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Green and resilient urban recovery (case of Ukraine)

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Green and Resilient Urban Recovery (case of Ukraine)

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Abbreviations

CBD – UN Convention on Biological Diversity
CBI – Climate Bonds Initiative
CDS – Credit Default Swaps
COP – Conference of the Parties under UNFCCC
CP – Coordination Platform
DLT – Distributed Ledger Technologies
EO – explosive ordnance
EO – Explosive Ordnance
ESG – Environmental, Social and Governance Principles
ESM – European Stability Mechanism
ETS – Emission Trading Scheme
EU – European Union
FM – Financial Mechanism
FOC – Full Operating Capabilities
GE – Governance Framework
GFA – Green Finance Accelerator
GHG – Greenhouse Gases
GLA – Green Labelling Agency
GO – Guarantees of Origin
GSX – Green Stock Exchange
IA – Implementing Agency
ICMA – International Capital Market Association
IDPs – interlay displaced persons
IFI – International Financial Institution
IPO – Initial Public Offering
KH – Knowledge Hub
MOC – Minimum Operating Capabilities
MP – Master Programme
MSC – Minimum Sustainable Capabilities
NBS – Nature-based Solutions
NDC – Nationally Determined Contributions
NRP – National Recovery Plan
RBA – Resilience by Assessment
RBD – Resilience by Design
RFF – Recovery Financial Facility
RRF – Recovery and Resilience Facility
SDG – Sustainable Development Goals
SFDRR – Sendai Framework on Disaster Risk Reduction
SLP – Sustainability Leadership Programme
TF – Trust Fund
UN – United Nations

UNDP – United Nations development Programme
UNFCCC – United Nations Framework Convention on Climate Change
UNISDR – United Nations Office for Disaster risk Reduction
UO – Unexploded Ordnance
VF – Venture Fund
WEF – World Economic Forum

1. Background and rationale for a proposed approach

According to preliminary estimations, losses and damages caused by the ongoing Russian military aggression against Ukraine are already exceeding USD 411 billion ([The World Bank, 2023](#)). These numbers are growing steadily, with UAH 5-6 billion being added every week ([DW, 2022](#)). As per beginning of 2023, over 350 000 items and millions of square meters of the critical infrastructure have been destroyed due to the military aggression in Ukraine ([VisitUkraine, 2023](#)). The biggest pressure is being put on the cities and urban areas, both in terms of damage and increasing number of internally displaced persons (IDPs). As a result, existing problems go beyond the limits, especially around housing conditions and waste disposal. ([Deloitte, 2022](#)).

Cities and local communities are at the forefront of current military conflict (e.g., Mariupol, Bucha, Irpyn, etc.), where local population is suffering because of shelling, subsequent contamination of the territories with explosive ordnance (EO), and destruction of critical infrastructure. The lack of drinking water, food, heating, and electricity caused and still causes many deaths and injuries among Ukrainians. An unprecedented inflow of IDPs to the Western parts of Ukraine increases pressure on available urban infrastructure. At the same time, local authorities are experiencing lack of financial resources to cope with outstanding challenges and those needs are only partially covered by the National Recovery Plan (NRP) proposed by Ukrainian government ([URC, 2022](#)). Moreover, Russian forces' shelling of non-military targets has specifically destroyed critical urban infrastructure and has already caused devastating damages to the generation and transmission of vital services such as energy, water, and health care ([VOA, 2022](#)).

Over 70% of Ukrainian population were living in the cities before the war and the highest rates of urbanization were recorded in Donetsk, Luhansk, Zaporizhzhia regions ([VOXUKRAINE, 2022](#)). As most of the recovery efforts are expected to be concentrated in the urban areas, existing bottlenecks while channeling green and sustainable finance from centralized funds to recipients should be addressed. These bottlenecks comprise of knowledge gaps, lack of private sector investments, lack of climate and environmental data, insufficient capacity in financial structuring, metrics development, etc., and overcoming them is vital to facilitate related recovery activities ([WEF, 2022b](#)).

Hence, there is a need in facilitating access to the most important resources while working on recovery and reconstruction efforts on the urban level. Moreover, cities should be able to resist better or recover quickly in case if similar events would happen in the future – have an improved resilience to Environmental, Social and Governance risks (ESG). In other words, it's important to make sure that principles of "building forward better" and "leaving no one behind" are incorporated into the post-conflict recovery activities ([UNDP, 2020](#); [UN, 2017](#)). Such an approach requires clear middle- and long-term strategies, action plans and dedicated financial plans to support them. Moreover, elaborated recovery efforts should encompass prevention, mitigation, and adaptation activities against ESG risks – improve resilience and enhance ability of Ukrainian cities to manage existing and potential threats.

Considering existing shortages, it's important to elaborate a systemic solution on facilitating collection of the best practices, enhancing capacity development efforts, and providing technical assistance to the relevant recovery and resilience building activities. Additionally, given that capacities of the local authorities are limited, actions of relevant developing agencies and stakeholders around early recovery, peacebuilding and reconstruction should be consolidated and coordinated. Moreover, dedicated governance arrangements should be elaborated to manage outstanding activities in a coherent and comprehensive way. This will ensure high-level integrity and improve efficiency of a joint response to the military aggression against Ukraine and its consequences. For this purpose, dedicated financial solutions, capacity development and knowledge sharing projects are needed both on early recovery and post-conflict phases. Once the capacities on urban level will be improved, all elaborated solutions should be handed over to Ukrainian local and national authorities, ensuring that recommendations will be sustainable and do not require significant external support in the future.

2. Resilience as a core of urban recovery in Ukraine

Natural and man-made disasters are affecting our daily activities by imposing certain threats, causing losses and damages. As a result of the ongoing military aggression, escalation of the above-mentioned risks is accelerating with serious consequences. According to the latest report published by the World Economic Forum (WEF), the top-3 global risks in the next two years will be centered around cost-of-living crisis, natural disasters and extreme weather events, and geo-economic confrontations ([WEF, 2023](#)). Extreme weather events, such as floods, storms and extreme temperatures, have become more frequent between 1980 and 2020 ([The World Bank, 2021a](#)).

Hence, it's important to be resilient to such threats, be able to stand strong and recover quickly should such risks escalate in the future. At the same time, resilience related activities at the urban level shouldn't create additional pressure on the environment but should prevent degradation of nature and reduce related losses. Moreover, green, and resilient post-conflict recovery should be supported through a better access to the necessary resources to speed up planned activities (e.g., financial, natural, and human resources).

2.1. Why resilience is important

According to United Nations Office for Disaster risk Reduction (UNISDR), resilience could be defined as "an ability of a system, community or society exposed to hazards to resist, absorb, accommodate, adapt to, transform and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions through risk management" ([UNISDR, 2008](#)). The meaning of this term is reflected in different international agreements and encompasses various aspects of this phenomena.

An important international agreement signed in 2015 and relates to the issues around improving resilience and reducing the disaster risks, both man-made and natural extreme events (Sendai Framework on Disaster Risk Reduction (SFDRR)). Where resilience stands for substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries ([UN, 2015b](#)). The biggest advance of this agreement is a detailed set of Environmental, Social and Governance indicators to support achievement of the overall goal – improve resilience of economic agents to disasters with particular emphasis on the local level:

- Reduce the global disaster mortality by 2030 (down to 100,000 global mortality rate) (Target A) and the number of affected people to 100,000 globally (Target B).
- Reduce related economic losses in relation to global GDP by 2030 (Target C) with particular emphasis to the critical infrastructure (Target D).
- Substantially increase the number of the national and local DRR strategies, since most of the disasters are occurring on the local level (Target E).

Another important milestone in shaping resilience framework was reached by signing the Paris Climate Agreement in 2015 under the United Nations Framework Convention on Climate Change (UNFCCC). The main goals of this document are centered on limiting the global average temperature increase to well below 2°C above pre-industrial levels. Additionally, it aims to limit the temperature increase to 1.5°C (mitigation), with the goals of reducing risks and potential negative consequences of climate change, enhancing the capacity for climate change adaptation, and directing financial flows to low-carbon and climate-resilient development (Article 2). Also, Paris Climate Agreement is aimed at achieving a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases (GHG neutrality) in the second half of this century (Article 4) ([UN, 2015a](#)).

As a result of the COP15 under the UN Convention on Biological Diversity (CBD) another set of important decisions have been taken to tackle the problem of nature loss, to safeguard our wealth and to protect our planet ([UNEP, 2022](#)):

- Effective conservation and management of at least 30 per cent of the world's land, coastal areas and oceans will be supported.
- Reduction to near zero the loss of areas of high biodiversity importance and high ecological integrity will be facilitated.
- Reduction of the global food waste by 50% will be granted.
- Support to the phasing out or reforming subsidies that harm biodiversity by at least USD 500 billion per year will be provided.
- Mobilization of at least USD 200 billion per year from public and private sources for biodiversity-related funding granted.
- Raising of the international financial flows from developed to developing countries to at least USD 30 billion per year will be facilitated.
- Transnational companies and financial institutions will be obliged to monitor, assess, and transparently disclose risks and impacts on biodiversity through their operations, portfolios, supply, and value chains.

The 2030 Agenda has 169 SDG targets and 92 (54%) of them relate to local governments ([UNFCCC, 2019](#)). At the same time, such goals and indicators are global and there is a need in applying them to concrete economic agent on the local level. An approach employed by the financial institution to assess resilience of the clients to non-financial risks and make decisions regarding sustainability of their activities easier – bridge the gap between on-the-ground needs and financial market expectations. For this purpose, financial institutions are dividing non-financial indicators into three dimensions: Environmental, Social and Governance. This facilitates the process of establishing the baseline and evaluating results of the projects as the investment-decision process becomes more transparent and efficient.

Hence, the term “resilience” should be divided into three dimensions: environmental, social and governance – to capture different non-financial aspects. To support evaluation of achieved results, whether it involves an increase or decrease in resilience to the non-financial risks, a dedicated set of the ESG principles and indicators should be developed.

2.2. Review of available literature and recommendations

The concept of resilience is well elaborated around nature-made disasters and respective risk management activities. At the same time, application of this concept to conflict-related (man-made) disasters is still in progress and certain bottlenecks, as well as shortcomings have been already identified:

- Available resilience theory framework should be adjusted to requirements of the post-conflict recovery ([Agryroudīs et al., 2020](#); [Al-Saidi et al., 2020](#)).
- Lack of fit-for purpose resilience framework for post-conflict peacebuilding (Kottmann, 2021; [Adreliimi, 2004](#); [Maxwell, 2017](#)).
- Prioritization of the efforts is needed to facilitate rebuilding of critical infrastructure ([Earnest et al., 2015](#)) with adaptive features ([Kottmann et al., 2021](#)).
- Reconstruction should be conducted by an external organization ([del Castillo et al., 2008](#)).
- Resilience-building approaches could be divided into the following types: Resilience by Assessment (RBA) is more relevant for war-torn countries, Resilience by Intervention (RBI) – for post-conflict countries and Resilience by Design (RBD) – for proactive measures (ex-ante) (Mitoulis S.-A. et al., 2023).
- Capabilities of critical infrastructure to operate are divided into the following minimum operating capabilities (MOC), minimum sustainable capabilities (MSC), full operating capabilities (FOC) ([Hay et al., 2019](#)).

Availability and quality of the post-conflict recovery and resilience-building plans are still an issue. Since the beginning of the full-scale invasion in Ukraine, various proposals have been elaborated to facilitate recovery after the conflict. Current and available solutions provide suggestions and recommendations to support post-conflict recovery in Ukraine but are focused on specific and distinct elements. For instance, existing recommendations on post-war recovery in Ukraine are aimed at:

- Planning in a systematic and timely manner before recovery (Mitoulis S.-A. et al., 2023).
- Mainstreaming local climate and resilience lens into the urban recovery processes (ICLEI, 2022).
- Developing socially inclusive, low-carbon urban and resilient pathways (GGGI, 2021; Utkina et al., 2023).
- Supporting people-centered recovery that focuses on the well-being, improved inclusiveness, and reduced inequality (Climate Alliance, 2021).
- Looking beyond rescue efforts towards green and social recovery of critical infrastructure (BCG, 2022a; BCG, 2022b).
- Promoting informed and well-educated response to existing threats and risks through capacity building and capacity development activities (UNDRR, 2019; Bierwirth, 2021).
- Providing financial basis for planned activities (KNEU, 2023; BCG, 2022a; BCG, 2022b; CEPR, 2022).
- Developing a sequence suite of policy instruments, the five I's – information, incentives, insurance, integration, and investments – at the disposal of policy makers (Mukim et al., 2023).
- Supporting innovative solutions to facilitate modernization of Ukrainian economy through involvement of the venture capital (e.g., venture funds) (KNEU, 2023).
- Ensuring a high-level transparency for recovery efforts (Conley, 2022; Mingarelli, 2023).

Also, the following challenges should be considered while elaborating post-conflict early recovery and reconstruction plans for Ukraine:

- Potential contamination level of the occupied and recently liberated areas with explosive ordnance is excessive and unprecedented ([KMU, 2023](#)).
- Available National Recovery Plan has no clear framework and no direct link to mobilization of private green and sustainable finance with a very limited focus on the local needs ([Recovery, 2023](#)).
- Institutional framework in most of the thematic areas was even before the war at a very initial stage (e.g., no methodologies for environmental damage assessment still requires significant improvements and coordination, etc.) ([UNECE, 2023](#)).
- Green and sustainable finance area received first strategic documents just before escalation of a full-scale war (e.g., Concept of a green bonds market in Ukraine was adopted only as of February 23, 2022) ([Rada, 2022a](#)).
- Critical infrastructure is a heritage from the Soviet times, which creates some limitations for promoting development of energy from renewable sources (RE) (now RE is at 9% of the total energy consumption and has already caused a significant budget deficit; electricity grid is not designed for additional inputs of RE) ([Epravda, 2023](#)).
- Forestry and water areas are still the so-called "grey zones" since there is no precise information regarding available resources and their quality ([TU Dresden, 2020](#)).

- Agriculture is the most promising sector, and the EU is interested in importing Ukrainian organic products (EU proposed solutions on expanding export corridors for Ukrainian agricultural products) ([EC, 2022](#)).
- Definition of “critical infrastructure” was incorporated into the legal acts only in December 2022 and relevant strategic documents in this area are still missing ([Rada, 2022](#)).
- One of the most important challenges on the way to green and resilient post-conflict recovery is related to a significant number of corruption cases (also in the military sector) ([Kyiv Post, 2023](#)).

The current policy paper is going to address the above-mentioned issues and elaborate a systemic and coherent solution to support green and resilient urban recovery. This will be achieved through introduction of the governance arrangements, as well as the necessary institutional changes for improving management of recovery efforts and funnelling resources (e.g., information, finance, etc.) into the reconstruction activities on the urban level. Elaborated framework stands for provision of the end-to-end solutions to be handed over to the Government of Ukraine without necessitating further massive external interventions.

3. Aim and components of a proposed framework

A proposed recovery framework is *aimed* at facilitating access for Ukrainian cities and communities to the necessary resources (e.g., finance, information, human capital) for a green and resilient early recovery, as well as post-war reconstruction based on the principles “building forward better” and “leaving no one behind” – becoming more resilient to environmental, social and governance risks.

The entire recovery process should be divided into two phases: early recovery and peacebuilding, as well as post-conflict reconstruction. First response should be centered around safe return of the local population and businesses to their daily activities. At the same time, post-conflict reconstruction efforts should encompass support to the urban areas through improvement of their abilities to resist and recover quickly in case of a similar disaster.

Alongside with improved access to the most important resources, Ukrainian urban areas could have some additional *co-benefits*. A proposed bottom-up approach is also crucial for fostering Ukraine's European integration, attracting private green and sustained finance for recovery and resilience-building efforts in Ukraine in accordance with the EU Taxonomy for Sustainable Activities. Furthermore, EU Regulation on establishing Recovery and Resilient Facility (RRF) is playing an important role while establishing selection criteria and preparing relevant recovery projects ([EC, 2021](#); [EU, 2020](#)).

An elaborated framework contains the following elements: *Governance Element (GE)*, *Supportive Element (SE)* and *Taxonomy*. Implementation of recovery activities under proposed framework will require an appropriate GE to make sure that planned activities will be implemented in a most efficient way. Considering limited capacities of national, regional, and local authorities, it would be necessary to have a temporary SE (e.g., coordination of donors and investors, mobilization of financial resources, etc.). When capacities of the

government on different levels will be improved, functions of the components under SE will be passed over to official authorities (e.g., Ministries, Agencies, etc.) Also, selection of recovery projects, as well as control over the results will require a taxonomy as a set of pillars and specific indicators. This will be also important to evaluate the status of recovery efforts and do the necessary adjustments in case if selected trajectory will be deviating.

*A thematic objective-based approach in establishing GE provides a comprehensive, coherent, and consistent solution that is not time bound, and easily adaptable to differing levels of national capacity maturity: risk prevention; risk mitigation; risk adaptation; resilience building; sustainability enabling. Where under risk prevention an assessment of risks and their impact on main socio-economic indicators should be conducted (e.g., risk and post-disaster needs assessment on the local level). Risk mitigation thematic area will be concentrated on physical removal of the risks and reduction of impact – returning situation back to normalcy as soon as possible (e.g., demining activities, debris removal, and GHG emission reduction activities on the local level with special attention to the energy efficiency projects). In case of risk adaptation, adapting interventions to changing threats and environment will be supported (e.g., recycling of debris, victim assistance, climate change adaptation measures on the local level with specific attention to nature-based solutions, and NBS). Resilience building interventions should contribute to strengthening critical infrastructure and institutions – ensuring full functionality, facilitating recovery, and reconstruction (e.g., improving resilience of the critical infrastructure through mobilization of financial resources, capacity building and capacity development efforts). Sustainability enabling component should support scaling down of external interventions and assist around development of internal capacities and institutions (e.g., supporting coordination and enhancing national Quality Management (QM) infrastructure) (see **Table 1**).*

SE will be important to manage recovery efforts and enable operationalization of the following institutional arrangements under proposed framework:

- Implementing Agency (IA) to support implementation of the planned activities and facilitate quality management.
- Coordination Platform (CP) for a more efficient elaboration and implementation of recovery efforts (e.g., advocating interests of different stakeholders, ensuring quality monitoring and necessary institutional reforms).
- Financial Mechanism (FM) (e.g., Recovery Financial Facility to support early recovery and peacebuilding, as well as green and resilient reconstruction in Ukraine.
- Knowledge Hub (KH) for capacity building and capacity development created, or/and existing facilities of ICLEI (Circulars Hubs) (e.g., preparation of the project pipelines, educational programs, etc.).

Since urban areas experiencing lack of the necessary capacities, involvement of an appropriate IA will be necessary to make sure that GE, all institutional arrangements, and planned activities are implemented, quality assurance granted. While selecting an implementor it's important to consider available experience in implementing projects in Ukraine, ability to provide security guarantees for experts and staff coming to Ukraine (e.g., UN Agencies, GIZ, ICLEI). Moreover, coordination among them will be crucial to support the

necessary institutional developments and reforms, such as establishing new agencies and conducting capacity-building activities, all aimed at facilitating recovery efforts.

Table 1. Governance Element (GF) and related institutional arrangements.

Governance Element components	Role	Supportive Element components
Risk Prevention	<ul style="list-style-type: none"> - Conducting risk and post-disaster needs assessment. - Elaborating and validating ESG indicators - Assessing available capacities on emergency response, early recovery capacities on the local level. - Supporting implementation and maintenance of the monitoring system, as well as a database with relevant information. - Promoting risk management education. 	Implementing Agency Knowledge Hub Coordination Platform
Risk Mitigation	<ul style="list-style-type: none"> - Prioritizing activities and improving efficiency of resource utilization. - Removing the most critical risks to ensure save living and business conditions. - Reducing exposure to and impact of existing risks on environmental, social, and economic assets. - Reducing impact of outstanding threats on available assets, both economic and non-economic, e.g., human lives. - Restoring basic functionalities of critical infrastructure. 	Implementing Agency
Risk Adaptation	<ul style="list-style-type: none"> - Elaborating adaptation pathways to cope with outstanding risks. - Supporting local authorities in their operations, and/or bilateral complimentary intervention aimed at adopting to existing threats, e.g., shelling and climate change. - Enhancing local capacities in managing information, analysis, and adapting to evolving threat environment. 	Implementing Agency
Resilience Building	<ul style="list-style-type: none"> - Connecting local authorities to the global community for the purpose of resource mobilization. - Implementing resilience-building activities to financial and non-financial threats on the local level. - Building up and improving capacities of the local authorities. 	Implementing Agency Coordination Platform
Sustainability Enabling	<ul style="list-style-type: none"> - Supporting and facilitating local authorities with access to the opportunities of relevant treaties and agreements previously signed by the national government. - Improving coordination of various stakeholders for a better response. - Supporting quality management activities and sharing experience with relevant local authorities. - Developing monitoring and evaluation infrastructure. 	Implementing Agency Knowledge Hub Financial Facility Coordination Platform

Source: built by the authors.

Hence, establishment of a CP will be necessary to facilitate dialogues and exchange of information regarding the outstanding needs and required institutional improvements. Such a platform could integrate all the relevant developing agencies and stakeholders while working on rebuilding and transforming the entire country – improving its resilience to the non-financial risks and facilitating European integration plans.

To facilitate post-war reconstruction efforts, it's important to conduct post-disaster needs assessment and evaluate risks – support preparation of the subsequent strategic documents and action plans. Such strategies and plans should contain concrete actions on supporting green and resilient recovery of Ukrainian cities. Considering latest developments on the financial market (especially in the EU), green and sustainable considerations are important to get access to private finance, which is crucial to mobilize necessary funds.

Implementation of strategic and short-term plans will require mobilization of green and sustainable finance from different sources. Moreover, available, and potential public sources would not be sufficient to cover the needs for green and resilient recovery activities. Hence, private finance will play an important role in this regard. To facilitate mobilization of financial resources from different sources (blending finance), leverage political risks and provide an adequate oversight over the planned activities, dedicated FM (e.g., Trust Funds, Recovery Financial Facility) and relevant institutional arrangements should be established.

Elaboration and implementation of recovery plans, mobilization of the necessary financial resources will require an adequate capacity development on the city level since current contingent has no relevant knowledge and experience. For this purpose, there is a need in establishing KH to facilitate provision of the technical assistance, support capacity building and capacity development services (e.g., preparation of the bankable projects, elaboration of the recovery strategies and relevant action plans, etc.) aimed at creating an enabling environment for green resilient recovery on the local level.

As a result, recovery and reconstruction activities should address major gaps: technical, informational, and financial. An elaborated systemic solution should also contain concrete principles, pillars to make sure that project pipelines and necessary financial resources could be generated to support recovery efforts. Additionally, a clear and transparent governance structure should be created to provide a clear signal to the investors that their funds will be used in a proper way.

4. Principles, pillars, and indicators of a recovery framework

Post-conflict recovery and resilience-building activities in Ukraine on the urban level should be built upon three core *principles*:

- *Environmental* - planned activities should encompass environmental aspects and limited availability of natural resources.
- *Social* – safe return of people to their homes and improved resilience of the health services, provision of sustainable sources for living.
- *Governance* – enhance trust and transparency of recovery efforts.

Application of ESG indicators will facilitate resilience evaluation process and provide a common language with financial institutions. Such a connection to the financial market will be important to cover financial needs and facilitate evaluation of achieved results. At the same time, ESG considerations are important to translate global Sustainable Development Goals into resilience indicators of a concrete economic agent. In our case, it will be applicable for resilience evaluation process on the city level. For financial institutions it provides important information regarding ability of a specific client to stand and deliver, i.e., be able to repay provided credit resources. In case of investments, application of the ESG indicators will be necessary to comprehend resilience improvements of a given economic agent to the non-financial risks, and to understand perspective of the blended value creation process. The former one relates to the process of generating positive results other than economic value, e.g., certified greenhouse gas emission reductions.

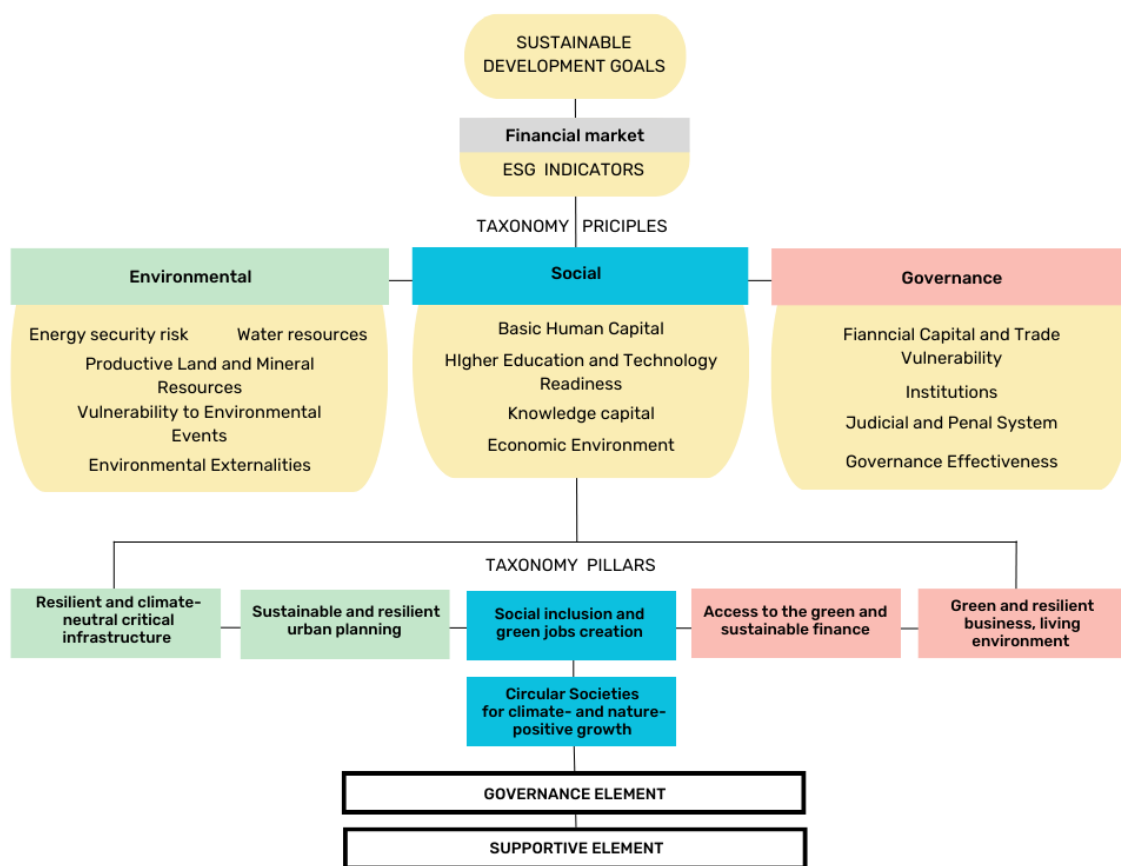


Figure 1. A framework for green and resilient urban recovery in Ukraine.

Source: built by the authors.

To facilitate green and resilient urban recovery in Ukraine (selection of relevant projects), a dedicated Taxonomy with concrete *pillars, principles and indicators* should be established (see **Figure 1**):

- *Green and resilient business, living environment* in liberated cities and regions granted (e.g., public services, technical, and non-technical surveys, demining of the liberated territories). **Governance**
- Access to the *green and sustainable finance* facilitated (e.g., direct access to the green and sustainable finance). **Governance**
- *Sustainable and resilient urban planning* enabled (e.g., nature-based solutions – NBS, redesigning of the urban spaces, energy efficient public and private buildings). **Environmental**
- *Resilient and climate-neutral critical infrastructure* supported (e.g., energy production/storage/supply, roads, hospitals, schools, utility companies, etc.). **Environmental**
- *Circular societies for climate- and nature-positive growth* established (e.g., recycling of debris, improved waste management, participation of civil society representatives e.g. in repair cafés, education for circularity, promotion of circular design and business models incl. new role of consumers as prosumers, using products as a service, sharing economy, combining creativity (entrepreneurship, arts) for new models of participation and more acceptancy, using tools like e.g. Mapstories etc.). **Social**
- *Social inclusion and green jobs creation* at the local and regional level enhanced (e.g., equal access to the labor market for all: education for circularity / just transition / green recovery, establishment of the regional and local Knowledge Hub). **Social**

In this regard, following *tools* should be used to support elaboration and implementation of recovery and reconstruction efforts in Ukraine:

- *ESG metrics* elaborated by the financial market (e.g., measurement of recovery efforts' results to bridge with expectations of private investors).
- *Advanced technologies and methods* on dealing with limited natural resources (e.g., smart grids, IT solutions to support storage and collection of the data, recycling of debris for recovery purpose, and Nature-based solutions).
- *Green and sustainable financial mechanisms* (e.g., transition bonds, social impact bonds, green and sustainability bonds, biodiversity credits, Guarantees of Origin, and GOs).
- *Capacity building and capacity development activities* (e.g., Sustainability Leadership Programme (SLP)).

5. Stakeholder mapping under proposed framework

Current set of stakeholders involved into recovery and resilience-building processes could be divided into the following groups: *governmental institutions, implementing partners, civil society, private sector* (see **Table 2**).

Table 2. Stakeholder mapping for green and resilient urban recovery in Ukraine.

	GOVERNMENT	IMPLEMENTING PARTNER	CIVIL SOCIETY	PRIVATE SECTOR
SUSTAINABLE AND RESILIENT URBAN PLANNING	City Councils, Regional Military Administrations	UNDP, WWF, GIZ, EBRD	SYNCHRO SPACE, PLATO, CEDOS	SYNCHRO SPACE, PLATO, CEDOS
GREEN AND RESILIENT LIVING AND BUSINESS ENVIRONMENT	City Councils, Regional Military Administrations, SESU	UNDP, UNICEF, UNHCR, JICA, DRC, HALO Trust	Ukrainian Demminers Association, Environment People Law, Ecodiya	Certified companies for mine clearance
CRITICAL INFRASTRUCTURE	City Councils, Regional Military Administrations, Ministry for Communities, Territories and Infrastructure Development, Ministry of Infrastructure, Ministry of Energy	UNDP, UNIDO, GIZ, EBRD, IFC, EIB, Covenant of Mayors East	DiXi Group, Environment People Law, Ecobusiness, Energy Industry Research Center, Association of Energy Efficient Cities	ESCO companies, DTEK
GREEN AND SUSTAINABLE FINANCE	City Councils, Regional Military Administrations, Ministry of Finance	UNDP, UNIDO, GIZ, EBRD, IFC, EIB, Covenant of Mayors East	ASDE, CBVS	Deloitte, EY
CIRCULAR SOCIETIES	City Councils, Regional Military Administrations	UNDP, WWF, UNIDO, GIZ, EBRD, IFC	Environment People Law, Ecodiya, Ecobusiness	Neo-Eco, Green Mix, Greenera
GREEN JOBS CREATION AND SOCIAL INCLUSION	City Councils, Regional Military Administrations	UNDP, UNWomen, UNIDO, UNHCR, GIZ, EBRD, IFC, FAO	Association of Energy Efficient Cities	ESCO companies, Neo-Eco, Green Mix, Greenera

Source: built by the authors.

Urban areas account for approximately 70% of the world’s energy consumption and upwards of 70% of emissions (UN, 2011). At the same time, around 58% of global population lives in cities with a predicted growth up to 68% in 2050 (UN, 2018). Hence, recovery and reconstruction efforts will be concentrated in urban areas. The biggest achievements have been made under the pillar "Green and Resilient Business, Living Environment". The current level of digitalization of different public services in Ukraine is very high, which was important to ensure their provision even after the outbreak of a full-scale aggression against Ukraine. Internally displaced persons (IDPs), as well as businesses had access to the basic necessary public services (e.g., registration in the city, issuance of the driver’s licenses, taxation, etc.). All these services are being provided through different modules integrated into the DIA platform (DIA, 2023) and elaborated by the Ministry of Digital Transformation of Ukraine with support provided by various international partners (e.g., GIZ and UN Agencies).

At the same time, safe return of people and restart of the business activities on recently liberated territories is limited due to an extremely high level of contamination with explosive items. Territories affected by current military conflict are potentially contaminated with explosive and unexploded ordnance and the process of technical and non-technical surveyance could take years. According to official data provided by the Government officials,

around 30% of the Ukrainian territory is potentially contaminated and available capacities to proceed with the necessary activities are limited ([UNIAN, 2023](#)).

Moreover, the process of technical and non-technical surveyance doesn't contain impact analysis of Explosive and Unexploded Ordnance (EO, UO) on Environmental, Social and Governance considerations (ESG). This limits the process of prioritizing early recovery and reconstruction activities – applying limited capacities by the Ukrainian government in a most efficient way. Moreover, availability of ESG data could facilitate direct access to green and sustainable finance (e.g., farmers and cities).

Availability of ESG indicators and relevant baselines is important for a subsequent damage assessment, both in economic and non-economic terms (e.g., losses of species, biodiversity, etc.). Such information will be crucial to proceed with strategic planning of the necessary early recovery and reconstruction efforts, with specific emphasis on connecting the needs on the ground with expectations and opportunities on the financial market.

Under the pillar "*Sustainable and Resilient Urban Planning*" first steps should be made to start with recovery planning, where redesigning and "rethinking" of urban spaces could provide the necessary conditions for making them more sustainable and resilient to non-financial risks. For instance, on the city level, most critical environmental risks relate to air pollution, lack of green spaces, severe storms and flooding, as well as a weak stormwater management ([EEA, 2022](#)). At the same time, the full-scale invasion in Ukraine demonstrated that the most critical issue in big cities (e.g., Mariupol) was related to the lack of drinking water after the heavy shelling. For this reason, introducing a blue-green infrastructure (e.g., Nature-Based Solutions, NBS) could facilitate provision of ecosystem services, protect against disasters and create affordable living conditions. Overall, implementation of a blue-green infrastructure could contribute to: climate regulation, water flow maintenance, flood protection, and improvement of air and water quality ([Climate-KIC, 2017](#)).

The next pillar under the proposed framework relates to "*Social Inclusion and Green Jobs Creation*", where planned sustainable projects could facilitate creation of the new opportunities for people living in cities. Officially, escalation of the war in Ukraine led to increase of the unemployment rate, which is expected to reach 26% in 2023 ([Forbes, 2023](#)). At the same time, GDP in 2022 fell by almost 30% which was reflected in decrease of the tax revenues and a sharp decline in social support provided by the government on different levels ([ME, 2023](#)). Additionally, in Ukraine over 4 million people left the country as a result of the military aggression. Over 7,8 million people are officially registered as internally displaced persons (IDPs) with a need in providing almost USD 350 million of the financial assistance ([OHCHR, 2023](#); [IOM, 2023](#)).

Impact of the conflicts has some social implications, where victims of war require an adequate support to recover from the stress. From this point of view, NBS could serve as a good enabler for the physical and psychological rehabilitation of victims of armed conflict ([OCHA, 2021](#)). As an example, the city of Irpyn requested by the UN agencies a support in greening the rooftops on the eve of heating season 2022/2023 to do quick repairs of slightly damaged buildings and provide an opportunity for the people to communicate through active collaboration. As a result, people in such residential buildings could get together and support each other while recovering from the shocks. Additionally, some green jobs could be created

if the size of such "rooftop farms" could allow to sell products to the markets. Another good example of initiatives that could generate green jobs and provide the necessary conditions for social inclusion is the so-called "Eco Villages" initiative ([GEN Ukraine, 2023](#)). Since an enormous amount of people moved to the central and western parts of Ukraine to escape from the full-flagged invasion, cities and urban areas started to experience an increased pressure. To reduce such a pressure in western regions, abandoned villages have been adopted to accommodate IDPs, both on temporary and permanent basis. The main idea was to provide people with eco-fertilizers and necessary equipment to support production of bio-products and ensure sustainable way of living.

The pillar "*Circular Societies for climate- and nature-positive growth*" is equally important to facilitate early recovery and reconstruction activities. For instance, because of heavy shelling aimed at civilian infrastructure, public and private houses, administrative buildings, and critical infrastructure, huge amounts of debris were generated. According to official estimations, around 10-12 million tons of debris have been generated during the military aggression in Ukraine ([KMU, 2023](#)). At the same time, construction companies moved to the western regions from the central and eastern part of Ukraine, which created some barriers to debris removal and recycling activities in the war-affected areas. Unfortunately, a first regulation on removal, recycling and usage of the debris was published only at the end of 2022, which posed some limitations regarding potential utilization of recycled debris (reconstruction of the roads, bridges, etc.) ([Rada, 2022b](#)). This also created some difficulties for providers of the technical assistance to start implementation shortly after the liberation and decontamination of the territories.

Another aspect relates to the waste management in Ukraine. Unprecedented pressure on the western regions has been posed on regional and local levels caused by massive reallocation of IDPs. The situation escalated during the summer months in 2022 when the amounts of bio waste increased exponentially and the waste management systems in place were not able to tackle the challenge. At the same time, such amounts of bio waste could be used to produce energy from renewable sources (e.g., production of biogas) and increase resilience of cities to blackouts or shortfalls in the energy supply.

The outdated critical infrastructure designed and constructed mostly in the Soviet times is highly centralized and has low level of resilience. Under the pillar "*Resilient and climate-neutral critical infrastructure*" following sectors should be covered: chemical sector, critical manufacturing sector, communications sector, dams' sector, defense industrial base sector, emergency service sector, food and agriculture sector, healthcare and public health sector, IT-sector, nuclear reactors, materials, and waste sector, transportation systems sector, water and wastewater systems, government facilities sector, energy sector, financial services sector ([Rada, 2022c](#); [CISA, 2023](#)). The territory of Donbas (Donetsk and Luhansk regions) used to be one of the most important locations for industrial production (e.g., steel, heavy machinery, chemical production, etc.). As a result of the full-flagged invasion in 2022, most of those sites were damaged or destroyed completely. Hazardous materials were released and contributed to further deterioration of environment, e.g., water and air contamination. Moreover, application of the military ammunition is another source of emissions, both of hazardous elements and greenhouse gases ([Rubryka, 2023](#)). Hence, if these production sites will be recovered, there is a need in making them more resilient to potential non-financial risks and

reducing negative impact in case of further destructions or damages (e.g., case of the “Azot” factory) ([TSN, 2022](#)).

In case of the communication sector, escalation of the military conflict and a subsequent occupation of Ukrainian territories led to significant disruptions in communications. Such a difficult situation made it impossible to keep connections with occupied territories and among Ukrainian people who decided to stay and avoid evacuation to the controlled territories ([KyivIndependent, 2022](#)). To ensure undisrupted and effective communication in the future, a set of measures should be implemented to make sure that the control over communication lines will be resilient and still manageable even if there will be no connection to an occupied territory ([Wired, 2022](#)). At the same time, it’s important to consider the consequences of climate change and their impact on functionality of communication lines (e.g., during heat waves) ([Mirror, 2022](#)).

The impact of war on the water sector is unprecedented, both in terms of availability and quality of this valuable resource. As it was mentioned above, lack of drinking water was very critical in the big cities and people were suffering without access to it. Additionally, since part of the electricity is being produced by hydro power plants, dams are playing an important role in contributing to the overall energy security of Ukraine.

Even the military sector is affected by climate change related consequences. For instance, it leads to reallocation of the bases, additional casualties caused by natural disaster. Moreover, it creates some difficulties while planning the military activities when adjusting them to the changing environmental conditions. At the same time, implementation of the so-called concept “bases of the future” is built upon greener practices and smart technologies which could contribute to an improved resilience of communities ([Atlantic Council, 2021](#)). For instance, military bases are usually attached to communities and serve as cultural hubs. At the same time, military bases are highly dependent on labor forces living in the cities and communities. Hence, improvements in resilience of the infrastructure lead to significant benefits for the cities and communities.

Establishing a decentralized energy production, expansion of the storage capacities and improvement of supply was especially critical when Russian military forces managed to hit the energy system in the most vulnerable places of transformation and transmission the end consumers ([IEEE, 2022](#)). As a result, energy producers should decrease their generation to maintain stability of the entire system.

According to preliminary estimations made by the UN and the World Bank, an entire energy sector experienced damages of about USD 10 billion, which is 5 times higher than by June 1, 2022. The power sector damages have already reached the threshold of about USD 6,5 billion, where generation component is responsible for USD 3,9 billion and transmission part – for USD 1,9 billion of the damage caused. The gas sector recorded the damage for almost USD 1,2 billion and this source of energy is important to ensure that maneuvering capacities, as well as the central heating in the cities could be provided. The central heating infrastructure itself was also damaged and requires about USD 1,2 billion to support early recovery and reconstruction activities¹.

¹ Based on the draft report prepared by UNDP and the World Bank “Ukraine. Energy Damage Assessment”, February 2023.

To make sure that energy sector and the cities become more resilient to similar threats in the future, there is a need in fostering decentralized production, storage, and transmission capacities. For this purpose, application of distributed ledger technologies (DLT) could provide opportunities to transform small and medium consumers into producers, so called prosumers. This would facilitate creation of virtual storages, as well as transmission of the energy produced. At the same time, decentralization of such processes will make cities more resilient to the energy shocks, potential shelling in the future, making them less dependent on centralized energy systems. Additionally, this would be important to remove barriers to expansion of renewable energy production beyond existing limited capacities of an outdated energy system.

6. Elaborated solutions and recommendations

Considering huge financial needs and lack of available technical capacities on the city level, some additional institutional arrangements should be elaborated not only to support implementation of recovery activities but also to make sure that necessary capacities will be established on the city level.

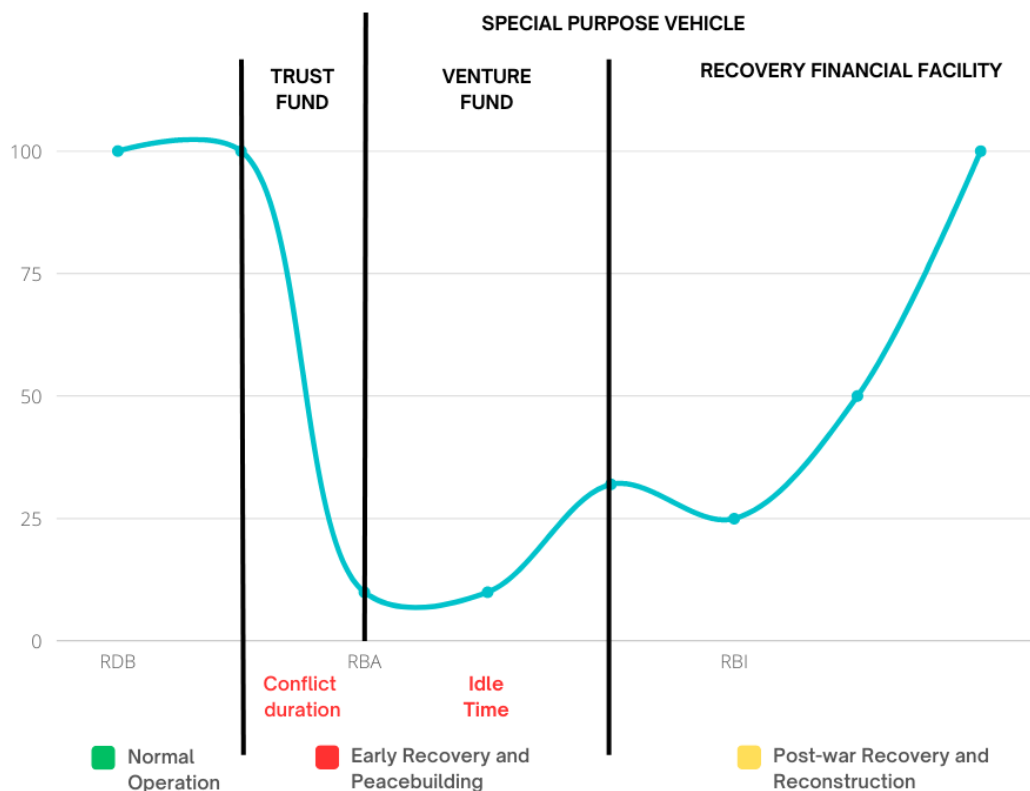


Figure 2. Phases and components of urban recovery in Ukraine.

Source: built by the authors, based on Mitoulis S.-A. et al., 2023.

Moreover, certain important actions should be conducted on the newly liberated territories to make sure that business conditions and living environment will be secure and displaced people could return to their homes. At the same time, damage assessment should be conducted to estimate the needs (e.g., financial, and human resources) and to support preparation of the reconstructions plans and subsequent mobilization of the financial resources (see **Figure 2**).

6.1. Access to green and sustainable finance

As it was already mentioned above, an enormous amount of financial resources should be mobilized to facilitate green and resilient recovery on the local level in Ukraine. Moreover, some technical barriers are in place (e.g., external payments from Ukraine are prohibited) guarantee that planned activities will be built upon the principles of “building forward better” and “leaving no one behind” (see **Table 3**).

Table 3. Barriers to the availability of private urban resilience-building finance.

Type	Urban Capacity Required
Technical Barriers	<ul style="list-style-type: none"> - Available vulnerability risk assessment (with the special emphasis on climate-related threats). - Well-functioning administrative and institutional capacity and adequate funding from local revenue generation and intergovernmental transfers.
Commercial and Market Barriers	<ul style="list-style-type: none"> - Strong capacity for legal oversight and management. - Well-functioning local or national financial markets that city governments can access. - Exchange rate and inflation uncertainty
Governance Barriers	<ul style="list-style-type: none"> - Good relations with national governments, strong administrative capacity to design and implement policies and plans. - ESG indicators incorporated into the strategic and action plans. - High level of corruption before and after escalation of the military conflict. - Low investment profile before the war. - Increased military influence during the wartime because of escalation of internal/external conflicts. - Low quality of the bureaucracy.

Source: built by the authors based on the Revi et al., 2014 - [IPCC 5th report](#) and [Sändstrom, 2008](#).

In fact, there is a shortage on money to finance and conduct recovery and reconstruction efforts: *technical barriers* (e.g., poor policy and institutional environment, etc.), *commercial barriers* (e.g., uncertain value-add, high cost, etc.), and *governance barriers* (e.g., management and operational capabilities). The cities are looking for new opportunities to

finance resilience-building projects, adopt to climate change and meet their sustainable development goals. Worldwide, there are numerous schemes, which have been already implemented in different cities all around the world to finance resilience-building instruments (e.g., climate change mitigation, adaptation and sustainable development). Among the most popular are the following: (i) *subsidies* for related projects, (ii) *loans*, (iii) *direct funding*, (iv) financing via *climate bonds*, and (v) *co-funding* (EEA, 2017).

Table 4. Financial mechanisms and instruments for resilience-building projects.

Level/Type	Public	Private	Alternative	Examples
Local	Local revenue raising policies: taxes, fees, and charges or use of local bond markets			Bologna Local Urban Adaptation Plan for a resilient city
	Public-Private Partnerships (PPP) contracts and concessions			Quezon city drainage systems, waste-to-energy solutions https://business.gov.nl/subsidy/green-projects-scheme/
	National or local financial markets			Cities of Hamburg, Lisbon, Bilbao
National	National (or state / provincial) revenue transfers or incentive mechanisms			Payments for ecosystem services in Vancouver and New York
	Climate Insurance Schemes			Catastrophe insurance schemes in China
			Philanthropy	Bill Gates's climate-oriented venture capital fund
International	Market-based investment			Direct Investments, biodiversity credits
	Grants, concessional financing			Adaptation Fund
	Risk transfer mechanisms			Cat bonds , Cat swaps Debt-for-Nature swap Debt-for-Climate swap

Source: built by the authors based on Revi et al., 2014 - IPCC Fifth Report, 2014.

Existing financial mechanisms could be divided into four broad groups: *savings or self-financing, contingent and crisis financing, debt financing, climate insurance, and risk transfer (reinsurance)* (see **Table 4**). These mechanisms rely heavily on the participation of the private sector under a wide perspective, including large companies, small and medium sized enterprises, as well as consumers. Cities and countries consider these private sector mechanisms to serve a dual objective of creating incentives to reduce carbon emissions and energy consumption, while also potentially enhancing local tax base to fill the financing, technological and regulation gaps for the implementation of other climate action measures.

There is no single type of mechanism and source of finance that would meet all the needs in urban areas. The packages of finance mechanisms are determined by several factors, such as political risks, power market risks, social acceptance risks, financial sector risks and macroeconomic risks, the scale and type of project and the city's fiscal status, creditworthiness, and financial autonomy. While determining financial structure of urban projects and assessing possible sources of climate finance, the local circumstances and project's characteristics must be considered.

The following instruments could be of particular importance to facilitate resilience-building finance mobilization in Ukraine: *refinancing of the green loans* through the facilities of the International Financial Institutions (IFIs); issuance of the *sovereign green financial instruments* (e.g. sustainability, green bonds) with positive signal to the international green financial market; issuance of the *municipal green and sustainable financial instruments* (approved by the Ministry of Finance); *green supply chain financing* (implementation of the internal carbon pricing techniques, issuance of the corporate carbon credits, refinancing of the green projects by the importers).

6.2. Financial mechanisms for early recovery, peacebuilding, and reconstruction

Available examples from the war-affected countries demonstrate that establishment of a dedicated Trust Fund (TF) and/or Recovery Financial Facility (RFF) is an important prerequisite to support all planned activities – facilitate early recovery (including peacebuilding activities) and subsequent reconstruction efforts. Establishment of TF to support early recovery and peacebuilding activities could be based on the non-profit principles and conducted under the umbrella of TF ([MPTF, 2023](#)) (see **Figure 3**).

Functioning of TF could be considered as non-profit and preparatory phase for reconstruction activities once the military activities will be over. At this phase recipients of the funds (e.g., local authorities) could prepare themselves for applying ESG criteria for monitoring and evaluating results of the planned projects. In other words, they will be able to measure their resilience from the beginning and till the final step under the proposed reconstruction plans.

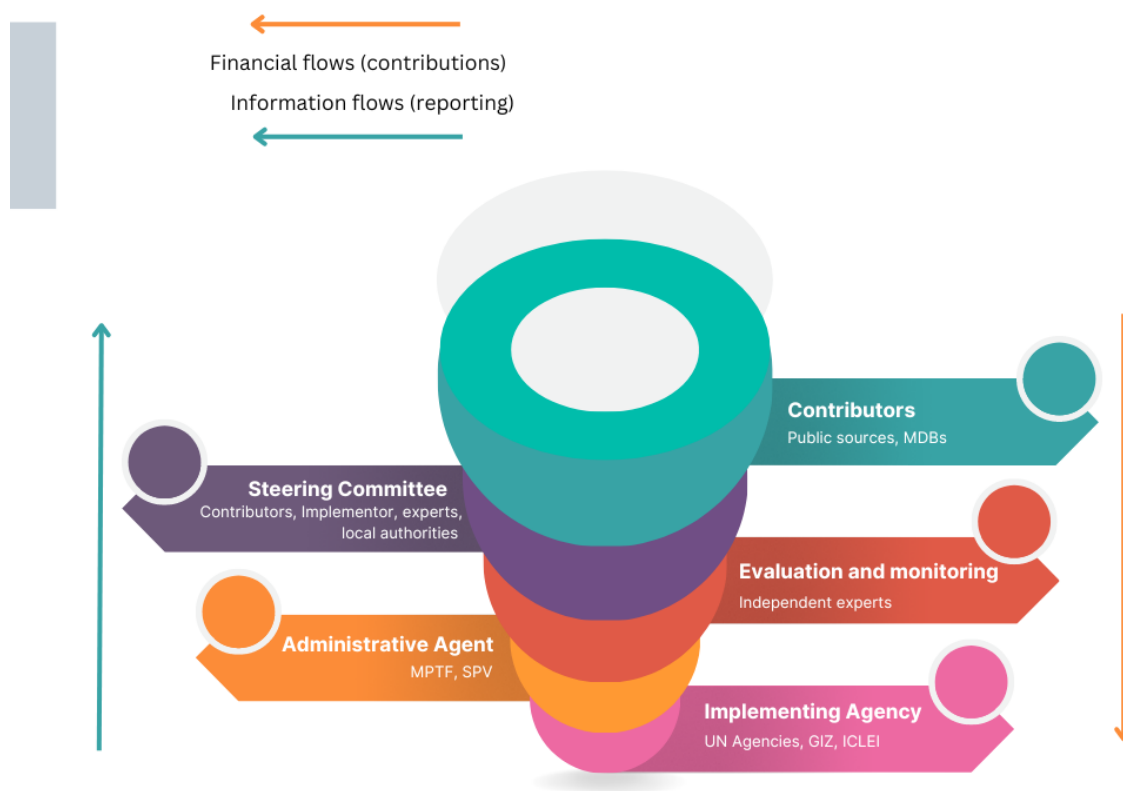


Figure 3. Governance structure of a Trust Fund to support early recovery and peacebuilding activities.

Source: built by the authors based on the [MPTF, 2023](#).

The existing legal framework and practice in Ukraine foresees co-financing for any credits and grants heading to local level in Ukraine. Since almost no funds are available now, there is a need in supporting co-financing part from the cities – facilitate provision of credits and grants for the cities. This becomes even more important in case of value added tax, which will be charged while procuring products and services by the cities while implementing planned activities. For this purpose, TF could serve as an important source to cover the above-mentioned expenditures. Capacities and opportunities of TF on the stage of post-war recovery could be extended to provide collateral and reduce cost of capital – facilitate access to private funds for economic agents on the local level.

Where contributors and other relevant stakeholders will be supporting functioning of TF under the Steering Committee and daily activities will be conducted by the administrative agent. At the same time, an independent monitoring and evaluation of planned and achieved results should be granted to ensure penetration of ESG indicators and principles into the project activities. At the stage of early recovery and peacebuilding activities, mostly public funds, as well as funds from IFIs will be the main source to achieve objectives of TF. At the same time, some objectives of TF should contain specific requirements to establish necessary conditions for recovery and reconstruction efforts based on combination of public and private funds (e.g., non-financial reporting, ESG considerations, etc.). For this purpose, a dedicated evaluation and monitoring entity should be established and have independent experts on

board to facilitate implementation of ESG indicators into the evaluation and reporting process. As the main goal on this stage is to provide immediate support and to restore minimum operating capabilities (MOC) or even minimum sustainable capabilities (MSC) (e.g., provision of public services and management of explosive ordnance).

Table 5. Short- and long-term options on mobilizing funds for urban green and resilient recovery in Ukraine.

	Short- and middle-term	Long-term
Aim	Early recovery and peacebuilding, establishment of a basis for post-war reconstruction	Green and resilient urban post-war reconstruction
Duration	3-5 years	Over 5 years
Form	Trust Fund	Recovery Financial Facility, Venture Funds
Instruments	Grants, credit guarantees	Credits/Investments
Location	Outside Ukraine	Ukraine/Outside Ukraine
Results	Non-financial	Financial and non-financial
Sources	Public	Public and Private
Implementation of planned activities	GIZ/UN Agencies/ICLEI	GIZ/UN Agencies/ICLEI
Management	GIZ/UN Agencies/ICLEI	Investors, implementor, partners
Framework thematic area	Continuity and sustainability	
Principles	Recovery Framework (see Figure 1)	Recovery Framework

Source: built by the authors.

Once the military activities will be over full operating capabilities (FOC) could be reestablished. On the long-term run limited capacities within the country and unfavorable business conditions even before the war are making an option with establishment of a financial facility outside the country very attractive ([The World Bank, 2021b](#)) (see **Table 5**). In case of Ukraine, extent of damage is unprecedented and only public funds cannot cover all needs. For this purpose, involvement of the financial market is crucial and necessary to mobilize funds. At the same time, since military activities are still in place, establishment of such facility outside the country could be one of the temporary solutions. Selection of the most suitable location for establishing a financial facility outside the country could be based on available rankings (e.g., [The Global Green Finance Index](#)) ([Long Finance, 2023](#)). It is important to have access not only to investors, but also a well-developed infrastructure which could cover all the existing legal requirements (e.g., non-financial reporting, and due diligence).

6.3. Special Purpose Vehicle to support venture investments and risk transfer.

Since financial needs for the post-war green and resilient urban recovery in Ukraine will be enormous, dedicated systemic and complex solutions should be employed. Alongside with temporary arrangements (Recovery Financial Facility, etc.) supportive mechanisms should be also established. For instance, Special Purpose Vehicle (SPV) could be considered as a supportive solution to *take over venture investments* after a venture fund will reach its lifetime limit or to *facilitate risk transfer* while providing credits to Ukrainian economic agents.

Military aggression of Russian Federation against Ukraine brought massive distractions, losses, and damages. At the same time, responding to such type of challenges required innovative solutions and various entrepreneurs and NGOs developed solutions of particular interest for the market (e.g., demining drones, etc.). To support existing innovations and facilitate subsequent emerging ideas during restoration phase, venture capitals will be needed. A dedicated Venture Fund/s (VF) to facilitate such developments could be established by private investors. Sometimes, Special Purpose Vehicles (SPVs) are being established to support innovative projects beyond the lifecycle of VF (see **Table 6**).

Table 6. Combination of Venture Fund and Special Purpose Vehicle.

	Venture Fund	Special Purpose Vehicle
Aim	Support long-term investments	Short-term investments (Support to VF)
Timeline	Over 10 years	up to 5 years
Revenues	around 15,000,000 USD	-
Assets	around 10,000,000 USD	-

Source: built by the authors based on [HBR, 1998](#).

Establishment of Venture Fund/s will allow to pool different investors to provide funds to one specific project and facilitate investment activities in companies or projects outside existing strategies. It allows to select best ideas and invest emerging companies with the purpose of acquisition or Initial Public Offering (IPO). Usually, such an arrangement facilitates investments towards innovative ideas on the long-term run, which is important for projects on the early stages of maturity. To overcome existing limitations by VF, a dedicated SPV could be created to optimize liquidity and facilitate extension of investment activities beyond the predefined lifetime of the Venture Fund.

As it was already mentioned before, financial needs to restore pre-war conditions could be already approaching USD 1 trillion (see Introduction part). At the same time, supporting restoration in general and especially on the local level will be accompanied by various barriers mentioned in **Table 2**. For this reason, the most effective solution in this case could be the implementation of the Recovery Financial Facility (RFF). Contributors to such mechanism could be Multinational Development Banks, sovereign, and private partners, as well as Ukrainian government. The latter one could provide at least 10-20% of the necessary

resources to have a presence in the governance bodies. The rest could be divided among IFIs and sovereign and private partners: 25-30% for each group. Selection process should be based on the analysis of ESG criteria, taking into consideration relevant and available legal acts in the EU. Governance of RFF will be supervised by a *Managing Director*, who will be selected by the *Board of Governors* with representation according to the inputs to RFF. The Managing Director will be leading all the current activities and will be supported by the *Management Board* – subordinated to the Board of Directors.

The process of selecting and funding eligible projects could be presented as a flowchart as reflected in **Figure 4**. An immediate green light could be provided to reconstruction projects under one of the proposed pillars after confirmation that this activity has ESG criteria covered (see **Figure 1**). In case if indicators under Environmental, Social or Governance Principles would be negatively affected by a proposed project, this proposal should be returned for additional improvements.

Considering huge amounts of debt financing, there will be a need to transfer related risks and providing protection against speculative operations on the market. In this regard, availability of SPV could address the following problems:

- Reduce cost of capital (due to the high level of trust in Multinational Development Banks and sovereign governments).
- Overcome existing restrictions for the local governments to borrow financial resources directly on the financial market.
- Provide protection for investors (e.g., Credit Default Swaps, CDS by Special Purpose Vehicle).
- Grant access for Ukrainian cities (implementors of specific projects) to the financial resources of the RFF.

Additionally, there is no guarantee that the same situation won't occur in the future and the EU will be forced once again to cut its budget expenditures or redirect them to solve the problem. In other words, there is a need in a special purpose vehicle (SPV), which should be able not only to issue financial debt instruments, but also could use the synthetic financial instruments (e.g., credit default swaps, catastrophe swaps) to protect the EU from possible sovereign debt crisis. More precisely, it is about a stabilization mechanism to lower the cost of capital for all member states and protect the entire Union from the possible financial turmoil. Moreover, such stabilization mechanism should be able to issue specific debt instruments and bear related credit protection at the same time.

For this purpose, EU established the European Stability Mechanism (ESM) to facilitate mobilization of private funds for highly indebted countries in the south of Europe and ensure the risk transfer. Additionally, issuance of CDS allowed to equalize spreads for contracts on the financial market and prevent further escalation of the debt crisis in Europe ([Blundell-Wingnall, 2012](#)).

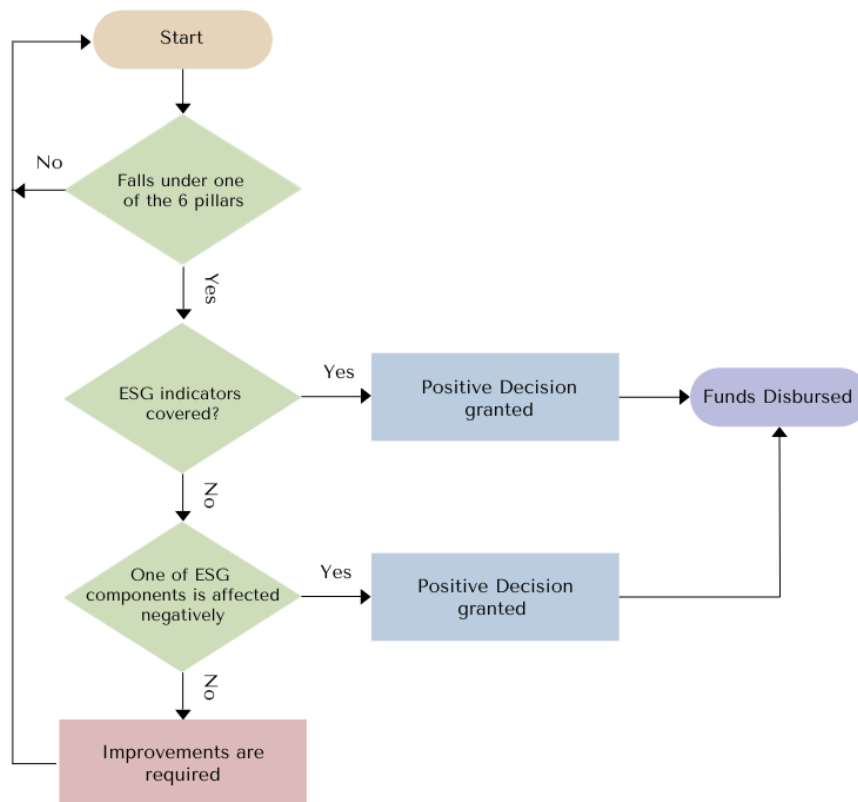


Figure 4. Project selection process under Recovery Financial Facility (RFF).

Source: built by the authors.

The level of non-financial risks could also affect the spreads for CDS. Companies with poor ESG performance have wider and stronger volatility in CDS spreads and companies with strong ESG performance show the opposite result (Barth et al., 2022). Hence, alignment of operational activities (TF and RFF) with ESG criteria will be important not only to support green and resilient urban recovery in Ukraine, but also could have a positive impact on CDS spreads to cover the risks for outstanding credit portfolio.

6.4. Coordination Platform to enable sustainable access to finance

CP is considered as a key element for an enhanced and improved communication among the main stakeholders, both on the short- and long-term run. Such a communication is important to ensure information symmetry and provide a coordinated response. Overall, collected data regarding the needs and gaps could provide important insights on how to update existing legal framework, prioritize response activities, define the content of educational services, etc. Moreover, CP should play a key role while improving institutional arrangements (e.g., setting up standards) on the financial market, facilitating mobilization of green and sustainable finance.

Such a platform could be hosted by the Government of Ukraine (e.g., Ministry of Finance or Ministry of Foreign Affairs) with a technical assistance provided by donors/contributors, implementing agencies. On the short-term run CP will be facilitating collection of needs from governmental authorities on different levels with a subsequent coordination of emergency response actions. This will ensure a high level of efficiency for planned actions and avoid duplication of expenditures. At the same time, CP will enable establishment of the necessary institutional arrangements in line with expectation of the private business and financial institutions. On a long-term perspective CP will support achievement of positive co-benefits: establishment of its own infrastructure to become a financial center for the entire region of Eastern Europe; and provision of an important impulse for developing local financial market.

“Soft” (e.g., initiatives, legal acts) and “hard” (e.g., Green Stock Exchange, Green Finance Accelerator) solutions are necessary to facilitate implementation of recovery and reconstruction activities in Ukraine. At the same time, “soft changes” should encompass implementation of the necessary instruments and mechanisms in line with the latest trends on financial market, which will be necessary not only on the stage of recovery, but also to support integration to the European market.

One of the important soft elements is the “price on carbon”. To put the price on carbon and facilitate transition to a low-carbon and green economy a set of methods are being applied on the international, regional, and national levels: *direct and shadow carbon pricing*. Direct carbon pricing encompasses legal fiscal and market-based instruments (e.g., carbon or environmental taxes, emission allowances, etc.), but only few successful cases could be mentioned. Internal Carbon Pricing (shadow pricing) is a response on the corporate level to the lack of adequate carbon pricing on the market with intention to improve investment decision-making process and unlock private climate finance.

Cost of capital are much lower in developed countries comparing to existing conditions for the economic agents in developing countries (e.g., 2:10). At the same time, big companies in the EU are obliged to report on the GHG emissions on different scopes (inclusive GHG from the suppliers) and are forced to manage their climate-related risks. For the suppliers from developing countries this is an opportunity to use internal price on carbon and get access to green supply chain financing from the European companies (e.g., Carbon Farming Initiative).

To achieve long-term co-benefits there is an urgent need in creating a new institutional framework to facilitate mobilization of private sustainable and green finance in Ukraine and to support development of a sustainable financial system in Ukraine. In this regard, establishment of *Green Finance Accelerator* (GFA) would be necessary to support (both, financially and methodologically) functioning of the following components: *Green Stock Exchange* (GSX), *Green Labelling Agency* (GLA). Coordination Platform under current framework could provide coordination support. For instance, GFA could assist in pre-checking of the green and sustainable bankable projects in Ukraine, facilitate preparation of the bankable green projects, their mapping and further communication with investors through the CP.

One of the existing Ukrainian Stock Exchanges will be transformed into the green one or at least part of its activities will be concentrated in a separate “green segment”. The GSX will

be the main platform for issuing green, sustainable, social impact and catastrophe bonds in accordance with existing requirements, with assessment of Environmental, Social, and Governance risks and related results (e.g., ESG ratings).

GLA will be functioning as an initiative (e.g., non-profit organization) created by the acknowledged verifiers (e.g., approved by the Climate Bonds Initiative, CBI) and financial institutions, conducting its activities in accordance with the principles and guidelines elaborated by International Capital Market Association (ICMA): Green Bond Principles, Social Bond Principles, Sustainability Bond Guidelines. The Ukrainian government, IFIs and leading asset managers will be also the co-founders of this initiative.

CP will provide administrative and financial support in registration and functioning of the asset managers on the territory on Ukraine with the main emphasis on the green and sustainable projects. CP could contribute to reduction of the high political and market risks associated with activities of financial institutions in Ukraine. Also, CP could provide an access to expertise of IFIs while selecting and conducting green and sustainable projects. Moreover, it will help in aligning the project proposals with existing requirements elaborated by financial institutions.

Creation of the GFA could speed up reforms and support improvements in the following areas:

- Facilitate green and resilient recovery for Ukraine through mobilization of the private green and sustainable finance.
- Improve sustainability of entire financial system in Ukraine – ensure better resilience to ESG risks.
- Support submission of a more ambitious NDC under the Paris Agreement, achievement of the SDGs in Ukraine.
- Facilitate and support establishment of the Monitoring, Reporting and Verification mechanism, as well as the Emission Trading Scheme (ETS) in Ukraine.
- Improve evaluation of Environmental, Social and Governance (ESG) risks and credit ratings of Ukrainian economic agents on the international green and sustainable financial markets.
- Enhance climate resilience of value and supply chains in Ukraine, support international trade and green finance flows.
- Support establishment of the necessary ecosystem on financial market for a green financial center in the Eastern Europe.
- Provide an important development impulse for the entire Ukrainian financial market with perspective for implementation of innovative green and sustainable financial instruments (e.g., sustainable, social impact, catastrophe, transition, and green bonds, etc.).
- Facilitate creation of the PPP initiatives to support registration and functioning of the national and foreign asset managers, ensure an effective and sustainable multiplicative effect in mobilizing green and climate finance.

6.5. Capacity development and knowledge exchange for urban recovery

Information collected under CP regarding the outstanding gaps and needs could serve as a basis for responsible actors while working on their plans and elaborating response actions. For instance, lack of capacities on the local level could be solved through implementation of relevant educational services, facilitation of exchange on the best practices and experience around green and resilient recovery.

For this purpose, it's important to create a Knowledge Hub (KH) (with further expansion of this concept to different regions of Ukraine), where both functions could be merged. Universities could play this role by establishing and hosting an online data base with best cases and practices. Moreover, a dedicated set of educational services and Programmes could be elaborated to facilitate capacity building and capacity sharing activities. At the same time, available technical capacities could provide quality assurance services while evaluating results of the recovery activities. For instance, short-, middle- and long-term courses will support dissemination of knowledge and preparation of the necessary technical capacities on the local level. Under the proposed framework, availability of KH will be an important prerequisite to implement activities under several thematic areas (e.g., prevention and avoidance; continuity and sustainability).

For instance, a dedicated Master Programme (MP) could serve as a first step on the way to establishing KH as it introduces sustainability economics and sustainable finance for the public servants and professionals working in different related sectors and levels of the economic system. MP will equip participants with essential knowledge around sustainable development and finance.

MP should be aimed at facilitating the establishment of sustainable development conditions (e.g., Recovery Financial Facility) and capacities on the national, regional, local as well as the corporate levels through facilitating mobilization of sustainable finance from different sources (national, EU, UN, etc.).

The achievement of the above-mentioned goal will be supported by the following objectives:

- To establish an ambitious and innovative MP (e.g., Sustainability Leadership Programme (SLP) – drawing on expertise across private, public, and academic sectors.
- To develop a network of 'next generation' leaders with skills, experience and confidence in economic policy.
- To inspire and empower future leaders in the areas of policy and economic development.
- Each cohort will continue to learn, debate, discuss and work collaboratively on ideas and solutions for the 'grand challenges' of sustainable, green, and resilient development.

Responsibilities of national, regional, local authorities, corporate sector, and other relevant stakeholders around sustainable development and finance:

- Senior executives, policymakers responsible (e.g., public servants, city mayors, etc.) for overall economic/business growth and strategic initiatives who are seeking to

make strategic changes – make economic development more equitable and sustainable (e.g., just transition).

- ESG and sustainability specialists, who are seeking to minimize their organization's negative environmental and social impact through sustainability practices.
- Public servants on the national, regional, and local levels responsible for establishing sustainable development capabilities, mobilizing sustainable finance from different sources.
- Mid- to senior-level functional managers in traditional industries such as energy, industrial goods, logistics, agriculture, and manufacturing, who are seeking to contribute to their organization's sustainability efforts within their function and to gain an understanding of how sustainability will affect their current role and business practices.
- Consultants seeking to offer their clients solutions to help them achieve their sustainability goals, to keep up with industry trends in sustainability and to gain a respected credential to demonstrate specialization in sustainability consulting.

MP will be ideal for those with responsibility for strategy, policymaking, marketing, finance and investment, innovation, operations, communications, people, and sustainability. MP will be designed to provide the following:

- Knowledge and insights on how to align positive economic results with the long-term non-financial outcomes (e.g., Environmental, Social and Governance, ESG).
- Leadership skills to drive improvement of the resilience to the non-financial challenges (ESG).
- Latest cases, methodologies for sustainability and sustainable finance mobilization.
- Practical tools and frameworks to think systemically, identify priorities and embed leadership.
- Inspiration and resources to look at the world differently and mobilize support.

7. Concluding remarks

Our current Discussion Paper demonstrated that recovery in Ukrainian urban areas should be divided into two phases: *early recovery and peacebuilding, as well as post-conflict reconstruction phase*. This will define the architecture of financial arrangements and support selection of dedicated mechanisms aimed at mobilizing funds, facilitating planned activities.

As a result of current research, the following key points and recommendations should be considered:

- Programmatic and systemic approach should be deployed to support early recovery and peacebuilding, as well as post-war reconstruction activities on the urban level in Ukraine.

- Proposed framework encompasses the following components: *Governance Element, Supportive Element, Taxonomy* with relevant pillars, ESG Indicators and a clear link to SDGs.
- Considering the lack of available capacities of Ukrainian government on different levels, implementation of recovery actions under the proposed framework should be facilitated by a dedicated *Governance Element*.
- First thematic area under proposed GE should be dedicated to Risk Prevention, where risk assessment (including loss and damage assessment) efforts will be encompassed, and necessary information provided for other thematic areas.
- Collected information under the Risk Prevention thematic area will be passed over to Risk Mitigation thematic area and support removal of identified threats and risks.
- In case if removal of identified risks cannot be conducted, under the Risk Mitigation thematic area, the necessary actions should be implemented to improve adaptive capacities of economic agents and infrastructure (Risk Adaptation).
- Another important thematic area should be dedicated to improvement of resilience and to potential threats under the Resilience Building thematic area (e.g., mobilization of finance, capacity building and capacity development activities).
- The last but not the least thematic area under Governance Element should be dedicated to enabling sustainability of efforts aimed at supporting early recovery and reconstruction efforts on the local level in Ukraine (Sustainability Enabling).
- *Implementing Agency* should support operationalization of while technical capacities of national, regional, and local authorities will be developed.
- To make sure that proposed solution could be handed over to national, regional, and local authorities on the later stages, Knowledge Hub should be created – this will facilitate exchange of the necessary information and support capacity development efforts, as well as mobilization of financial resources.
- Mobilization of financial resources is one of the key elements of recovery and reconstruction on the local level in Ukraine – important is to establish a Trust Fund (early recovery and peacebuilding) and Recovery Financial Facility (post-war reconstruction).
- To cover financial liabilities cities should explore alternative solutions and assets which could be offered because of recovery activities (e.g., Guarantees of Origin, nature-positive capital biodiversity credits, land value capture).
- To achieve long-term benefits and sustain positive results on mobilizing green and sustainable finance it's important to establish "soft" and "hard" institutional arrangements (e.g., internal carbon pricing, Green Climate Finance Accelerator).
- Coordination Platform will facilitate communication among the key stakeholders, exchange of the best practices, support implementation of the so-called "soft" and "hard" institutional arrangement.
- Proposed Taxonomy contains the following pillar: *Social inclusion and green jobs creation; Circular societies for climate- and nature-positive growth; Resilient and climate-neutral critical infrastructure; Sustainable and resilient urban planning; Access to the green and sustainable finance; Green and resilient business, living environment.*
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- Taxonomy for green and resilient projects will support selection of eligible projects and alongside with ESG indicators could help in measuring results and achievement of the overall goal.

As a result, proposed framework could support regional, and local authorities in getting access to the necessary resources (e.g., financial, informational, human resources) and becoming more resilient to Environmental, Social and Governance (ESG) risks.

References

1. Al-Saidi, M., Roach, E. L., & Al-Saeedi, B. A. H. (2020): Conflict resilience of water and energy supply infrastructure: Insights from Yemen. *Water*, 12(11), 3269.
2. Anderlini, S.N., & El-Bushra, J. (2004): Post-conflict reconstruction. In: *Inclusive security, sustainable peace: A toolkit for advocacy and action*, 51–68.
3. Argyroudis, S. A., Mitoulis, S. A., Hofer, L., Zanini, M. A., Tubaldi, E., & Frangopol, D. M. (2020): Resilience assessment framework for critical infrastructure in a multi-hazard environment: Case study on transport assets. *Science of the Total Environment*, 714, Article 136854.
4. Atlantic Council (2021): Building smarter military bases for climate resilient communities, URL: <https://www.atlanticcouncil.org/blogs/geotech-cues/building-smarter-military-bases-for-climate-resilient-communities/>
5. Barth, F., Hübel, B. and Scholz, H. (2022), "ESG and corporate credit spreads", *Journal of Risk Finance*, Vol. 23 No. 2, pp. 169-190.
6. BCG (2022a): Supporting Ukraine: A Study on Potential Recovery Strategies for Ukraine, Boston Consulting Group, URL: <https://media-publications.bcg.com/Supporting-Ukraine-Potential-Recovery-Strategies-Feb-2023.pdf>
7. BCG (2022b): Ukraine. A Sustainable Economic Recovery for People and Nature, Boston Consulting Group, URL: https://wwfeu.awsassets.panda.org/downloads/ukraine_a_sustainable_economic_recovery_for_people_and_nature_wwf_bcg_sept_2022_light.pdf
8. Bierwirth, A. (2021): Resilient, sustainable, and ready for the future: guidelines for urban development of tomorrow, Working Paper, Wuppertal Institut für Klima, Umwelt, Energie.
9. Blundell-Wignal, A (2012): Solving the Financial and Sovereign Debt Crisis in Europe, *OECD Journal: Financial Market Trends*, Volume 2011 – Issue 2.
10. CEPR (2022): A Blueprint for the Reconstruction of Ukraine, CEPRP Res, URL: https://cepr.org/system/files/publication-files/147614-a_blueprint_for_the_reconstruction_of_ukraine.pdf
11. CISA (2023): Critical Infrastructure Sectors, URL: <https://www.cisa.gov/topics/critical-infrastructure-security-and-resilience/critical-infrastructure-sectors>
12. Cities Alliance (2021): Building Climate Resilient and Sustainable Cities for All, Cities Alliance/UNOPS, Brussels.
13. Climate-KIC (2017): Blue Green Solutions. A Systemic Approach to Sustainable, Resilient and Cost-Efficient Urban Development, URL: <https://www.climate-kic.org/wp-content/uploads/2017/10/BGD-Guide.compressed.pdf>
14. Coninx, I., Sushchenko, O., Michalek, G., Schwarze, R. (2019): Evolving issues brief 2019, *Wageningen Environmental Research & UFZ*, 10 pp.
15. Conley H.A. (2022): A Modern Marshall Plan for Ukraine. Seven Lessons from the History to Deliver Hope, GMF, URL: <https://www.gmfus.org/sites/default/files/2022-10/A%20Modern%20Marshall%20Plan%20for%20Ukraine.pdf>

16. del, Castillo (2008): Rebuilding war-torn states: The challenge of post-conflict economic reconstruction. New York: Oxford University Press Inc.
17. Deloitte (2020): Stand with Ukrainian cities. **Допомагаймо міста України разом**, URL: <https://www2.deloitte.com/content/dam/Deloitte/ua/Documents/public-sector/stand-with-ukrainian-cities.pdf>
18. Diia (2023): **Державні послуги онлайн**, URL: <https://diia.gov.ua>
19. DW (2022): **Експерти підрахували попередні збитки від війни в Україні**, URL: <https://www.dw.com/uk/eksperty-pidrahuvaly-poperedni-zbytky-infrastruktury-vid-viiny-v-ukraini/a-61165782>
20. Earnest, J. (2015): Post-conflict reconstruction – A case study in Kosovo: The complexity of planning and implementing infrastructure projects. *International Journal of Emergency Services*, 4(1), 103–128.
21. EC (2021): The Recovery and Resilience Facility, URL: https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility_en
22. EC (2022): COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS. An action plan for EU-Ukraine Solidarity Lanes to facilitate Ukraine's agricultural export and bilateral trade with the EU, URL: <https://transport.ec.europa.eu/system/files/2022-06/COM20220217.pdf>
23. EEA (2022): Urban sustainability in Europe – Post-pandemic drivers of environmental transitions, EEA Report, No 06/2022.
24. Epravda (2023): **Яким має бути розвиток ВДЕ України – Національний план дій до 2030 року**, URL: <https://www.epravda.com.ua/columns/2023/02/21/697267/>
25. EU (2020b): REGULATION (EU) 2020/852 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 18 June 2020 on the establishment of a framework to facilitate sustainable investment, and amending Regulation (EU) 2019/2088, URL: <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32020R0852&from=EN>
26. Forbes (2023): **Безробіття в Україні залишатиметься у 2023 році на рівні 26% - НБУ**, URL: <https://forbes.ua/news/bezrobittya-v-ukraini-zalishatimetsya-u-2023-rotsi-na-rivni-26-nbu-03022023-11513>
27. Gauthier, C; Higgs, M.; Scherf, F.; Schmid, A.F.; Cousiño, J.S.; Sushchenko, O. (2021): DigitalSkills4Future.eu: Verbesserung der Fähigkeiten von Bürger*innen und Expert*innen in Bezug auf die Doppeltransition Paris, Berlin und Frankfurt (Oder), *ZfU*, 366-380.
28. Gauthier, C.; Higgs, M; Scherf, F; Schmid, A.F; Cousino, J.S.; Sushschenko, O. (2021): DigitalSkills4Future.eu: Improving skills of citizens and professionals on the twin transition, *European University Viadrina*, URL: https://www.kuwi.europa-uni.de/de/studium/master/es/Pensees-Francaises/Utopie-Europa-Wettbewerb/Position-paper_ENG.pdf
29. GEN Ukraine (2023): Ecovillage Network Ukraine, URL: <https://621b426d411ea.site123.me>

30. German Eastern Business Association (2022): Rebuild Ukraine. Proposals of the German business community for the reconstruction and modernization of the Ukrainian economy, Berlin, URL: https://www.ost-ausschuss.de/sites/default/files/page_files/2022-10-12%20PM%20Ukraine_Dossier%20Recovery%20Ukraine.pdf
31. Gernego, I., Dyba, M. I., Shkoda, T., & Dyba, M. V. (2023): Venture Financing as Support for the Sustainable Model of Post-War Rebuilding in Ukraine. *European Journal of Sustainable Development*, 12(2), 1.
32. GGGI (2021): GGGI Green and Resilient Recovery, Global Green Growth Institute, URL: https://gggi.org/wp-content/uploads/2021/07/Green-and-Resilient-Recovery-brochure_WEB-version-1.pdf
33. Hay, A. H., Karney, B., & Martyn, N. (2019): Reconstructing infrastructure for resilient essential services during and following protracted conflict: A conceptual framework. *International Review of the Red Cross*, 101(912), 1001–1029.
34. HBR (1998): How venture capital works, URL: <https://hbr.org/1998/11/how-venture-capital-works>
35. Holovko, I., Haug, C. (2023): Rebuilding Ukraine. Principles of a green post-war reconstruction. Berlin: adelphi consult GmbH, URL: https://adelphi.de/de/system/files/mediathek/bilder/Rebuilding%20Ukraine_adelphi_January_2023_final.pdf
36. ICLEI (2022): Guide on Connecting Green Recovery and Resilience in Cities, Local Governments for Sustainability e.V., URL: [https://www.giz.de/de/downloads/giz2022-de-resilient-cities-action-package-2021%20\(ReCAP21\).pdf](https://www.giz.de/de/downloads/giz2022-de-resilient-cities-action-package-2021%20(ReCAP21).pdf)
37. IEEE (2022): Transformer Stockpiles—and Grids—Come Under Threat. The U.S. failed to improve its stock, but Ukraine’s supply may be improving, URL: <https://spectrum.ieee.org/transformer-stockpiles#toggle-gdpr>
38. IOM (2023): Data and Resources, URL: <https://ukraine.iom.int/uk/dani-ta-resursy>
39. KMU (2023): Ukraine's demolition waste is already comparable to the amount of solid waste generated in the country on average per year: Ministry of Environmental Protection and Natural Resources, URL: <https://www.kmu.gov.ua/en/news/mindovkillia-vidkhody-ruinatsii-v-ukraini-vzhe-mozhna-porivniaty-z-kilkistiu-tverdykh-pobutovykh-vidkhodiv-shcho-v-serednomu-utvoriuiutsia-v-kraini-za-rik>
40. KMU (2023): **Денис Шмигаль: Державний центр гуманітарного розмінування братиме участь у плануванні заходів протимінної діяльності**, URL: <https://www.kmu.gov.ua/news/denys-shmyhal-derzhavnyi-tsentri-humanitarnoho-rozminuvannia-bratyme-uchast-u-planuvanni-zakhodiv-protyminnoi-diialnosti>
41. Kottmann, F., Kyriakidis, M., Dang, V. N., & Sansavini, G. (2021): Enhancing infrastructure resilience by using dynamically updated damage estimates in optimal repair planning: The power grid case. *ASCE-ASME Journal of Risk and Uncertainty in Engineering Systems, Part A: Civil Engineering*, 7(4), Article 04021048.
42. Kyiv Independent (2023): People under Russia occupation cut off from internet, mobile connection, URL: <https://kyivindependent.com/russia-descends-iron-curtain-over-occupied-land-cuts-people-off-internet/>

43. Kyiv Post (2023): Large-scale Misappropriation of Hostomel Recovery Funds – Investigation, URL: <https://www.kyivpost.com/post/18155>
44. Long Finance (2023): The Global Green Finance Index 11, URL: https://www.longfinance.net/media/documents/GGFI_11_Report_2022.04.20_v1.1.pub.pdf
45. Maxwell, D., Stites, E., Robillard, S. C., & Wagner, M. (2017): Conflict and resilience: A synthesis of feinstein international center work on building resilience and protecting livelihoods in conflict-related crises. Boston: Feinstein International Center, Tufts University.
46. ME (2023): **Мінекономіки попередньо оцінює падіння ВВП в 2022 році на рівні 30,4%**, URL: <https://www.me.gov.ua/News/Detail?lang=uk-UA&id=4470bafb-5243-4cb2-a573-5ba15d9c8107&title=MinekonomikiPoperedno>
47. Mingarelli, H. (2023): The Reconstruction Process in Ukraine, *Guest Commentary*, Stockholm Centre for Eastern European Studies, URL: https://www.europarl.europa.eu/cmsdata/267943/Mingarelli_The-reconstruction-process-in-ukraine.pdf
48. Mirror (2022): UK heatwave: Extremely hot weather could knock-out mobile phone services for thousands, URL: <https://www.mirror.co.uk/news/uk-news/uk-heatwave-extremely-hot-weather-27501570>
49. Mituolis, S.-A. ; Argyroudīs, S.; Panteli, M.; Fuggini, C.; Valkaniotis, S.; Hynes, W.; Linkov, I. (2023): Conflict-resilience framework for critical infrastructure peacebuilding, *Sustainable Cities and Society*, Volume 91, 104405.
50. MPTF (2023): What is an inter-agency pooled fund? URL: <https://mptf.undp.org/basic-page/what-pooled-fund>
51. Mukim, M. (ed.); Roberts, M. (ed.) (2023): *Thriving: Making Cities Green, Resilient, and Inclusive in a Changing Climate*. Washington, DC: World Bank.
52. OCHA (2021): Nature-based Solutions Vital to Mitigating Conflict-linked Environmental Damage, URL: <https://reliefweb.int/report/world/nature-based-solutions-vital-mitigating-conflict-linked-environmental-damage>
53. OGL (2021): The Economics of Biodiversity. The Dasgupta Review, URL: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/962785/The_Economics_of_Biodiversity_The_Dasgupta_Review_Full_Report.pdf
54. OHCHR (2022): Ukraine: civil causality update 19 December 2022, URL: <https://www.ohchr.org/en/news/2022/12/ukraine-civilian-casualty-update-19-december-2022>
55. Rada (2022a): **Розпорядження Кабінету Міністрів України «Про схвалення Концепції запровадження та розвитку ринку зелених облігацій в Україні»**, URL: <https://zakon.rada.gov.ua/laws/show/175-2022-p#Text>
56. RADA (2022b): **Постанова Кабміну «Про затвердження Порядку поводження з відходами, що утворились у зв'язку з пошкодженням (руйнуванням) будівель та споруд внаслідок бойових дій, терористичних актів, диверсій або проведенням робіт з ліквідації їх наслідків та внесення змін до деяких постанов Кабінету Міністрів України»**, URL: <https://zakon.rada.gov.ua/laws/show/1073-2022-p#Text>

57. RADA (2022c): **Закон України «Про критичну інфраструктуру»**, URL: <https://zakon.rada.gov.ua/laws/show/1882-20#Text>
58. Recovery (2023): **План відновлення України**, URL: <https://recovery.gov.ua>
59. Revi, A., D.E. Satterthwaite, F. Aragón-Durand, J. Corfee-Morlot, R.B.R. Kiunsi, M. Pelling, D.C. Roberts, and W. Solecki, (2014): Urban areas. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 535-612.
60. Rubryka (2022): **Атаки росії на хімічні підприємства: яка небезпека для води і ґрунтів і як її визначити?** URL: <https://rubryka.com/article/attacks-on-chemical-plants/>
61. Schwarze, R., Sushchenko, O. (2021): A green and resilient recovery for Europe - Working paper, October 2021, *SENDAI FRAMEWORK United Nations Office for Disaster Risk Reduction (UNDRR) Europe*, Brussels , 25 pp.
62. Snadström A. (2008): Political Risk in Credit Evaluation. Empirical Studies and Survey Results, *Ekonomi Och Samhälle*, Nr. 184, URL: <https://helda.helsinki.fi/server/api/core/bitstreams/ad725e96-6886-4930-8911-909e53106623/content>
63. Sushchenko, O., Schwarze, R. (2016): Carbon taxation and market financial instruments for mobilizing climate finance. **Оподаткування викидів парникових газів та ринкові фінансові інструменти мобілізації кліматичних фінансів**, *KAS Policy Paper 27*, 37.
64. Sushchenko, O., Schwarze, R. (2020): Economics and finance of disaster risk reduction and climate change adaptation: main gaps identified in the PLACARD project and arising alignment opportunities for the EU Green Deal. *PLACARD project*, FC.ID: Lisbon, Helmholtz Centre for Environmental Research - UFZ, Leipzig, 61 pp.
65. The World Bank (2021a): Ukraine. Historical Hazards, URL: <https://climateknowledgeportal.worldbank.org/country/ukraine/vulnerability>
66. The World Bank (2021b): Doing Business 2020. Ukraine, URL: <https://archive.doingbusiness.org/content/dam/doingBusiness/country/u/ukraine/UKR.pdf>
67. **The World Bank (2023): Оновлена оцінка потреб України на відновлення та відбудову**, URL: <https://www.worldbank.org/uk/news/press-release/2023/03/23/updated-ukraine-recovery-and-reconstruction-needs-assessment>
68. TNFD (2022): A quarter of Africa’s GDP is dependent on nature; it must be managed responsibly, URL: <https://framework.tnfd.global/knowledge-bank/a-quarter-of-africas-gdp-is-dependent-on-nature-it-must-be-managed-responsibly/>
69. TNFD (2023): Introduction to the TNFD Framework, URL: <https://framework.tnfd.global/introduction-to-the-framework/>

70. TSN (2022): Invaders Shelled Azot Plant Causing Release of Dozens of Tons of Oil and Resulting Major Fire, URL: <https://tsn.ua/en/ato/invaders-shelled-azot-plant-causing-release-of-dozens-of-tons-of-oil-and-resulting-major-fire-2084929.html>
71. TU Dresden (2020): WP C: Recommendations to improve the scientific basis for an IWRM, URL: <https://tu-dresden.de/bu/umwelt/hydro/iwm/meteorologie/ressourcen/dateien/forschung/projekte/projekt-mantra-river/WP3-Report.pdf?lang=en>
72. UN (2015b): Sendai Framework on Disaster Risk Reduction, URL: https://unfccc.int/sites/default/files/english_paris_agreement.pdf
73. UN (2017): Leaving No One Behind: Equality and Non-Discrimination at the Heart of Sustainable Development, URL: https://unscebe.org/sites/default/files/imported_files/CEB%20equality%20framework-A4-web-rev3.pdf
74. UN (2018): 68% of the world population projected to live in urban areas by 2050, says UN, URL: <https://population.un.org/wup/publications/Files/WUP2018-PressRelease.pdf>
75. UN (2105a): Paris Agreement, URL: https://unfccc.int/sites/default/files/english_paris_agreement.pdf
76. UNDP (2020): Building Forward Better, UNDP Ukraine Report 2020, URL: <https://www.undp.org/sites/g/files/zskgke326/files/migration/ua/UNDP-Ukraine-Annual-Report-2020.pdf>
77. UNDRR (2019): Making Cities Resilient Report: A snapshot of how local governments progress in reducing disaster risks in alignment with the Sendai Framework for Disaster Risk Reduction. URL: https://www.unisdr.org/campaign/resilientcities/assets/toolkit/documents/UNDRR_Making%20Cities%20Resilient%20Report%202019_April2019.pdf
78. UNECE (2023): UNECE convenes inter-agency group to coordinate assessment of environmental damage in Ukraine, URL: <https://unece.org/environment/press/unece-convenes-inter-agency-group-coordinate-assessment-environmental-damage>
79. UNEP (2022): COP15 ends with landmark biodiversity agreement, URL: <https://www.unep.org/news-and-stories/story/cop15-ends-landmark-biodiversity-agreement>
80. UNFCCC (2019): Climate Finance and Sustainable Cities. 2019 Forum of the Standing Committee on Finance, URL: https://unfccc.int/sites/default/files/resource/SCF%20Forum%202019%20report_final.pdf
81. UNIAN (2023): **Страшні наслідки війни з РФ: названо площу України, забруднену смертоносними предметами,** URL: <https://www.unian.ua/war/zaminuvannya-v-ukrajini-nazvano-ploshchu-ukrajini-zabrudnenu-smertonosnimi-predmetami-12119418.html>
82. UNISDR (2009): 2009 UNISDR Terminology on Disaster Risk Reduction, URL: https://www.unisdr.org/files/7817_UNISDRTerminologyEnglish.pdf
83. URC (2022): Ukraine's National Recovery Plan, July 2022, URL: https://uploads-ssl.webflow.com/621f88db25fbf24758792dd8/62c166751fc41105380a733_NRC%20Ukraine%27s%20Recovery%20Plan%20blueprint_ENG.pdf

84. Utkina, K; Otto, IM; Churkina, G. (2023): Rebuild better for a sustainable future. PLOS Clim 2(3): e0000165.
85. [VisitUkraine \(2023\): Міста України, які повністю зруйнувала російська армія, URL: <https://visitukraine.today/uk/blog/1874/mista-ukraini-yaki-povnistyu-zruinuvala-rosiiska-armiya>](https://visitukraine.today/uk/blog/1874/mista-ukraini-yaki-povnistyu-zruinuvala-rosiiska-armiya)
86. VOA (2022): UN: Half of Ukraine's Energy Infrastructure Destroyed by Russian Attacks, URL: <https://www.voanews.com/a/un-half-of-ukraine-energy-infrastructure-destroyed-by-russian-attacks/6874897.html>
87. WEF (2022a): Putting Nature at the Heart of the Global Financial System, URL: <https://www.weforum.org/agenda/2022/05/nature-positive-net-zero-global-financial-system/>
88. WEF (2022b): Rethinking City Revenue and Finance. Insight Report, August 2022, URL: https://www3.weforum.org/docs/WEF_C4IR_GFC_on_Cities_Finance_2022.pdf
89. [WEF \(2023\): The Global Risks Report 2023, 18th Edition, Insight Report, URL: \[https://www3.weforum.org/docs/WEF_Global_Risks_Report_2023.pdf\]\(https://www3.weforum.org/docs/WEF_Global_Risks_Report_2023.pdf\)](https://www3.weforum.org/docs/WEF_Global_Risks_Report_2023.pdf)
90. Wired (2022): Shadow Russian Cell Phone Companies are Cropping Up in Ukraine, URL: <https://www.wired.co.uk/article/ukraine-war-mobile-networks-russia>
91. [WOXUKRAINE \(2022\): Урбанізація в Україні, URL: <https://voxukraine.org/urbanizatsiya-v-ukrayini>](https://voxukraine.org/urbanizatsiya-v-ukrayini)