behavior and attitude

The stakeholders stated there has been an increase in awareness of sustainable development in recent years by citizens and a growing need for citizen participation in decision-making on the future development of their community. It is necessary to raise awareness among professionals in the post-earthquake reconstruction on: (i) for architects and urban planners – a comprehensive view of the purpose and design identity (especially in urban and rural areas), (ii) for evaluators – assessment of the stability of damaged buildings, preparation of studies for the restoration of structures that are retained, (iii) for experts in cultural protection – valorisation and protection grading. The 'expert knowledge transfer' is vital for achieving containment policies. The post-earthquake reconstruction process did not adequately accept the opinions of experts and the community. One of the interviewees stated that the post-earthquake reconstruction in the suburbs of the surrounding counties (Krapina-Zagorje County and Zagreb County) would be better solved by building replacement houses in the planned new settlements at slightly higher densities and therefore reduce pressure on natural areas.

The historic core of the City of Zagreb, which suffered the most damage, is a complicated case. Due to its compactness, further densification is difficult but not impossible. There is a potential for the regeneration of neglected blocks and their courtyards which would also help tackle the problem of old, substandard housing stock. It is necessary to find a solution for the inherited structure of users of endangered facilities who cannot financially bear the burden of maintenance and improvement. The historic core area needs to shift towards sustainable mobility (through reduction of car traffic), apply green infrastructure principles, promote circular management of space and buildings, adopt NBS solutions to reduce heat islands and apply demographic measures. However, a bigger problem in the context of sustainable urbanization and land-use is inadequately organized and outdated transport systems, waste management, water supply and other urban infrastructure, large derelict brownfields, neglected historical heritage, etc. The issue of revitalization of the Banovina area (part of Sisak-Moslavina County), affected by the earthquake in December 2020 is not the same as in Zagreb. There a need exists for overall transformation in economic and social

terms, not just physical reconstruction. It is a rural and relatively underdeveloped area that is demographically distressed and challenged by economic decline.

6.3 Final remarks and main challenges

The country is facing a series of challenges that will influence the next decades of territorial development. Land use is a complex phenomenon: socioeconomic, institutional, and cultural factors all intertwine in their impacts on space. The most important challenges within the next period in relation to land-use in Croatia and its sustainability are:

- *Lack of a long-term vision for post-earthquake reconstruction*– Since there is no long-term vision to accommodate short-term steps into a wider framework, there is a high risk of uncontrolled territorial development and less sustainable land use.
- *Need for integrated urban revitalization* – Urban spaces need to be viewed in combination with their surrounding areas in which they have strong functional interrelations. Urban revitalization therefore should be as comprehensive as possible (e.g. including social, economic, environmental, architectural factors).
- *Need for a more participatory approach* – Urban and rural areas should be created together with the inputs from its residents as they will be the final users after the development. Lack of participatory approach and turning towards a top-down approach can undermine functionality and transform residents into opponents if they feel left out of decision-making.
- *Adjustment of spatial planning documents to support post-earthquake reconstruction process* – To secure the conditions for the effective implementation of the post-earthquake reconstruction measures and integrated urban revitalization, a revision of spatial plans in the earthquake-affected areas is needed. Within the spatial planning system, it is necessary to first create a framework for selecting safe locations for construction (creation of spatial layers - fault maps, revised maps of seismic spaces, potential landslides, etc.) and then plan accordingly.
- *Lack of horizontal and vertical cooperation* – There is a strong need for improving cooperation between different levels of authorities (local, regional, national) as well as among different sectors on the same level of authority (various ministries, etc.).
- *Support better coordination between strategic and spatial planning* - In order to make viable plans, better coordination is needed between strategic and spatial planning. Separately, the full spectrum of sustainable development cannot be taken into account.
- *Need for improvement of the land management system* - To ensure sustainable urbanization and land use before, during and after post-earthquake reconstruction, it is necessary to continuously address property issues, especially cadaster, land registers and property rights which together form the basis for all land management activities (including integrated revitalization).
- *Protection of cultural heritage* – There is a need for further development of plans for the protection of cultural heritage as well as deciding upon which sites should be preserved in their original state and which should receive minor adjustments to fit today's needs, and to find a model of creative management.
- *Risk management and preparedness* - Developing new plans of risk management as well as including risk management and preparedness as important features in current spatial plans is advisable.

7 Selecting interventions from the SUPER guide

Post-earthquake reconstruction and recovery opens opportunities for the integration of sustainable urbanization and land-use principles into urban revitalization efforts. The ESPON SUPER project collected successful and unsuccessful interventions into a database and noted their positive or negative effects on sustainability. Drawing on this work, the *SUPER Guide to sustainable urbanization and land- use* (ESPON, 2020a) offers a wide panorama of instruments and interventions that can promote sustainable land-use. However, their level of success depends on a variety of factors (e.g. institutional, social and economic). Policy makers and decision makers should therefore be aware that there are no 'one size fits all' solutions, so every intervention should be adjusted to fit the specific context.

Building on the main domestic needs and challenges identified in earlier in this report, this chapter presents examples of interventions drawn from the SUPER project that can inform the implementation of the post-earthquake reconstruction in Croatia. Based on the analysis, 13 interventions were selected (see Table 7.1).

Table 7.1
List of interventions selected based on type of instruments

Type of instrument	Name	Country	Type of intervention
Visions and strategies	Red for green: 'contour policy'	NL	Containment
	Masterplan - Cooperative spatial concept for the core region of Salzburg	AT	Containment
	High density urban expansion	NL	Containment
		Total	**3**
Rules and legal devices	Warsaw metropolitan area - planning law and housing policy implementation	PL	Governance
	Poznan metropolitan area planning law	PL	Governance & Containment
	Soil compensation account	DE	Containment
		Total	**3**
Land-use regulations	'Regionaler Leitplan - Bezirk Mödling' (Regional Master Plan of 20 communities of Mödling)	AT	Containment
	Infrastructural Cost Calculator	AT	Densification
		Total	**2**
Programmes	22@Barcelona programme	ES	Regeneration
	Incentives to increase roof greening in Linz	AT	Regeneration
		Total	**2**
Projects	Reinventing Paris (fr. Réinventer Paris)	FR	Regeneration
	Community-led regeneration in Casoria	IT	Regeneration
	Regeneration of part of the Taht-el-Kale Quarter	CY	Regeneration
		Total	**3**

Source: authors' elaboration based on ESPON SUPER

7.1 Vision and strategies

Visions and strategies can help decision makers and policy makers to address sustainable land-use. Visions define concrete targets and new forms and principles of land use (new value, ambitious objectives, new form of governance etc.). During the desk-research, three relevant interventions were identified:

- In the Netherlands, the province Zuid-Holland applied a successful 'contour policy' strategy. This divided rural areas into different protection categories. The strategy was backed by a general provincial urban containment policy, where one containment measure – 'red for green' is important for the Croatian case. This policy links planning permission for a new building in the countryside to the demolition of an equal surface area elsewhere. This is essentially a transfer of development rights scheme. This could be used in Croatia to aid containment and densification during post-earthquake reconstruction.
- In Austria, in 2013 the 'Cooperative spatial concept for the core region of Salzburg' was developed which provided an overall long-term vision of key development measures for the entire region in the areas of housing, economy, transport and landscape. It tries to implement measures to halt land consumption, manage housing development and reduce environmental pollution (ESPON, 2020a). This sustainability oriented urban revitalization plan can inspire the Croatian post-earthquake reconstruction.
- In the Netherlands, the City of Amsterdam adopted the concept of 'high urban density expansion' to retain open areas and promote compact yet attractive urban areas. Two main groups of interventions to steer densification are: (i) adding building volumes; (ii) transforming current urban structures or buildings (re-use and re-structure).

The examples are in line with the idea of containment, aiming to limit development beyond a certain area to reduce urban sprawl and promote more rational land use (Table 7.2). This topic is relevant for Croatia since post-earthquake reconstruction requires the demolition of highly damaged buildings and rebuilding.

Table 7.2

Selection of visions and strategies

Name	Country	Intervention type	Main scope	Lessons Learned	Relevance
Red for green: 'contour policy'	NL	Containment	The province Zuid-Holland divided rural areas into several protection categories (contours). The 'red for green' policy links planning permission for new building in the countryside to equal demolition elsewhere.	The strategy was backed by a general provincial urban containment policy, which supports the need for a high-quality vision and strategy.	This could be used in Croatia to achieve the containment and densification in post-earthquake reconstruction.
Masterplan - Cooperative spatial concept for the core region of Salzburg	AT	Containment	This provided an overall long-term vision of key development measures for the entire region in the areas of housing, economy, transport, and landscape.	Measures to stop land consumption, manage housing development and reduce environmental pollution. Supported by participatory planning and a clear vision of future development.	This can serve as an inspiration for the development of an overall strategy for earthquake affected areas to achieve sustainable urbanization and land use.
High density urban expansion	NL	Containment	Amsterdam adopted the concept of 'high urban density expansion' to retain open areas and promote compact yet attractive urban areas. It aims to (i) add building volumes; (ii) transform the urban structure.	A clear strategy makes it possible to achieve a high level of urban compactness and containment.	Need for a complete strategy to avoid urban expansion during the post-earthquake reconstruction.

Source: authors' elaboration based on ESPON SUPER 2020

7.2 Rules and legal devices

As SUPER highlighted, sustainable land use can be addressed by promoting a series of laws, regulations and norms. This can be targeted in spatial planning as well as via related sectors (see table 7.3). It can be done by introducing *ad hoc* laws and norms (e.g. towards land use or environmental protection) as well as or imposing disincentives (fees, *ad hoc* taxes etc.) (ESPON, 2020a). This section offers examples of different interventions in relation of scope and outcome (Table 7.3). Within the 'governance' topic, several examples are relevant to Croatian post-earthquake reconstruction:

- In Poland, the Warsaw metropolitan area's planning law and housing policy successfully contributed to both the core city and its surrounding metropolitan area. Its aim was long-term sustainable development (e.g. green corridors, green areas, urban sprawl disincentives).
- In Poland, the Poznan metropolitan area's planning law focused on environmental protection and cultural landscape, providing indicators for degraded areas that require urgent revitalization. However, it failed to achieve expected results due to unsuccessful municipal coordination (ESPON, 2020a).
- In Dresden (Germany), new development on undeveloped land requires adequate (de)sealing measures or 'greening' measures elsewhere within the city boundary; developments in the inner urban area are usually exempted to encourage infill. Developers may carry out compensation measures themselves or pay a compensation fee to the municipal Environment Authority. The objective is to confine built-up land for settlements and traffic to 40% of the total urban land.

Table 7.3
Selection of rules and legal devices

Name	Country	Intervention type	Main scope	Lessons Learned	Relevance
Warsaw metropolitan area - planning law and housing policy implementation	PL	Governance	This successful planning law and housing policy aims at long-term sustainable development such as green corridors, green areas, reduction of urban sprawl etc.	Coordination and political will between stakeholders assure successful implementation.	Underlines the need for coordination and political will between stakeholders at all governance levels.
Poznan metropolitan area planning law	PL	Governance & Containment	The law focused on environmental protection and cultural landscape and provided indicators for degraded areas that require urgent revitalization.	It failed to achieve expected results due to unsuccessful intermunicipal coordination.	Multilevel governance is needed for post-earthquake reconstruction.
Soil compensation account	DE	Containment	In Dresden, new developments on undeveloped land require adequate (de)sealing measures or 'greening' measures elsewhere within the city. The inner urban area is usually exempted from this. Developers can carry out compensation measures by themselves or to pay a fee to the municipality.	Compensation measures	It gives the option to steer development towards urban areas within the framework of post-earthquake reconstruction.

Source: authors' elaboration based on ESPON SUPER 2020

7.3 Land-use regulation

Based on the ESPON SUPER intervention database, plans can either be pro-development or conservation-oriented (ESPON, 2020a). Two interesting interventions seem to hold insight for the Croatian case (see also Table 7.4):

- In Austria, 20 communities around Mödling developed a Regional Master Plan. This was prepared with the support of experts and representatives of local communities. It was based on three simple principles: control and steer growth, (2) protect, use, connect and design green areas, (3) promote sustainable transport modes. This intervention was successful due to its coordinative function across administrative borders.
- Also in Austria, the federal planning authority of Lower Austria developed a 'Infrastructural cost calculator'. This was made available as a free online tool allowing municipalities to assess the costs of urban expansion. Given that diffuse development generally requires more infrastructural public investment per capita than compact development, this tool could affect local decision making.

The last example could help argue for compact development with respect to post-earthquake reconstruction. This complements Croatian interventions such as up-zoning and measures for infill development in Zagreb's historic core for instance.

Table 7.4
Selection of land-use regulations

Name	Country	Intervention type	Main scope	Lessons Learned	Relevance
'Regionaler Leitplan - Bezirk Mödling' (Regional Master Plan of 20 communities of Mödling)	AT	Containment	A Regional Master Plan was prepared with the support of experts and local community representatives. It was based on: (1) controlling and steering growth (2) protecting, using, connecting and designing green areas and (3) sustainable transport.	Intervention was successful due to its coordinative function across administrative borders.	Multi-level governance is needed for post-earthquake reconstruction process.
Infrastructural Cost Calculator	AT	Densification	The 'Infrastructural cost calculator' is a free online strategic planning tool. It allows municipalities to assess financial costs of urban expansion.	Given that diffuse development generally requires more infrastructural public investment per capita than compact development, this tool could affect local decision making.	There is a need for effective and helpful instruments during the post-earthquake reconstruction.

Source: authors' elaboration based on ESPON SUPER 2020

7.4 Programmes

Throughout Europe, a number of interesting programmes have been used directly or indirectly to promote fair, equal and balanced land-use practices (ESPON, 2020a). Two interesting interventions seem particularly relevant for the Croatian case (see also Table 7.5):

- In Spain, the City of Barcelona developed its successful 22@Barcelona regeneration programme. This was well-integrated in the process of the physical and functional restructuration of the metropolitan area and the overall framework of urban policies. The local government initiated the transformation of the dilapidated historic cotton district of Sant Marti into a booming knowledge center. Also, the 22@Barcelona project converted 2,000 hectares of industrial land of Poblenou into an innovative district offering modern spaces for the strategic concentration of intensive commercial and knowledge-based activities (ESPON, 2020b).
- In Linz (Austria), the municipal 1984 Green Space Plan includes incentives to increase greening in built-up areas to reduce air pollution. Linz had been struggling with a loss of green spaces and

a reduction of quality of life. The plan included four main pillars: (i) sound, basic research; (ii) legally binding development plans; (iii) financial support; (iv) Information and advertising.

The Act on the Reconstruction of Earthquake-damaged Buildings in the Territory of the City of Zagreb, Krapina-Zagorje County, Zagreb County, Sisak-Moslavina County and Karlovac County serves as a good example of programmes since it structures the financial mechanisms that help to implement the post-earthquake reconstruction process.

Table 7.5
Selection of programmes

Name	Country	Intervention type	Main scope	Lessons Learned	Relevance
22@Barcelona programme	ES	Regeneration	Rehabilitation of 200 ha of industrial land into an innovative district offering modern facilities for intensive commercial and knowledge-based activities.	If supported by a strong political will, regeneration programmes can support sustainable urbanization.	The whole post-earthquake reconstruction process in Croatia needs an efficient programme and strong political will supporting it.
Incentives to increase roof greening in Linz	AT	Regeneration	Incentives to increase greening in built-up areas to reduce air pollution.	Targeted incentives can enhance spatial quality and reduce land consumption in existing urban areas.	The City of Zagreb lacks public green spaces and there is a nation-wide need to implement green infrastructure and nature-based solutions to combat climate change effects.

Source: authors' elaboration based on ESPON SUPER 2020

7.5 Projects

The quality of projects and their mechanisms of implementation can be aligned with sustainable land-use objectives. Regeneration processes have the ambition to improve unused and problematic sites such as brownfields. In terms of the Croatian case, the area affected by the earthquake damage needs a valid regeneration methodology to achieve sustainability. More specifically, regeneration interventions aiming to revitalize areas to enhance the economic, environmental and social quality and promote long-term sustainable development. Three projects that might help in the Croatian situation all fall into the category of 'regeneration' (see Table 7.6).

- In France, the Reinventing Paris project aims to transform underutilized areas to achieve long-term sustainable development. The city asked urban designers to come up with innovative uses for 34 areas under city ownership that were unused or underused. Many were vacant metro stations, basements of historic buildings, tunnels freed up by banning cars from Seine's lower quay, and underground parking lots. By delegating the idea development to urban designers it promoted innovation.
- In Italy, Casoria led a community-led regeneration process which produced positive results in the rehabilitation of abandoned areas and the enhancement of public participation. This was a socially oriented process that implemented a series of small interventions in line with the broader urban strategy. From the onset, for example, owners of key brownfield sites were asked to provide temporary public access to their land to connect future regeneration sites to the city centre (URBACT III, 2018).
- In Cyprus, the Taht-el-Kale Quarter regeneration project aimed at the regeneration and rehabilitation of Nicosia city centre sites. Project activities were integrated with several social and cultural projects already implemented in the area, as a part of a wider urban regeneration strategy. The

results were seen in improvement of the life quality for local population and stimulation of economic activities.

Table 7.6
Selection of projects

Name	Country	Intervention type	Main scope	Lessons Learned	Relevance
Reinventing Paris (fr. Réinventer Paris)	FR	Regeneration	This project aims to transform underutilized areas to achieve long-term sustainable development. The city asked urban designers to come up with innovative uses for 34 unused or underused areas under city ownership. Most concerned unused metro stations, basements of historic buildings, tunnels freed by banning cars from Seine's lower quay and underground parking lots.	By delegating the idea development to urban designers, it promoted innovation.	Integrated urban revitalization measures (including new innovations) are needed to support the post-earthquake reconstruction.
Community-led regeneration in Casoria	IT	Regeneration	This implemented a series of small interventions in line with a broader urban strategy. From the onset owners of key brownfield sites were asked to provide temporary public access to their land to connect future regeneration sites to the city center.	Project had positive results in rehabilitation of abandoned areas and the enhancement of public participation.	Participative approach and public involvement is needed to successfully achieve sustainability objectives in post-earthquake reconstruction.
Regeneration of part of the Taht-el-Kale Quarter	CY	Regeneration	The project aimed at the regeneration and rehabilitation of Nicosia city center sites. Project activities were integrated with several social and cultural projects in the area as a part of a wider sustainable integrated urban regeneration strategy.	The results were seen in the improvement the quality of life for the local population and the stimulation of economic activities.	Possibility to increase sustainability (both social, ecological and economic) during post-earthquake reconstruction.

Source: authors' elaboration based on ESPON SUPER 2020

7.6 Potentials and warnings

This section sums up the lessons from the selected interventions relevant for the post-earthquake reconstruction process. Those are grouped in main thematic categories: regeneration, governance, containment and densification and discussed according to the intervention type.

In terms of **regeneration**, it should be emphasized that every successful initiative needs a well-structured and organized **long-term vision and development strategy**, which should be drafted with the local community and relevant stakeholders according to participative planning principles. This is important to ensure the achievement of needed economic, environmental, social and temporal objectives. Successful interventions 'listen' to local communities and their needs to achieve a sustainability 'equilibrium' in places where many interests and needs are strongly intertwined. In the current state, the Croatian case does not have a global long-term vision for the post-reconstruction process, a point which was emphasized by many interviewed stakeholders. Instead, focus was placed on the immediate reconstruction to save human lives and to develop a legal framework for state support for the reconstruction. A long-term vision and strategy could positively contribute to the process of reconstruction.

Regeneration seems to be very successful when the **concepts of reuse** and of **integrated sustainable development** are included. This implies the integration of circular management of buildings and spaces, green infrastructure, energy efficiency and different socioeconomic measures into the process of reconstruction. This improves sustainability aspects of reconstruction process. Another major potential for incor-

poration into the post-earthquake reconstruction process is **to address environmental, economic and social issues at the same time**. By combining the three pillars of sustainability, policy and decision makers can achieve more uniform spatial development. Such development would encourage all aspects of development, thus avoiding single-use urban areas and the creation of monofunctional blocks, which ultimately are resilient to external shocks. On the contrary, warnings for policy makers and decision makers in terms of regenerations are the scarcity of stakeholder involvement and the lack of financial mechanisms.

Participative approach with citizen and stakeholders is necessary to obtain a well-tailored intervention that is oriented to real spatial needs. The interviewees stated that the participative approach was not sufficient during the development of the Act on the Reconstruction of Earthquake-damaged Buildings. Many architects and spatial planners said that the reconstruction of the historic core of Zagreb should be driven by well-structured ideas. The Act on the Reconstruction of Earthquake-damaged Buildings recognized this by setting the need for drafting of the Programme of complete restoration of the historical urban fabric of the City of Zagreb, although not for other important historical sites in the three counties. The need for effective financial mechanisms was well prepared by the Act.

In terms of **governance**, a huge focus was put on improving **multilevel cooperation between stakeholders** which often enhances effectiveness. As stated, a **long-term sustainable development perspective and integrated approach** is needed for success. To assure effectiveness, the need of integrating public priorities with private (corporate or individual) should be emphasized. If the needs of all stakeholders in the area and the needs of all levels of management and development are assimilated, it is possible to achieve successful sustainability and the implementation of interventions with harmonized effects. Also, successful interventions enable adaptive multilevel collaboration and governance. Unfortunately, the Croatian case lacks multilevel collaboration; many interviewees pointed out that the planning community and other sector experts were not sufficiently involved in the process of drafting the Act. According to the SUPER Guide, successful cross-sectoral integration policies should be accompanied and supported by **cooperative governance mechanisms** capable of including different scales and sectoral needs.

In terms of **containment**, the establishment of an **efficient normative apparatus** for the **adoption of legally binding instruments** often seems to improve the success of containment interventions. In Croatia, this potential seems well established since the main instrument is the Act on the Reconstruction of Earthquake-damaged Buildings. Since the interventions in Croatia concern three counties, it is important to achieve good cooperation and coordination between them. Because containment measures take time to take effect, the support of strong, stable and effective **political will** is needed. Also, the engagement with a heterogeneous group of experts or '**expert knowledge transfer'** was important for containment policies. Unfortunately, many interviewees pointed out that post-earthquake reconstruction did not adequately accept the opinion of experts and the community. This is understandable given how quickly frameworks needed to be prepared to commence reconstruction. These kinds of policies drastically impact the social behaviour and quality of life of the local population.

In terms of **densification**, the SUPER Guide stresses that **knowledge, data and technical capacity** is important factor for sustainable urban development. This is needed for the adoption of a **long-term perspective** for urban development. If interventions are not implemented correctly, they might lead to a discrepancy between the objectives and outcomes, undermining legitimacy. This is the reason why a long-term and stable strategy should be developed with **implementational strength**. Another important warning could be seen in the lack of territorial awareness which is often due to a shortage of knowledge, data and technical capability.

In summary, the main messages are:

- Private actors – The inclusion and involvement of private actors;
- Integrated approach – Successful regeneration interventions regeneration are those that promote a long-term sustainable perspective and integrated approach;
- Stakeholders – Cooperation and coordination between stakeholders improve effectiveness;
- Multidimensionality – Addressing environmental, economic and social issues at the same time;
- Long-term vision – The adoption of a long-term vision (e.g. enhance the economic, environmental and social quality of the area and local community);
- Political will – The support from a strong political will (ESPON, 2020a).

8 How to achieve sustainable urbanization

The recommendations developed from the Croatian study are structured into two main parts: those for decision makers and those for policy makers. According to the ESPON SUPER Guide (ESPON, 2020a), decision makers are mostly elected officials, representatives of bodies with decision-making powers, ministerial and departmental officials related to territorial development and land-use management. Policy makers are public administrators and officials in charge of land-use planning and development at the local, regional, and national levels. Additionally, recommendations were structured into two subcategories: national and regional/local.

The recommendations were crafted by linking the recommendations of the ESPON SUPER project to the conclusions of this Croatian study including the conclusions of the interviews. The recommendations contain suggestions for interventions that could be used to support sustainable urbanization and land-use during the process of the post-earthquake reconstruction. In addition, they can also assist in preparing urban and regional areas for the consequences of natural hazards. For instance, since earthquakes are frequent in Mediterranean countries some recommendations address the European level of decisionmaking and policymaking. These concern the following:

- **Raise awareness of the need to restore historic urban areas at the EU level**. On the EU and national levels, it is necessary to encourage urban regeneration and revitalization of urban centres because they have the greatest daily traffic and social flow and represent unique cultural heritage and cultural identity. It is important to bear in mind the need for a balance between development and preservation in historical urban cores due to their mixed use;
- **Raise awareness of the need to develop earthquake resilience at the EU level**. The EU's Mediterranean area is very prone to potentially devastating earthquakes. In order to reduce physical damage and human casualties, consideration should be given to creating an EU financial mechanism to co-finance seismic reinforcement (seismic retrofitting) of public buildings, commercial buildings and residential buildings. It is important to bear in mind that for relatively undeveloped areas or declining areas renovating buildings after an earthquake is not enough: there is a need for a broader process of revitalization and regeneration to ensure environmental, economic and social recovery.

8.1 Recommendations for the national level

8.1.1 Decision makers

The results of the Croatian study produced recommendations for decision makers at the central state level, which are also relevant for other EU Member States. The following should be borne in mind:

- **Adapt a legal framework to support reconstruction**. The implementation of sustainable land-use policies before and after earthquakes requires a legislative framework, implementing documents, acts, regulations, ordinances and spatial plans. In parallel with the reconstruction planning process, it is necessary to ensure an interactive adaptation of the broader legal framework to allow the implementation of sustainable reconstruction;
- **Strive for better coordination of spatial and strategic planning systems**. In order to ensure successful implementation of urban development documents and policies, better coherence and coordination of the spatial and strategic planning system on all the levels is necessary. This is a prerequisite for successful sustainability of urbanization and land-use;
- **Ensure a stable financial mechanism for post-earthquake reconstruction**. A stable financial mechanism is needed to structure earthquake reconstruction assistance and ensure the financial security for reconstruction;
- **Identify financial resources for a broader process of integrated urban revitalization**. It is important to enable the use of EU funds towards the revitalization of earthquake affected areas. Urban areas should have the opportunity to use EU Green Deal funds and to integrate 'green' measures to achieve better sustainability of urbanization and land-use;

- **Promote coordination during post-earthquake reconstruction and revitalization**. Successful cross-sectoral integration of policies should be accompanied and supported by cooperative governance mechanisms capable of including different scales and sectoral needs between all governance levels. The support of strong, stable and effective political will is needed since the spatial effect of containment initiatives usually takes time to become apparent. In the context of long-term planning of post-earthquake reconstruction and revitalization, it is necessary to ensure cross-sectoral and interdisciplinary coordination;
- **Bolster political will in multilevel governance**. When affected areas include several administrative units, as it was the case in Croatia, it is necessary to ensure quality cooperation and foster political will towards a common goal;
- **Establish a more efficient framework to manage cultural heritage and cultural assets**. It is necessary to clearly define the approach towards cultural heritage in relation to preservation of original forms and the development of modern uses, as well as finding a model of creative management of cultural heritage. Revitalization does not necessarily imply complete reconstruction of historical, but rather finding solutions where historical elements can inspire the creation of new values.

8.1.2 Policy makers

National policy makers should explore a series of initiatives (instruments) that could better address sustainable land use during post-earthquake reconstruction. These recommendations were developed as recommendations for both the Croatian case and other EU Member States. Policy makers at the national level should therefore be aware of:

- **Promote knowledge transfer and capacity building**. Expert knowledge transfer is vital for achieving sustainable policies. The engagement of a heterogeneous group of experts support the creation of effective interventions. Moreover, knowledge, data and technical capacity is important for ensuring the adoption of a long-term perspective of sustainable urban development. Moreover, the exchange of experiences from other earthquake-affected areas would enable the application of best practices and widen the knowledge base for integrating sustainable urbanization and land-use in the reconstruction plans;
- **Engender cooperation and coordination between sectors during reconstruction**. Improvement of multilevel cooperation and coordination between stakeholders from different sectors strengthens effectiveness;

8.2 Recommendations for local and county levels

As far as for the decision and policy makers on the central, the counterpart on the local and county level should bear in mind that their roles are crucial for addressing post-earthquake reconstruction in a more sustainable way.

8.2.1 Decision makers

The role of decision makers on the local level is fundamental for applying central political priorities while addressing contextual needs and priorities. In so doing, decision makers should be aware of territorial differences which characterize the country. These recommendations were developed as recommendations both for the Croatian case and other EU Member States. Decision makers on local and county level should be aware of:

- **Promote long-term post-earthquake reconstruction planning through integrated urban revitalization**. Sustainable urban revitalization and post-earthquake reconstruction are possible only through planned and structured activities directed at sustainable development goals. Therefore, it is necessary to reconstruct damaged urban and rural areas in ways that will ensure functionality and sustainability (economic, demographic, safety, environmental and public infrastructure sustainability). When reconstructing and/or adapting existing buildings and proposing new buildings, it is necessary to consider modern needs and challenges (adequate quality of life, environmental sustainability, climate change impacts, etc.) and potential future disasters and hazards, especially earthquakes. To assure the achievement of needed economic, environmental, social and tem-

poral objectives, a well-structured and organized long-term vision and development strategy is essential. This should be drafted with local community and relevant stakeholders using participative planning principles. The strategy should have strong implementation strength to be effective and successful;

- **Think multidimensional**. To achieve sustainable post-earthquake reconstruction and integrated urban revitalization, it is important to address environmental, economic and social issues simultaneously. By combining these pillars of sustainability, policy makers and decision makers can achieve a prudent development of space that avoids the creation of monofunctional certain urban areas which have less resilience to external shocks;
- **Adopt an integrated approach in decision-making**. Successful interventions are those that promote an integrated approach. In the context of the post-earthquake reconstruction and integrated urban revitalization, it is necessary to involve experts of different profiles and expertise. There is a long-term need to strengthen public awareness about the need for an integrated and interdisciplinary approach in the decision-making process;
- **Strengthen the participative approach in urban development projects**. Urban development projects should be encouraged to ensure the participation of civil and private stakeholders to improve public awareness of the need and to raise opportunities for cooperation between the public, private and civil sectors in the decision-making process. This is of particular importance for projects related to historical urban cores.

8.2.2 Policy makers

Policy makers on the local level reside at the nexus between spatial planning and development practices. Their role is particularly important since they are on the forefront of everyday urbanization. These recommendations are valid for both Croatia as well as other EU Member States. Policy makers on local and county level should therefore be aware of:

- **Adapt spatial plans**. To lay the conditions for effective implementation of post-earthquake reconstruction and integrated urban revitalization, it is necessary to revise spatial plans in earthquake-affected areas (as a result of a comprehensive review of the manner and degree of reconstruction, both individual buildings and the urban/rural structure), but also in other parts of the country as a preventive measure. Within the spatial planning system, it is necessary to create a framework for selecting safe locations for construction (creation of spatial layers – fault maps, revised maps of seismic areas, maps of potential landslides etc.) and creating an adequate construction typology. This could be done by including spatial layers into spatial planning systems to ensure sustainable development. Data should be accessible and interoperable for the use in terms of geospatial analyses. This would enhance the cooperation among planners and different sectors. Potentially, there is a possibility for integration of a new spatial plan type on the lowest level which would be used as conservation plan for the historical urban core;
- **Conduct continuous and efficient land management**. To support sustainable urbanization and land-use planning before, during and after post-earthquake reconstruction and provide foundations for integrated urban revitalization, it is necessary to solve property issues, especially in regard to cadastre, land registers and property rights that comprise the foundation for all land-use management activities. Also, it is necessary to revise the planned construction sites in spatial plans to avoid occupation of problematic areas. Also, urban consolidation (reparcelling) should be considered as a tool for better urban management and revitalization;
- **Rehabilitate neglected and illegal areas to create resilience**. Areas characterized as neglected areas, substandard areas and areas of illegal construction need to be rehabilitated. Due to poor construction and management, these areas are at the highest risk of damage during the earthquakes and other natural disasters, so it is necessary to make them resilient and resistant. The recommendation applies in particular to areas that have a residential function. Illegal construction undermines sustainable urbanization and land-use, and thus, the post-earthquake reconstruction. This kind of construction creates permanent damage to the urban structure, so subsequent repairs and attempts to ‘introduce order’, to ensure adequate transport, communal, social, green and other infrastructure are very demanding because there is usually no room left for such infrastructure;

- **Improve hazard resistance of public and private buildings and spaces**. It is necessary to continuously raise the threshold of safety in the use of urban space and buildings (resilience to earthquake, fire, other hazards, etc.). It is also necessary to prescribe mandatory spatial standards for hazard risk reduction (planning of urban areas, evacuation routes, collapse zones, etc.) and continuously renew buildings that do not meet safety requirements (earthquake resistance, ensuring fire precaution measures, regulations on mandatory maintenance of facades and buildings in protected historic urban areas, etc.). During these activities, it is especially important to involve all sectors responsible for enacting regulations. More specifically, it is advisable start with the regeneration of old urban cores, raising the safety threshold of vital public buildings (schools, kindergartens, hospitals and social institutions) and developing plans for natural and anthropogenic hazards which ensure that reconstruction activities are implemented clearly and in a coordinated manner;
- **Put safety first**. In the event of an earthquake, emergency repairs on buildings and spaces should be carried out immediately to ensure the safety of citizens and solve urgent problems, while long-term reconstruction requires a structured implementation plan supported by spatial planning and strategic documents. After the earthquake, emergency repair measures need to be implemented swiftly but also in a way that does not undermine future revitalization plans. In affected areas, seismic rehabilitation is a prerequisite for demographic renewal and the return of a sense of security among residents;
- **Focus on plan implementation for post-earthquake reconstruction and integrated urban revitalization**. Post-earthquake reconstruction plans and integrated urban revitalization plans must have implementation strength. Therefore, they must be well connected with the spatial planning system and the strategic planning system (EU funds). A wide range of experts from different fields of science and expertise need to be involved in the process of planning post-earthquake reconstruction and urban revitalization. In doing so, it is necessary to simplify reconstruction programme implementation. It is also important to ensure good communication among sectors to engender better quality and efficiency. When making strategic and spatial plans, special attention should be given to risk management and revitalization;
- **Implement interventions that ensure the sustainability of urbanization and land-use**. Post-earthquake reconstruction and revitalization need to be directed towards achieving spatial sustainability goals. Sustainability of urbanization and land-use must be ensured through all the elements of spatial organization and management (transport, infrastructure, waste management, etc.). When building replacement houses and buildings after an earthquake, it is necessary to direct construction towards the sustainable urbanization goals and to use tools to achieve regeneration, containment and densification;
- **Apply good practices regarding green infrastructure and circular management of buildings and spaces**. When planning the reconstruction and revitalization of earthquake-affected areas, it is necessary apply concepts of green infrastructure and circular management of buildings and spaces. This can help promote sustainability during the post-earthquake reconstruction;
- **Strive for densification and regeneration**. Densification is a pathway towards containment which can preserve and protect natural land. There are many substandard and/or brownfield areas that could and should be regenerated to avoid new greenfield construction. For example, in dense urban areas, the courtyards of residential blocks provide potential for sustainable land-use. Urban areas that are substandard or have low infrastructure quality should be upgraded or rezoned (e.g. recreation, function for local community and residents, etc.) and should be able to ensure accessibility in times of emergency. By giving new ‘life’ to obsolete construction areas and using them for urban development, this can limit greenfield development. Regeneration seems to be successful when the concepts of reuse and of integrated sustainable development are included in interventions. This implies the integration of circular management of buildings and spaces, green infrastructure, energy efficiency and different socioeconomic measures into the process of reconstruction. The need to revitalize brownfield areas and neglected and abandoned urban areas must be integrated with the needs of the post-earthquake reconstruction;
- **Preserve cultural heritage**. Cultural heritage supports cultural and spatial identity. It should be nurtured during and after the earthquake reconstruction process and integrated into revitalization processes. It is necessary to prepare conservation documentation and appraise protected cultural

assets and historical areas (especially historical urban cores). There is a need for a clear vision for cultural heritage which identifies which parts should be preserved in its original state and which parts should be adapted to current needs. It is also important to ensure good reconstruction and renovation quality (e.g. chimneys and roofs) via modern techniques and methods. There should be awareness of the limitations to renovation of cultural heritage sites and buildings;

- **Ensure public participation of citizens and private stakeholders during the post-earthquake reconstruction process and integrated urban revitalization**. It is necessary to ensure public participation of all sectors (public, private, civil) during the post-earthquake reconstruction process and the process of integrated urban revitalization in order to ensure the social component of sustainability (public, citizens, associations, local community). A participative approach with citizens is necessary to obtain a well-tailored intervention, which steers real spatial needs.

References

Arbaci, S. (2007). Ethnic Segregation, Housing Systems and Welfare Regimes in Europe. *European Journal of Housing Policy, 7*(4), pp. 401-433.

City of Zagreb. (16/07, 8/09, 7/13, 9/16, 12/16). General Urban Plan of Zagreb. Zagreb: Official Gazette of the City of Zagreb.

City of Zagreb. (2017). *ZagrebPlan – Development Strategy Plan for the City of Zagreb.* Zagreb: City of Zagreb.

City of Zagreb. (2020). *City of Zagreb*. Retrieved 12 02, 2020, from https://www.zagreb.hr

City Office for Physical Planning, Development of City, Construction, Utility Service and Traffic. (2020). *City Office for Physical Planning, Development of City, Construction, Utility Service and Traffic*. Retrieved 11 13, 2020, from https://www.zagreb.hr/gradski-ured-za-prostorno-uredjenje-izgradnju-grad/829

City Office for Strategic Planning and Development of the City. (2015). *Demographic Development and Indicators of Functional Relationship in the Zagreb Urban Agglomeration.* Zagreb: City of Zagreb.

City Office for Strategic Planning and Development of the City. (2017). *Zagreb Urban Agglomeration Development Strategy for the period up to 2020.* 2017: City of Zagreb.

City Office for Strategic Planning and Development of the City. (2018). *Analysis and Evaluation of Development Potential and Limitations of the Zagreb Urban Agglomeration.* Zagreb: City of Zagreb.

City Office for Strategic Planning and Development of the City. (2020). *The Overview of brownfield areas of Zagreb Urban agglomeration.* Zagreb: City of Zagreb.

Croatian Bureau of Statistics. (2011). *Census of Population, Households and Dwellings.* Zagreb.

Egbelakin, T., Wilkinson, S., Potangaroa, R., & Ingham, J. (2011). Challenges to successful seismic retrofit implementation: a socio-behavioural perspective. *Building Research & Information, 39*(3), pp. 286-300.

ESPON. (2018). *COMPASS - Comparative Analysis of Territorial Governance and Spatial Planning Systems in Europe: Lithuania.* Luxembourg: ESPON EGTC.

ESPON. (2020a). *ESPON SUPER – Sustainable Urbanisation and land-use Practices in European Regions. A GUIDE TO SUSTAINABLE URBANISATION AND LAND-USE.* Luxembourg: ESPON EGTC.

ESPON. (2020b). *ESPON SUPER – Sustainable Urbanisation and Land Use Practices in European Regions. Annex 1 - Evidence on developments.* Luxemburg: ESPON ETGC.

ESPON. (2020c). *ESPON SUPER – Sustainable Urbanisation and land-use Practices in European Regions. Annex 4 – Sustainability assessment and scenarios.* Luxemburg: ESPON EGTC.

ESPON. (2020d). *ESPON SUPER – Sustainable Urbanisation and land-use Practices in European Regions. Annex 3.7. Case Study HR-Coastal.*

ESPON project 2.3.2. (2006). *Governance of Territorial and Urban Policies from EU to Local Level, Final Report.* Bruxelles: ESPON EGTC.

European Commission. (1997). *Compendium of Spatial Planning Policies and Systems in the European Union.* Bruxelles.

European Commission. (2019). Green Deal. Bruxelles: COM(2019) 640.

Government of the Republic of Croatia. (2020a). *Croatia Earthquake Rapid Damage and Needs Assessment 2020 [RDNA].* Zagreb: Government of the Republic of Croatia.

Government of the Republic of Croatia. (2020b). *National Development Strategy 2030*. Retrieved 12 16, 2020, from https://hrvatska2030.hr/

Institute for Physical Planning of Krapina-Zagorje County. (2020). *Institute for Physical Planning of Krapina-Zagorje County*. Retrieved 12 2, 2020, from http://www.prostor-kzz.hr/

Institute for Physical Planning of Zagreb County. (2020). *Institute for Physical Planning of Zagreb County*. Retrieved 12 2, 2020, from https://www.zpuzz.hr/

Jukić, T., Mrđa, A., & Perkov, K. (2020). *Urban renewal. Urban rehabilitation of Donji grad, Gornji grad and Kaptol/Historical urban ensemble of the City of Zagreb.* Zagreb: Faculty of Architecture, University of Zagreb.

Krapina-Zagorje County. (2016). *County Development Strategy for Krapina-Zagorje County.* Krapina: Krapina-Zagorje County.

Krapina-Zagorje County. (2020). *Krapina-Zagorje County*. Retrieved 12 2, 2020, from http://www.kzz.hr/

Ministry of Physical Planning, Construction and State Assets. (2020). *National Programme for the Development of Circular Management of Space and Buildings for the period of 2021-2030 (draft).* Zagreb: Ministry of Physical Planning, Construction and State Assets.

Ministry of Physical Planning, Construction and State Assets. (2020). *Reconstruction of earthquake-damaged buildings*. Retrieved 11 10, 2020, from https://mgipu.gov.hr/o-ministarstvu-15/djelokrug/graditeljstvo-98/obnova-zgrada-ostecenih-potresom-na-podrucju-grada-zagreba-i-okolice/10668

Ministry of Physical Planning, Construction and State Assets. (2020a). *Reconstruction of earthquake-damaged buildings*. Retrieved 11 10, 2020, from https://mgipu.gov.hr/o-ministarstvu-15/djelokrug/graditeljstvo-98/obnova-zgrada-ostecenih-potresom-na-podrucju-grada-zagreba-i-okolice/10668

Ministry of Physical Planning, Construction and State Assets, Faculty of Architecture. (2020). *National Programme for the Development of Green Infrastructure in Urban Areas for the period 2021-2030 (draft).* Zagreb: Ministry of Physical Planning, Construction and State Assets, Faculty of Architecture.

Nadin, V., & Stead, D. (2008). European Spatial Planning Systems. *Social Models and Learning, DISP, 44*(172), pp. 35-47.

Official Gazette. (102/20). Act on the Reconstruction of Earthquake-damaged Buildings in the Territory of the City of Zagreb, Krapina-Zagorje County and Zagreb County.

Official Gazette. (102/20, 10/21). Act on the Reconstruction of Earthquake-damaged Buildings in the Territory of the City of Zagreb, Krapina-Zagorje County, Zagreb County, Sisak-Moslavina County and Karlovac County. (amendments).

Official Gazette. (119/20). The first programme of measures for the reconstruction of buildings damaged by the earthquake in the City of Zagreb, Krapina-Zagorje County and Zagreb County. Zagreb: Official Gazette.

Official Gazette. (123/17). The Act on the System of Strategic Planning and Development Management of the Republic of Croatia. Zagreb: Official Gazette.

Official Gazette. (147/14, 123/17, 118/18). Regional Development Act. Zagreb: Official Gazette.

Official Gazette. (153/13, 65/17, 114/18, 39/19, 98/19). Physical Planning Act. Zagreb: Official Gazette.

Official Gazette of Krapina-Zagorje County. (04/02, 06/10, 8/15). Spatial Plan of Krapina-Zagorje County. Zagreb: Krapina-Zagorje County.

Official Gazette of the City of Zagreb. (8/01, 16/02, 11/03, 2/06, 1/09, 8/09, 21/14, 23/14, 22/17). Spatial Plan of the City of Zagreb. Zagreb: City of Zagreb.

Seismographic Service within Geophysics Department of the Faculty of Science. (2020). *Earthquakes near Petrinja in the period from 28.12.2020. at 06:28 to 31.12.2020. at 17:00*. Retrieved 1 21, 2021, from https://pmf.unizg.hr/geof/seizmoloska_sluzba/izvjesca_o_potresima?@=1m69w#

Solly, A., Berisha, E., Cotella, G., & Janin Rivolin, U. (2020). How sustainable are land use tools? A Europe-wide typological investigation. *Sustainability, 12*(3), 1257.

Solly, A., Berisha, E., Cotella, G., & Janin Rivolin, U. (2020b). Interventions and instruments to promote sustainable land use in Europe. Napoli: INU.

Solly, A., Erblin, B., Giancarlo, C., & Umberto, J. R. (2020). There are different ways to address land use; however, none of them is either fully sustainable or unsustainable. Napoli: INU.

Spatial Development Strategy of the Republic of Croatia. (OG 106/17). Zagreb: Official Gazette.

URBACT III. (2018). *Cities in Action - Stories of Change.*

World Bank. (2019). *National Development Strategy Croatia 2030 Policy Note: Family Policies.* World Bank.

Zagreb County. (2017). *County Development Strategy for Zagreb County.* Zagreb: Zagreb County.

Zagreb County. (2020). *Zagreb County*. Retrieved 12 2, 2020, from https://www.zagrebacka-zupanija.hr

Zagreb County. (3/02, 6/02, 8/05, 8/07, 4/10, 10/11, 14/12, 27/15, 31/15). Spatial Plan of Zagreb County. Zagreb: Zagreb County Gazette.

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