

# Recommendations of Actions for Resilience and Sustainability

# YAKUTSK

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Executive Summary





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for Resilience and Sustainability

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Executive Summary

The *Recommendations of Actions for Resilience and Sustainability (RAR-S)* proposed in this report is the main result of the collaboration between Yakutsk City Administration of the Sakha Republic (Yakutia) and UN-Habitat City Resilience Global Programme. The main objectives of the Agreement are to analyse the Yakutsk urban systems, define a Yakutsk Resilience City Profile, and produce recommendations of actions that would address risks (shocks, stresses and challenges), and ultimately build resilience in Yakutsk.

This report builds upon the resilience building methodology and tool developed through the *Making Cities Sustainable and Resilient Action: Implementing the Sendai Framework for DRR 2015-2030 (MCSR)* at the local level. Since its inception in April 2016, the MCSR action has supported over 25 local governments, all over the world, to confidently address the risk and resilience agenda in their cities. Similarly, this report presents the findings and potential way forward for the city of Yakutsk based on the resilience analysis and diagnosis derived from the *City Resilience Profiling Tool (CRPT)*. UN-Habitat and the Municipality of Yakutsk have led the implementation of the CRPT in the city and have successfully overcome challenges related to data collection and revision. The project has secured commitment from key actors that play a role in current and future steps.

This report is based on the work undertaken during the years of implementation, and presents findings from analysis and diagnosis, as well as the *Recommendations of Actions for Resilience and Sustainability* for the city of Yakutsk.

We would like to extend our thanks to the City Administration of Yakutsk for being our active partner in this collaboration and without whom this report would not be possible. We also give recognition to the Arctic PIRE Network who successfully supported this project through peer support for the two first chapters, to Arrels Foundation for their contribution to our inclusive strategies, and to the regional administration of Republic of Sakha (Yakutia) for providing a regional perspective in the recommendations. We urge and encourage all project participants to continue being proactive in the city's progress towards resilience.



# Introduction

With over half of the global population living in cities, and with around 3 billion more people expected to live in urban areas by 2050, cities are facing unprecedented demographic, environmental, economic, social and spatial challenges. Rapid urbanization coupled with new and magnified challenges resulting from climate change are resulting in more people facing more risk in our cities. Building resilience into cities is therefore essential if we are to ensure that development gains are not lost when cities are inevitably hit by shocks, stresses or challenges. UN-Habitat's urban resilience work aims to support local governments and relevant stakeholders to transform urban areas into safer, more inclusive and better areas to live in, and improve their capacity to absorb, adapt and recover from these potential shocks and stresses, while transforming in a positive way towards sustainability.

UN-Habitat has been working closely with the City Administration of Yakutsk to create a comprehensive profile of the city and recommend actions to improve its resilience through the City Resilience Global Programme (CRGP) and its associated City Resilience Profiling Tool (CRPT). The CRPT provides a universal framework that uses verifiable and contextualised city data to establish a resilience profile and create an analysis and diagnosis of its most urgent challenges. This profile and diagnosis provide a basis for the creation of evidence-based and implementable Actions for Resilience, which are designed to be incorporated into current urban development strategies and management processes of the city. This process is intended to support the City Administration of Yakutsk and its partners in making informed decisions and, in turn, support long-term resilient and sustainable urban development.

The Recommendations of Actions for Resilience and Sustainability Report (RAR-S) presents the culmination of the work carried out throughout the CRPT implementation process and provides a summary overview of the analytical process through which the Actions for Resilience have been developed. The introduction of this report briefly presents the CRPT methodology, which serves as the basis for the analytical findings presented in the following chapters. Although the RAR-S report seeks to summarize the multifaceted implementation process, the analytical and diagnostic efforts, and the development of concrete recommendations for actions to build resilience in the pilot cities, it does not seek to provide details of the methodological basis from which the CRPT was developed, nor of the analytical process in its entirety, given its extensiveness. Please refer to the CRPT Implementation Manual for a detailed description of the CRPT implementation process.

## CRGP: Main Concepts

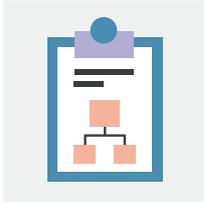
UN-Habitat's flagship tool for urban resilience, the City Resilience Profiling Tool (CRPT), provides a cross-cutting, action-oriented approach to resilience and sustainable urban development. Its methodology is based on UN-Habitat's definition of urban resilience, shown below, which encompasses a theoretical approach followed by a more practical description on what resilience-building efforts entail and target.

This definition and understanding of resilience outline the overall objective for each city implementing the CRPT. A shared understanding of resilience is crucial in catalysing stakeholder engagement and garnering buy-in from partners.

**The measurable ability of any urban system, with its inhabitants, to maintain continuity through all shocks and stresses, while positively adapting and transforming toward sustainability.**

**A resilient city evaluates, plans and acts to prepare and respond to threats - natural or man-made, sudden and slow onset, expected and unexpected - in order to protect and improve the lives of people, to ensure development, foster an investment environment and drive positive change.**

The Urban Resilience Principles were developed to guide the process of achieving urban resilience in cities. Note that these principles are embedded within the structure, design, and implementation approach of the CRPT.



### **Principle 1** Dynamic nature of urban resilience

Resilience is not a condition but a state that cannot be sustained unless the system evolves, transforms and adapts to current and future circumstances and changes. Therefore, building resilience requires the implementation of context-specific and flexible plans and actions that can be adjusted to the dynamic nature of risk and resilience.



### **Principle 2** Systemic approach to cities

Recognising that cities are comprised of systems interconnected through complex networks and that changes in one part have the potential to propagate through the whole network, building resilience requires a broad and holistic approach that takes into account these interdependencies when the urban system is exposed to disturbances.



### **Principle 3** Promote participation in planning and governance

A resilient system ensures the preservation of life, limitation of injury, and enhancement of the 'prosperity' of its inhabitants by promoting inclusiveness and fostering comprehensive and meaningful participation of all, particularly those in vulnerable situations, in planning and various governance processes. Such an approach can ensure sense of ownership, thus achieving successful implementation of plans and actions.



### **Principle 4** Multi-stakeholder engagement

A resilient system should ensure the continuity of governance, economy, commerce and other functions and flows upon which its inhabitants rely. This necessitates promoting open communication and facilitating integrative collaborations between a broad array of stakeholders ranging from public entities, private sector, civil society, and academia to all city's inhabitants.



### **Principle 5** Strive towards development goals

Resilience building should drive towards, safeguard and sustain development goals. Approaches to resilience should ensure that efforts to reduce risk and alleviate certain vulnerabilities do not generate or increase others. It must guarantee that human rights are fulfilled, respected and protected of under any circumstances.

# CRGP: Methodology and Alignment with the International Agenda 2030

The implementation of the CRPT is characterised by four overlapping steps: 1) data collection, 2) analysis, 3) diagnosis, and 4) recommended actions for resilience.

The CRPT is organised in four SETs that facilitate data collection and analysis. Each SET has a specific focus, through which the entire urban system is mapped, analysed, and interrelated. The data analysed throughout these SETs is derived from existing databases, official documents, research, and publications. While this data provides quantitative information to conduct a city-based analysis of the evidence, the findings are complemented by qualitative sources collected through workshops and expert readings in an attempt to capture the nuances of the city and the realities of the context. Collectively, the collection and analysis of quantitative and qualitative data leads to an in-depth diagnosis of the city, which provides a basis for the development of Actions for Resilience.

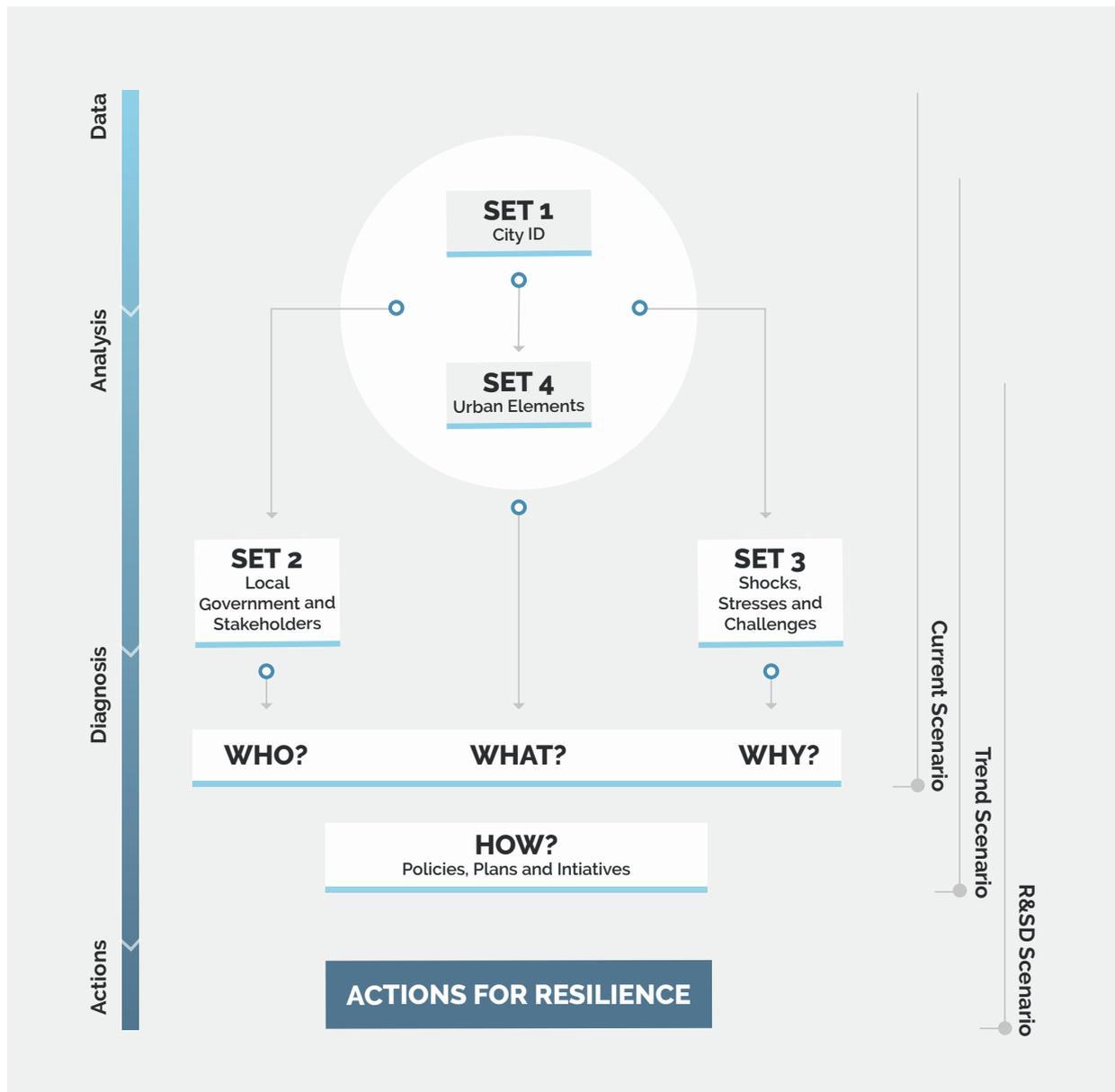


Figure: CRGP Implementation Process Diagram. Source: CRGP (2018).

As is illustrated in the diagram above, data is primarily collected in SET 1 – City ID, for context-related information, and in SET 4 – Urban Elements, for performance-related information. This data provides a basis to analyse the current strengths and weakness of the Urban System and its performance – the WHAT. Following this synthesis of data comprising the WHAT, information gathered regarding key stakeholders (including the local government) and shocks, stresses, and constraints (to which the city is found to be more or less vulnerable) are incorporated into the analysis.

SET 2, the WHO gathers information related to stakeholders which is used to analyse the role and relationships of the different institutions and organisations that act in the city and to identify the most influential actors. SET 2 includes an analysis of the local government, generating a map of the structure, functions, and responsibilities of the local government. In addition, SET 2 includes a general description of the main stakeholders external to the local government (other government levels, private companies, community organisations, NGOs, etc.).

SET 3, the WHY identifies and prioritises the shocks, stresses, and challenges present in the city. Experts evaluate the severity of potential impact of these risks by assessing whether or not, and to what degree, risk reduction measures have been established in the city.

The HOW – the policies, plans, and initiatives – portion of the CRPT evaluates existing development efforts. It uses the data collected in the aforementioned four SETS to map WHAT the issues are, WHO are able to act, and WHY action should be taken, ultimately establishing areas of focus, gaps, and overlaps and the formulation of actions to improve resilience.

## Lines of Action

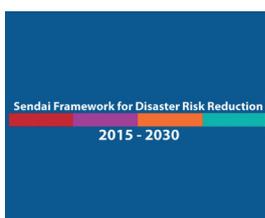
Lines of Action are prioritised thematic areas from which implementable actions are developed. Lines of Action are derived collaboratively with the local government and other key stakeholders through the quantitative and qualitative processes described above. Following a consolidation of findings and integration of key stakeholder input, the local government and experts from the CRGP team form a focused, consensus-derived path towards resilience. The Lines of Action present a culmination of collected data findings and preliminary analytical efforts, in combination with key stakeholder input gathered during workshops conducted in conjunction with the local government. These Lines of Action can vary in scope but relate directly to both quantitative and qualitative information, representing a synthesis of each methodological step in the CRPT implementation.

Based on these Lines of Action, Actions for Resilience are developed and proposed in order to co-create a resilient and sustainable roadmap for the city. These actions are intended to be both implementable and feasible, precise in targeting, and ambitious in their expected impact.

## Alignment with international frameworks and agendas

This methodology is developed in line with global intergovernmental frameworks – Sustainable Development Goals, Sendai Framework for Disaster Risk Reduction, Paris Agreement on Climate Change, World Humanitarian Summit: Agenda for Humanity, and the New Urban Agenda. Aligning CRPT with these frameworks enables the local governments who have implemented CRPT to better understand, report and deliver on specified targets.

## Sendai Framework for Disaster Risk Reduction



The Sendai Framework calls for resilience on all levels, from local to regional and national. CRPT contributes to the Framework's overall objective to reduce vulnerability to disasters and increase preparedness for response and recovery, including contributions to the Four Priorities for Action:

- Priority 1. Contribution: Building evidence-based knowledge on disaster risk reduction
- Priority 2. Contribution: Strengthening disaster risk governance through the adoption of plans
- Priority 3. Contribution: Investment in risk reduction for resilience
- Priority 4. Contribution: Scaling-up of preparedness and a 'build-back better' approach in recovery



## Sustainable Development Goals

Urban resilience relates to key elements of sustainable urban development and the goals of the post-2015 Sustainable Development Agenda, notably in Goals 1, 2, 3, 9, 11, 13 and 14 where resilience is referenced but also in other goals where it is implied. Resilience is also a strong component of many of the stated aims throughout the preamble and paragraphs 7, 9, 14, 23, 29 and 33 of the Declaration to the SDGs.



## Paris Agreement on Climate Change

Article 7 calls for strengthening of resilience to climate change in the pursuit of sustainable development. By engaging local governments in these efforts, resilience in cities contributes to the following principles of the Paris Agreement:

- Adaptation (dealing with impacts of climate change)
- Loss and Damage (minimizing loss and damage linked to climate change)
- Role of cities (building resilience)



## World Humanitarian Summit – Agenda for Humanity

The core responsibilities defined at the World Humanitarian Summit have strong foundations in resilience thinking and building. The approach adopted by UN-Habitat to build resilience contributes to Core Priority 1D, 4A, 4B, 4C, and 5A.



## New Urban Agenda

Advancing the urban resilience agenda and working globally delivers on a number of key goals of the New Urban Agenda agreed by Member States during Habitat III, most prominently:

- New resilient planning paradigms in urban systems
- Legal and regulatory frameworks to enable and govern urban development
- Analysing risks inherent in urban areas
- Promoting good practice in local economic, development strategies through marketing safer, resilient cities are fulfilled, respected and protected of under any circumstances.

## CRGP: Actions for Resilience

Actions for Resilience (A4R) constitutes the final step of UN-Habitat – CRGP’s urban resilience implementation process. These actions aren’t necessarily built from scratch; existing initiatives are taken into consideration, whether they are in progress or not. Actions for Resilience are not only focused specifically on the field of urban planning, but rather value sectoral initiatives related to each identified stress, in addition to those related to territorial development or planning.

In short, A4R builds evidence to modify and improve existing initiatives, as well as proposes new initiatives from a resilient and sustainable approach. The added value of A4R includes the development of a shared vision among actors, through a participation and consensus building process, and alignment with international agenda frameworks.

**The methodology for developing A4R is robust, but flexible and versatile enough to allow its adaptation and replication in different contexts. It constitutes a guide for designing new initiatives or modifying those already being implemented to promote resilience and sustainable development of local governments, focusing on the particularities of specific contexts.**

## CRGP: Recommendations of Actions for Resilience and Sustainability

This report serves as the culmination of the CRPT implementation process with the aim to better inform local governments, in this case the city of Yakutsk, of the state of the city with regards to resilience. It urges local government stakeholders to prepare, correct or apply initiatives (programmes, projects and plans) in a governance context that should be efficient, organized and transparent (with the local government leading the process) and within a safe and effective legal framework.

This document is divided into chapters that describe the stages of developing A4R:

- Current scenario: Identification and elaboration of the profile of the city, along with the
- Trend scenario: Potential impact of current plans, policies and initiatives
- Resilient and Sustainable scenario: Formulation of actions for resilience and sustainability.

### Building the current scenario: Identification and elaboration of the profile of the city

The current scenario is characterized through data derived from the collection of quantitative and qualitative indicators (SMART<sup>1</sup>: specific, measurable, achievable, relevant and timely), field visits, and local knowledge. These information reveal the composition of shocks, stresses and challenges specific to the context, which together serves as a profile of the city.

### Building the trend scenario: Potential impact of current plans, policies and initiatives

The trend scenario is built upon the current scenario, analyzing the expected effects on the urban system of current initiatives (policies, projects, programs and plans), whether they have been approved or not. The value of this analysis lies in its ability to propose potential corrections to certain negative trends or to include previously ignored issues into forecasting efforts. The trend scenario is the trigger for the formulation of Recommendations for Actions for Resilience.

<sup>1</sup> United Nations Development Programme (UNDP). (2009).

Handbook on planning, monitoring and evaluating for development results. Pg – 63

## Building the resilient and sustainable scenario: Formulation of actions for resilience (A4R)

The Actions for Resilience are organized according to actions that have integrative functions and actions on key strategic themes derived from the diagnosis. The resilient and sustainable scenario is derived from applying the Actions for Resilience to the trend scenario and therefore presents a realistic transformation process of the urban system.

## CRGP: Implementation Process in Yakutsk

### Project Objective

To make the City of Yakutsk more inclusive, sustainable, and resilient through strengthening the knowledge and capacity of the local government and develop targeted actions for building resilience.

Since early 2016, UN-Habitat CRGP has been engaged in building resilience with the City Administration of Yakutsk through a series of awareness-raising and training events and activities. These include Yakutsk's inclusion in the UN-Habitat's "Trends in Urban Resilience" publication, as well as UN-Habitat participation in the Yakutsk's Foresight Fleet 2017, among others.

The implementation of the CRPT officially began in May 2018, and for the following 2-year process, UN-Habitat CRGP has been working together with the Yakutsk City, primarily through designated personnel (Focal Points), in Yakutsk and in CRGP, to collect data and engage stakeholders in order to create an in-depth city profile, resilience diagnosis and proposed actions for Yakutsk.

Assigned municipal Focal Points received training on urban resilience more generally and the CRPT more specifically, not only regarding key concepts and rationale but also in specificities on data collection and analysis. The Yakutsk Focal Points, in coordination with designated UN-Habitat personnel directly implemented the CRPT in Yakutsk for the project. To ensure sufficient knowledge and support for the municipality, UN-Habitat hosted two Focal Point Training events in the Barcelona office, complemented by additional remote training sessions and regular meetings remotely performed with Yakutsk municipal Focal Points and specific expert personnel from City Administration, and UN-Habitat CRGP dedicated team. Furthermore, UN-Habitat performed a number of awareness-raising and capacity-building sessions during periodic field visits in Yakutsk to further engagement with key city partners.

The CRPT has been implemented in Yakutsk following the methodology previously described, consisting of the overlapping steps of data collection, analysis, diagnosis and recommendations for action. These efforts are primarily conducted through data mining, technical meetings, and workshops. The technical meetings and workshops in particular aim not only to populate and derive necessary information, but also to engage and train municipal technicians and decision-makers, as well as other relevant stakeholders, on urban resilience and its transversal nature.

In June 2019, UN-Habitat CRGP produced the first technical report which included initial findings, including a preliminary risk profile of the city. Following this submission, for the remainder of 2019, a series of bilateral meetings were held with selected departments and city administration personnel in order to share the results of the technical report as well as continue with further data collection processes and analysis. Upon the closure of data collection, a series of working group meetings were planned in order to collectively decide on the lines of action, starting from end of February 2020. While the first working group meeting took place, the succeeding workshops were disrupted due to the COVID-19 crisis. The Lines of Action were finally decided on by April 2020 through focused meetings between UN-Habitat CRGP and municipality representatives.

Based on the results of the analytical and diagnostic process described, the final version of the Recommendations of Action for Resilience and Sustainability (RAR-S) report was prepared, which includes a series of proposed Actions for Resilience for Yakutsk City. During the process of selecting Lines of Actions and designing Actions for Resilience, UN-Habitat CRGP consulted with representatives from the City Administration as well as topic experts. The Recommendations of Actions for Resilience and Sustainability report serves as a contribution to the development of a resilience roadmap for Yakutsk City based on urban resilience concepts that are transversal and integral in nature and allow for sustainable development. The official launch and distribution of the report takes place in September 2020 (see Annex I. CRPT Implementation Process in Yakutsk City).

Figure: Timeline of CRPT Implementation Process in Yakutsk. Source: CRPT (2020).



- Milestone events
- Major stages in implementation
- UN-Habitat CRGP Missions
- Yakutsk trainings and participation

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Over the past two years, UN-Habitat has been working closely with the City Administration of Yakutsk to create a comprehensive profile of the city and recommend actions to improve its resilience through the City Resilience Global Programme (CRGP) and its associated City Resilience Profiling Tool (CRPT). The CRPT provides a universal framework that uses verifiable and contextualised city data to establish a resilience profile and create an analysis and diagnosis of its most urgent challenges. This provides a basis for the creation of evidence-based and implementable Actions for Resilience, which are designed to be incorporated into current urban development strategies and management processes of the city. The Recommendations of Actions for Resilience and Sustainability Report (RAR-S) presents the culmination of the work carried out throughout the CRPT implementation process and provides a summary overview of the analytical “scenario-setting” process through which the Actions for Resilience have been developed.

## 1. Logic of the current scenario: collecting and analyzing data

Yakutsk, the capital of the Sakha Republic (Yakutia), is located just south of the Arctic Circle in the Far East region of the Russian Federation. It is the world’s largest settlement built on continuous permafrost and known as the coldest city on Earth, with temperatures averaging -8.8°C and extreme seasonal differences ranging from -60°C in winter to +40°C in summer. It is evident that Yakutsk has achieved a state of development rare for settlements in similar conditions and continues to grow and attract both people and investments. At the same time, Yakutsk faces a multitude of challenges and risks – categorised as shocks and stresses – that, if not addressed, may undermine this development.

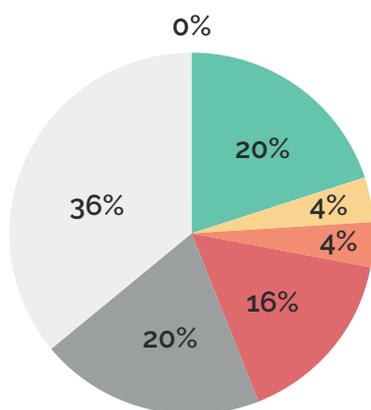
### Urban Performance Key Findings

The main basis for identifying key issues in Yakutsk urban system was through extensive sectorial data collection and analysis. Urban performance refers to the urban system’s profile of vulnerabilities and capacities based on data collected by the municipality from eight thematic groups (urban elements) through series of indicators. Collected data are assessed based on benchmarks formulated from international standards, various tools and frameworks measures in collaboration with practitioners in relevant fields.



While the availability of the required data in Yakutsk is only 43%, as this is the first time the city is conducting this type of data collection, the analysis has been supplemented by documentary review and key information interviews to derive key findings and serve as a foundation for the identification of risks present in the city.

## Built Environment



Inefficient urban expansion with high land consumption and low density

Only 5% of housing is located at risk-prone areas but "thawing bowls" have formed under majority of the houses

Low availability of open public spaces, sidewalks and other urban amenities

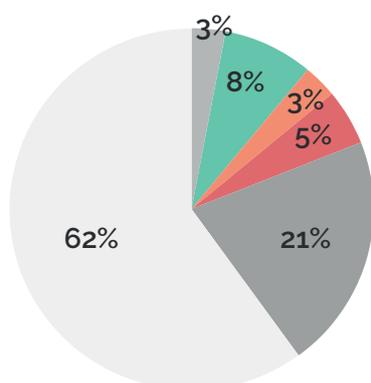
Relatively high tenure security (71.90%) and provision of housing schemes

Adequate housing is generally considered unaffordable for exempted groups

Large percentage of structures are considered inadequate and vulnerable to ground movement with 35% housing under emergency status

High depreciation of infrastructure (facilities, roads, pipes, etc.)

## Supply Chain and Logistics



Reliable primary source of water (Lena River) shallowing due to chaging watercourse

Reliance on abundant but unrenewable energy sources (natural gas)

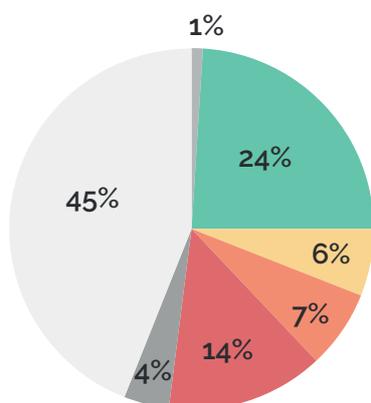
Insufficient local food production leading to heavy dependence on imports

Seasonal constraints in freight for main bulk supply routes and absence of unified transport and logistics system

Large proportion of cost of production (40%) is the transport component

Singular access route to suburban villages with roads in poor condition

## Basic Infrastructure



Wide coverage of water, wastewater and energy networks (97%, 78% and 100% respectively)

High capital and maintenance costs for infrastructure development

Difficulty to extended networks to newly granted land plots in outskirts

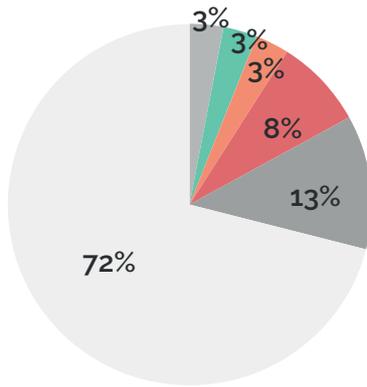
Large losses during delivery from poor insulation and depreciation

Lack of treatment of wastewater and solid waste

Existing landfills do not comply with safety and environmental standards

Limited stormwater drainage infrastructure leading to waterlogging

## Mobility



High dependency on private transportation (1 car for every 3 inhabitants)

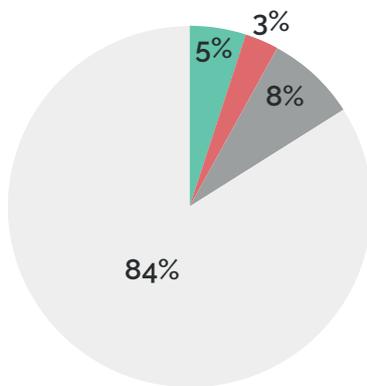
Roads do not meet regulatory requirements and are often congested

Public transport system is provided through buses and are considered reliable in the urban area, but poorly serves suburban villages

Transport is subsidized for children, youth and other special groups

Primary means of interregional/international transport is through air travel, with seasonal availability of river routes (ferries) and road

## Municipal Public Services



Ongoing digitalisation of municipal services and provision of free internet in schools and public areas to increase efficiency and accessibility

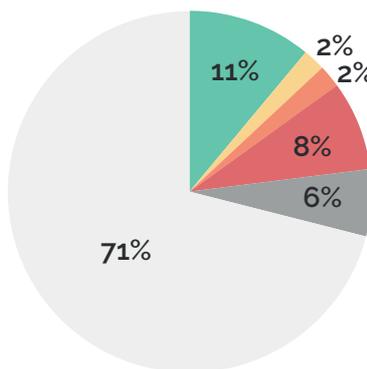
Cultural activities and facilities generally available for various demographics but limited involvement of women and vulnerable groups in policy/planning

High municipal support given to youth activities and organisations

Increasing occurrence of criminal activity and road accidents

Adequate average response time for emergencies at 10mins

## Social Inclusion and Protection

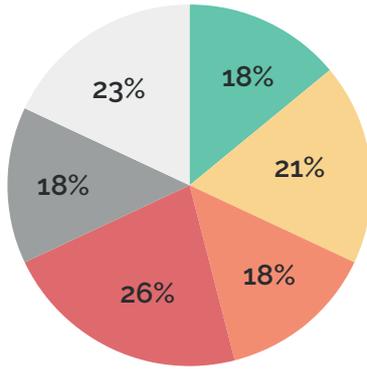


Availability of means for citizen participation through both traditional and digital engagement platforms

Differentiated measures of social protection and support are provided for various low-resource groups (specifically poor families with children, veterans and pensioners, disabled, and orphans)

Due to sharp increase in population, physical and personnel capacities of social services (education, health, etc.) is stretched

## Economy



Gross City Product (GCP) per capita is relatively high but considered volatile

Heavy concentration of financial, information and telecommunication

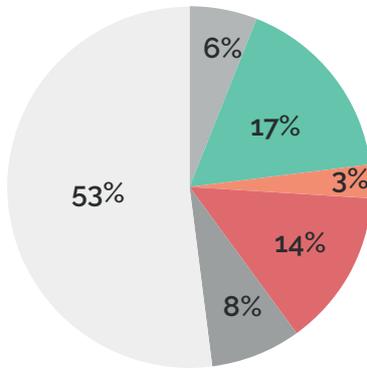
Low industrial composition diversity

High cost of doing business

Relatively low unemployment rate (5.6%)

A large proportion of households live below poverty line (20-50% depending on reference line) with a significant discrepancy among income classes (0.4 GINI Coefficient)

## Ecology



Urban growth necessitating conversion of natural areas (forest & floodplain)

Changes in permafrost soils lead to lower agricultural yield

Low proportion of green space per person (1.5 sqm/person)

Generally poor air quality due to vehicular and industry emissions

Poor surface water (particularly lakes) and soil quality due to mishandling of wastewater, solid wastes, and other unauthorised discharges (e.g. fuel leak)

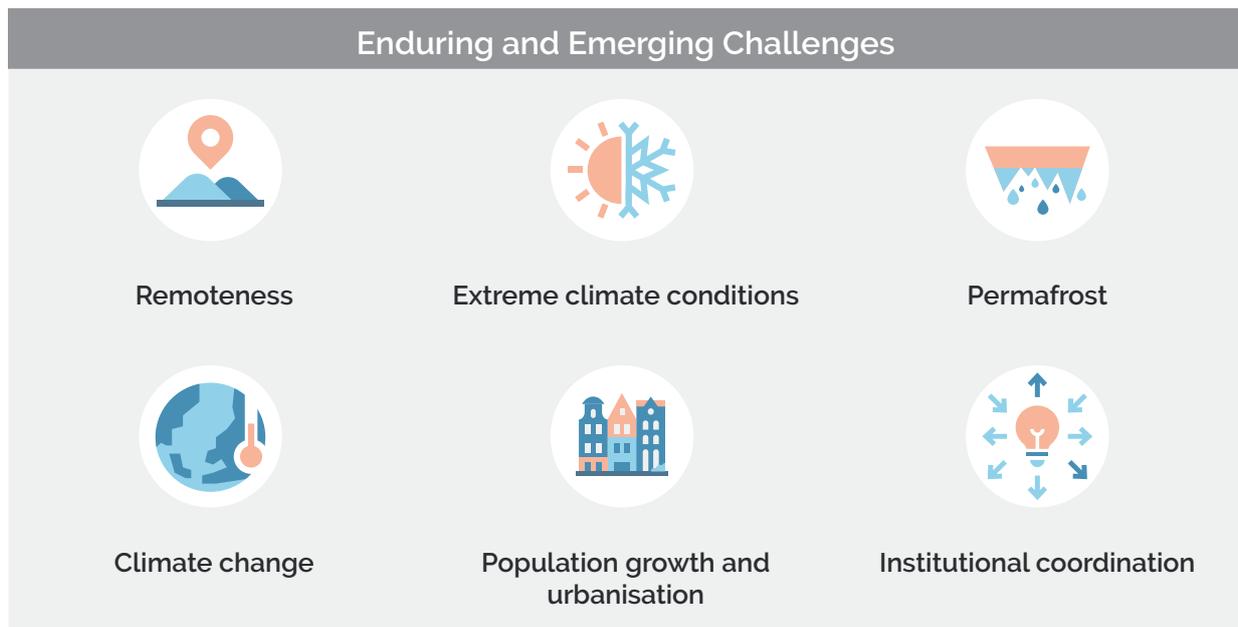
Monitoring mechanisms of air and water quality is regional, not municipal

## Risk Analysis Key Findings

Based on the data gathered on the urban context and urban performance, a risk analysis of the city was conducted. These include identifying the various shocks, stresses and challenges that is present in the city, and analysing their causes and impacts, and how these interact with each other.

### Enduring and Emerging Challenges

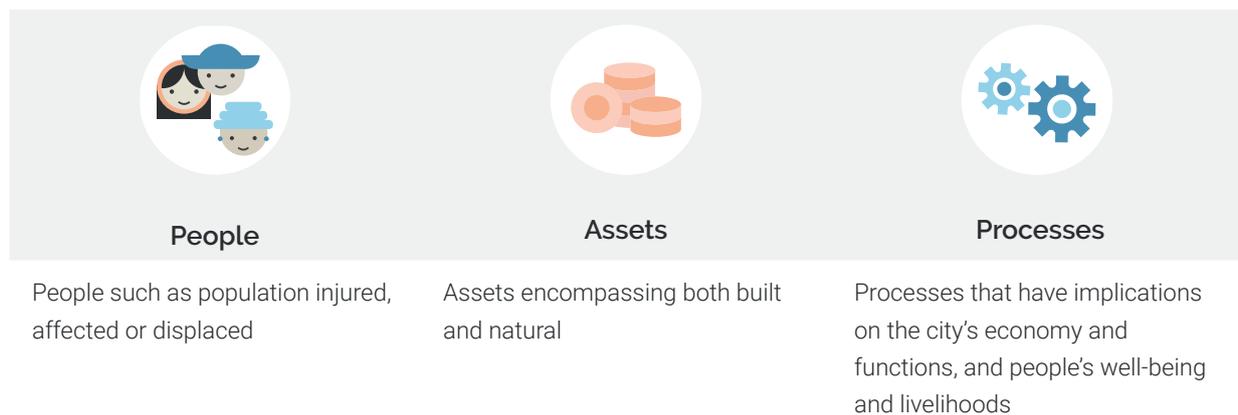
Before delving into the different shocks and stresses that Yakutsk faces, it is important to highlight certain challenges, due to enduring or emerging factors, which significantly affects the city's resilience. Enduring challenges are those that Yakutsk has been facing since its formation and has become intrinsic characteristics of the city, whereas emerging challenges are pressures extrinsic to the urban system brought forward due to changes occurring in this interconnected world.



### Shocks

Building on UNISDR's 2017 terminology and taxonomy on hazards, CRPT considers six main groups of shocks: Natural, Biological, Environmental, Technological, Societal and Complex. In addition to these four groups, CRPT's list includes complex shocks as well as societal shocks that seek to capture a range of potential socio-economic, socio-spatial, or socio-cultural shocks to which a city may be prone.

The type, frequency and, most importantly, the impact of each identified shock was analysed to build Yakutsk's resilience to shocks. The analysis focused on the constituents of the urban system affected by the adverse events and understanding the effects on People, Assets and Processes.



Drawing on the CRPT's shocks taxonomy and using data collected through the urban context, documentary analysis, local knowledge, and interviews with researchers and professional experts, the following section brings together information on the different plausible shocks identified in Yakutsk:

	<p><b>Floods</b></p> <p><b>Sub-type:</b> Fluvial Flooding, Pluvial/ Snowmelt Flooding, Ice Jam Flooding</p> <p><b>Triggered Secondary Shocks:</b> Water body degradation, Sudden water pollution, Inland erosion</p>
	<p><b>Wild Fire</b></p> <p><b>Sub-type:</b> Forest Fire</p> <p><b>Triggered Secondary Shocks:</b> Urban fire, Sudden air pollution, Biodiversity loss</p>
	<p><b>Extreme Meteorological Conditions</b></p> <p><b>Sub-type:</b> Cold Wave, Fog</p> <p><b>Triggered Secondary Shocks:</b> Biological shocks, Public services breakdown, Failure of supplies</p>
	<p><b>Storm</b></p> <p><b>Sub-type:</b> Extra-tropical storm</p> <p><b>Triggered Secondary Shocks:</b> Basic infrastructure breakdown, Public services breakdown</p>
	<p><b>Subsidence (from Permafrost Thawing)</b></p> <p><b>Type:</b> Mass Movement</p> <p><b>Sub-type:</b> Subsidence</p> <p><b>Triggered Secondary Shocks:</b> Built Infrastructure Breakdown, Urban Fire</p>
	<p><b>Failure of Infrastructure and Services</b></p> <p><b>Sub-type:</b> Built Infrastructure Breakdown, Basic Infrastructure Breakdown</p> <p><b>Triggered Secondary Shocks:</b> Urban Fire, Failure of supplies</p>
	<p><b>Urban Fire</b></p> <p><b>Type:</b> Non-Industrial Incident</p> <p><b>Sub-type:</b> Urban Fire</p> <p><b>Triggered Secondary Shocks:</b> Built infrastructure breakdown, Public services breakdown</p>
	<p><b>Failure of Supplies</b></p> <p><b>Sub-type:</b> Food Crisis</p> <p><b>Triggered Secondary Shocks:</b> Socio-economic shocks</p>
	<p><b>Infectious Diseases</b></p> <p><b>Sub-type:</b> Viral Epidemic &amp; Pandemic Disease, Bacterial Epidemic &amp; Pandemic Disease</p> <p><b>Triggered Secondary Shocks:</b> Socio-economic shocks, supply chain failure</p>

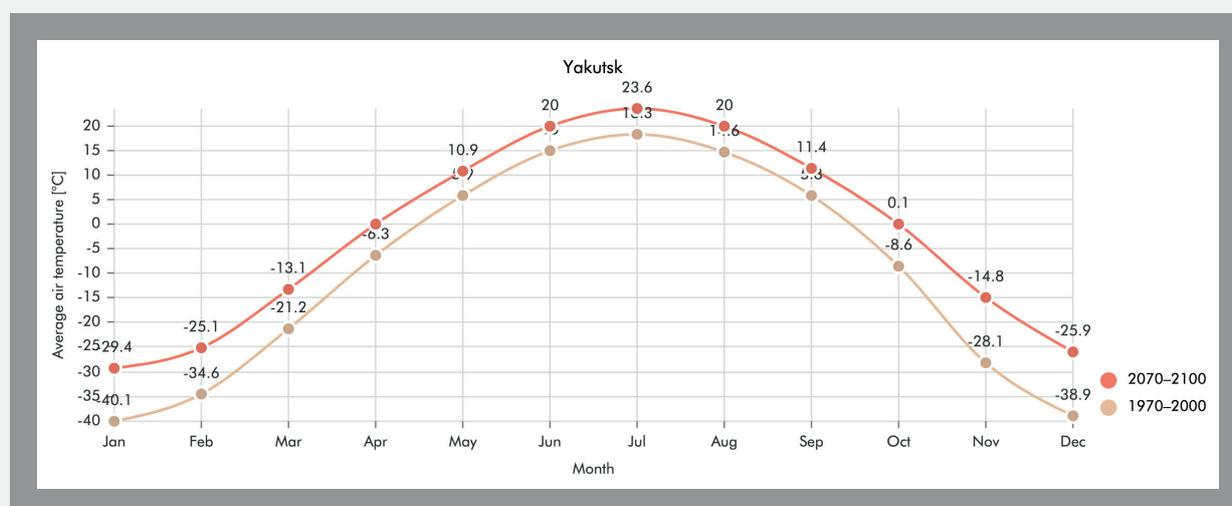
## Stresses

Risks in Yakutsk comes not only from the variety of shocks described in the previous section, but also in the form of stresses. These are chronic and ongoing dynamic pressures with cumulative impacts that undermine the urban system, rendering it fragile and vulnerable. Stresses are identified through findings from the urban performance indicators, and supplemented by extensive review of existing documents, including theoretical and empirical research by academics and practitioners, to support a qualitative analysis.

	<p><b>Unregulated Urban Growth:</b></p> <ul style="list-style-type: none"> <li>• Urban sprawl</li> <li>• Settlements in risk-prone areas</li> <li>• Limited spatial accessibility and connectivity</li> <li>• Lack of useable green and public spaces</li> </ul>
	<p><b>Inadequate Urban Infrastructure:</b></p> <ul style="list-style-type: none"> <li>• Fragile and dilapidated buildings and infrastructure</li> <li>• Retarded development of urban infrastructure</li> <li>• High costs of maintenance</li> </ul>
	<p><b>Socio-economic Deprivation:</b></p> <ul style="list-style-type: none"> <li>• Low income</li> <li>• Lack of affordable housing</li> <li>• High cost of goods and services</li> <li>• Social tension</li> </ul>
	<p><b>Environmental Degradation:</b></p> <ul style="list-style-type: none"> <li>• Air pollution</li> <li>• Water and soil contamination</li> <li>• Permafrost deterioration</li> </ul>
	<p><b>Mismanagement of Urban Metabolism:</b></p> <ul style="list-style-type: none"> <li>• Inadequate waste management</li> <li>• Inadequate storm water management</li> <li>• Unrenewable energy consumption</li> </ul>
	<p><b>Dependency on External Markets and Financing:</b></p> <ul style="list-style-type: none"> <li>• High but volatile GDP per capita</li> <li>• Low industrial diversification</li> <li>• Insufficient own food production</li> <li>• Inadequate logistics infrastructure</li> <li>• Low local budgetary autonomy</li> </ul>

## Expected Impacts and Vulnerabilities from Climate Change

- Projected seasonal warming is expected to have significant implications on the future stability of permafrost, as the Yakutsk City is built on a continuous such periglacial structures. The area of Yakutsk City and its surroundings is likely to experience a far faster thawing of permafrost than expected. The projected changes in freezing regime are likely to delay the complete freezing-up of the active layer than in the present-day climate or to prevent its consistent re-freezing.
- Landscape alteration due to the collapse of ice cellars, endangering transport infrastructure and city buildings.
- In response to the future projected changes in air temperature and precipitation, the Yakutsk City and its surroundings are likely to maintain prone to floods, due to the proximity of Lena River. This risk is expected to be high especially in spring due to a likely earlier snowmelt, but also to the transport of ice banks by the river.
- In response to the future projected signals of lengthening of summer dry intervals correlated to a growing frequency and persistence of hot-weather episodes, an increasing exposure to drought and wild fires is expected in the target area.
- The current high level of water contamination is expected to be a pressing issue for the city municipality also in the future, having in view the projected increases of precipitation which will favour the pollutant transport and re-distribution in the area, but also the lack of effective measures for greening the economy (e.g. ecological waste disposal sites, waste recycling) or of long-term territorial development planning. The provision of high quality drinking water to the local population is likely to remain an important ongoing challenge for the city over the 21st century.
- Correlated to energy consumption for heating, heating degree-days are projected to decrease visibly in both RCPs. A great saving energy for heating during the cold season is expected in the Yakutsk City due to milder thermal conditions by the end of the 21st century. The demand for indoor heating is projected to decrease all over the year. Peak declines are projected in October (during the cold season – October to March), while the smallest changes are estimated for July (during the warm season – from April to September). The estimated future changes could be summarized, as follows:
  - In RCP4.5: with 5 to 9% during extended winter season and 14 to 39% in summer, by 2040; with 8 to 15% during the extended wintertime and with about 13 to 59% during the warm season, by 2070; and with 10 to 19% from October to March and with 16 to 64% from April to September, by 2100.
  - In RCP8.5 the projected decreases are considerable and are estimated to: 5 to 10% in the cold season and to 9 to 42% from April to September, by 2040; 11 to 22% in the cold season and to 18-85% in the warm season, by 2070; 18 to 35% in the cold season and to 27 to 92% in the warm season, by 2100.



**Figure:** Change in average air temperature in Yakutsk based on RCP 8.5 scenario projection

Source: Lobelia Climate Trends in Yakutsk. Available at: [www.city-climate-trends.lobelia.earth/yakutsk](http://www.city-climate-trends.lobelia.earth/yakutsk)

# Priority Matters

While the previous section reveals the shocks, stresses and challenges that Yakutsk faces, these do not operate in isolation in the urban system. Stresses increase the vulnerability of the city to potential shocks; Shocks see their impacts compounded by the stresses that the city suffers; and Challenges create and intensify shocks and stresses in the urban system, rendering the city more fragile.

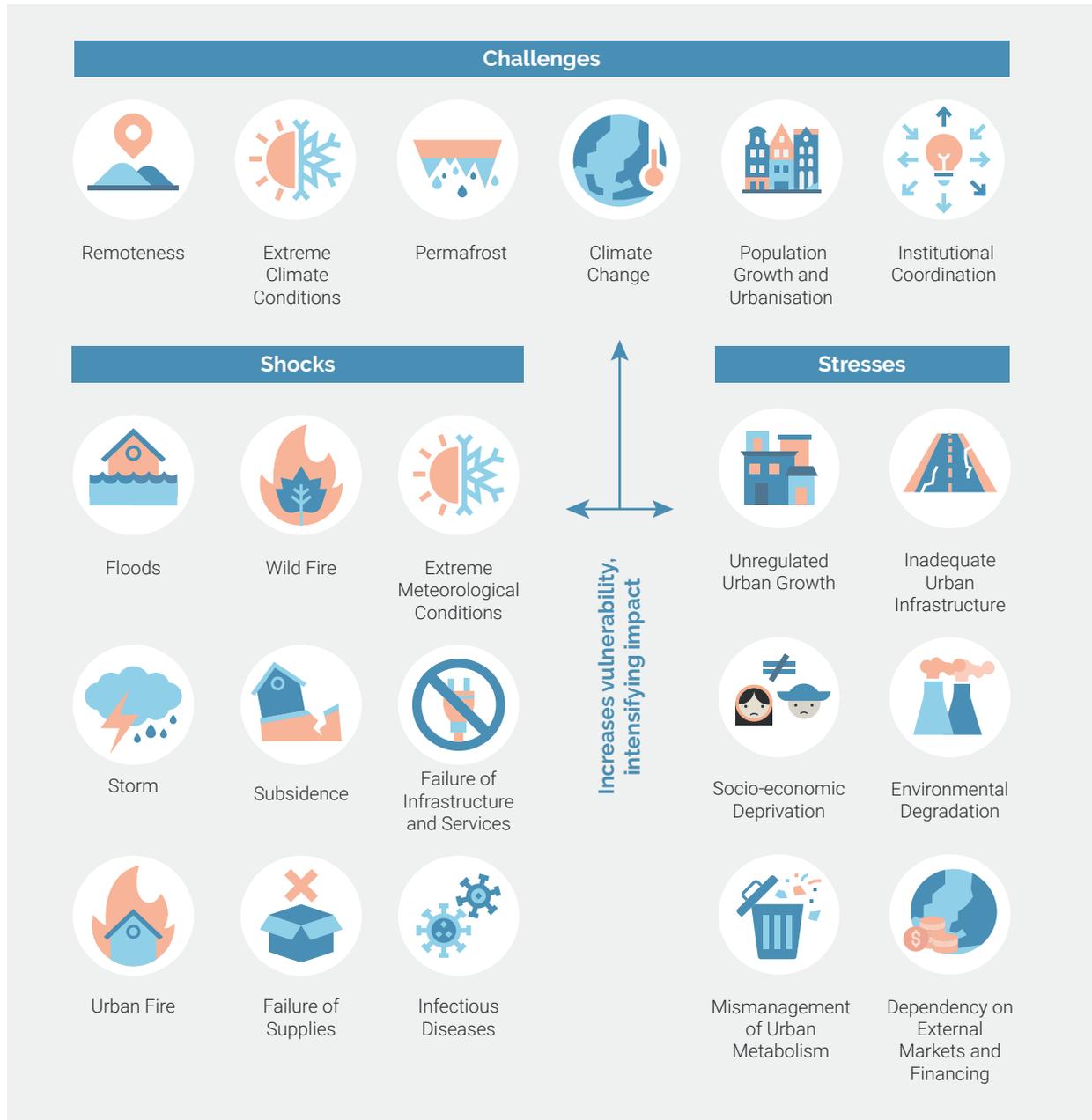


Figure: Linking shocks, stresses and challenges. Source: CRPT (2020).

It is important to recognize these relationships when building resilience as proposed actions should reduce vulnerability and help mitigate the impact of an external event. Consequently, the city's ability to regain its pace of performance must be improved. Through exposing the risks that Yakutsk face, interactions among risks and the components of the urban system can be drawn – the understanding of which are essential for designing actions seeking to build the city's resilience. A resilient city is one that considers how these various risks affect each other and therefore highlight priority matters to be addressed in order to achieve maximum impact.



Figure: Priority Matters. Source: CRPT (2020).

## 2. Logic of the trend scenario: legal and regulatory framework

Following the Current Scenario and determination of the priority matters derived from the interactions of risks, the Trend Scenario presents how the existing situation is likely to change based on the foreseen development trajectory of Yakutsk. This takes into consideration the policy context of Yakutsk and how local governance structure and processes can be assets and/or constraints in this development, recognising that when properly directed or oriented, these can be harnessed to reinforce the resilience of the city.

It was found that a multitude of strategies, plans and programmes that target the determined priority matters already exists, implying that, if properly implemented and enforced, Yakutsk is well underway in addressing many of its risks. Thus, it is less a matter of creating entirely new measures, but ensuring that these measures embody resilience characteristics.

- Ecological programs exist in supra-local levels, though with a 'band-aid' approach on the environmental issues, often limited to targeting the identification and elimination of already accumulated damage to the environment. There is a disjunction with the strategies set and in the activities planned in the local level. A systems approach should be made more evident in development strategies throughout different levels, recognising the effect on the environment and especially in the context of highly environmentally-sensitive territory of permafrost.
- The trend of urban growth in Yakutsk still follows a sprawling pattern with the conversion of forest land to provide land plots and other urban/agricultural uses, typically done without the provision of utility networks or strict building requirements, bringing with it problems of degradation and accessibility for the populace. While there is increasing efforts in intensifying inner city development and following a multiple-nuclei planning concept, care should be placed on locating these in non-hazardous areas, working with existing communal systems, and ensuring that these do not further degrade the environment.
- There is a demanding preoccupation in the deterioration caused by permafrost and extreme cold climate in Yakutsk, constantly providing maintenance of public infrastructure, and demolition of emergency buildings. Though currently, few norms regulating activities on permafrost exist, new regulation, technologies and approaches to building on permafrost is being developed in regional and local level, an example of which is the Law on the Protection of Permafrost. However, these protective regulations have not been possible thus far due to the lack of inclusion in the national budgets. Furthermore, due to the vague ownership models for housing and other infrastructures, especially those built in the Soviet period, there is difficulty in enforcing any set regulation and in properly maintaining these structures.

- While there is still primary reliance and growth of extractive industries to attract investors and increase the tax base in the region, it is also evident the significant approach focused on enhancing the “knowledge economy” through investments in education, technology and digitalisation, to improve economic security locally. In addition, diversifying the economy provides the population of Yakutsk, many of which are highly educated and are specialists, better prospects within the region and beyond.
- The local government plans and programmes address a wide range of development-related issues in the city, ranging from the improvement of physical assets to continue to provide services to the inhabitants and stimulating the local economy. However, there exists space for improvement, specifically related to managing the significant levels of pollution and degradation in Yakutsk, and addressing the needs of some of their most vulnerable populations that are often not well considered in established social systems and practices.
- Many of the municipal programmes and investment projects do directly provide both structural and non-structural risk mitigation measures for many of the city’s most prominent shocks (floods, fires, subsidence, and failures of infrastructure and supply chain); however, these do not explicitly address climate change trends and its impacts. Tying these measures in with climate change mitigation and adaptation strategies should be promoted to ensure resilience and long-term sustainability.
- There is significant presence of other sectors in the development activities of the city and important strides are already being made to further engagement of the general public. Civil initiatives, communities and non-profit organizations try to address the gaps where the government have not been able to provide a timely response to the civil society needs, or those of vulnerable groups, though participation is still a challenge. It is important to continue these efforts and ensure that barriers, whether physical, socio-economic or cultural, are addressed.

## Domains of Opportunity

The Yakutsk City Administration has been leading the way in developing and implementing strategies and initiatives to respond to these issues, and there are installed capacities within the local government and with their partners to implement resilience measures. However, the scale of the issues Yakutsk faces requires looking for opportunities for constant improvement of these capacities and finding synergies to address these priority matters.

- Coordination and holistic vision
- Information management to make decisions
- Raising awareness and knowledge of measures in place
- Replication and implementation of best practices and innovations

In addition to this focus on increasing governance capacities for resilience, below are three areas that were observed as particularly relevant for the city in their existing strategies and plans:

1. Provision of quality services to the general population
2. High rate of infrastructure development and maintenance
3. Promotion of diversification of the economy and rationalising resource use of the city

However, with the significant risks that Yakutsk is facing, which climate change will only continue to exacerbate, there is a need for the local government and stakeholders to step up and directly address these issues. One way is to transform the aforementioned areas by infusing them with environmental considerations and targets in order to ensure long term resilience. These include increasing efforts in permafrost protection, improving urban metabolism and the efficient use of resources, and protecting people most vulnerable to its impacts. Through this infusion, these areas become opportunity areas for building the resilience of the city.

### 3. Logic of the resilient and sustainable scenario: actions for resilience

Creating a Resilient and Sustainable Scenario for Yakutsk requires the implementation of Actions for Resilience and Sustainability based on CRPT's compound data collection, analysis and diagnosis processes, combining quantitative and qualitative approaches. Information on the Yakutsk unique context has been taken into consideration, as well as the overview of the city's performance, through which the risk profile of the city was identified. Proposed actions also incorporate the extent to which climate change and other challenges will impact the severity and frequency of shocks and exacerbate existing stresses, and through this determine priority matters that must be addressed.

From these findings, the Resilient and Sustainable Scenario was defined following a governance roadmap on which the proposed integrative and strategic actions are framed.

#### Governance roadmap for actions

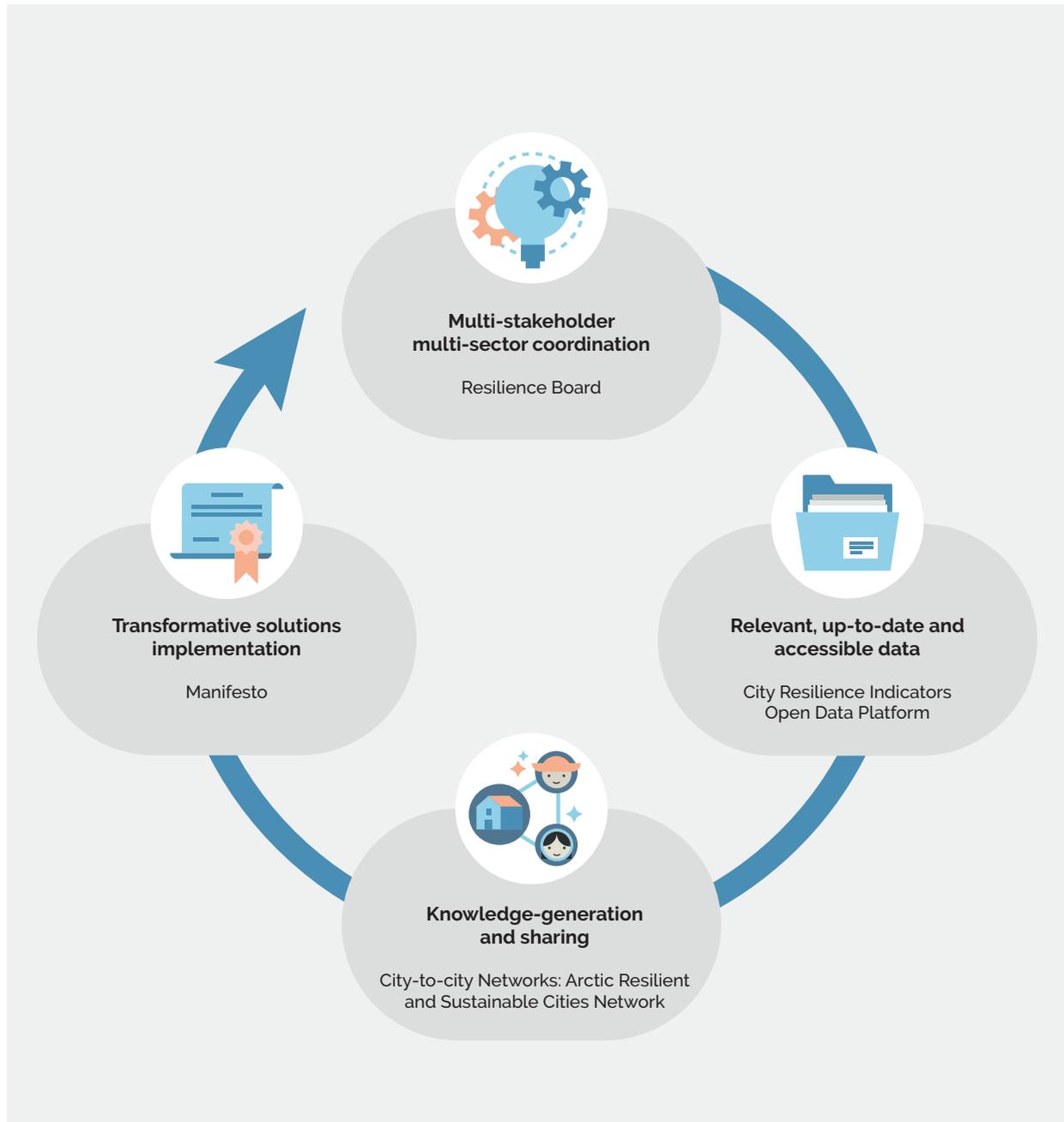
Resilience-building necessitates a governance process that is integrated, reflexive and transformative. The governance roadmap guides the design and implementation of the recommended actions, and calls for greater coordination and alignment among various stakeholders, more relevant and inclusive data and information management, and wider exchange of knowledge and best practices, which together inform various transformative solutions for the city.



**Figure:** Governance roadmap for actions. Source: CRPT (2020).

## Integrative actions

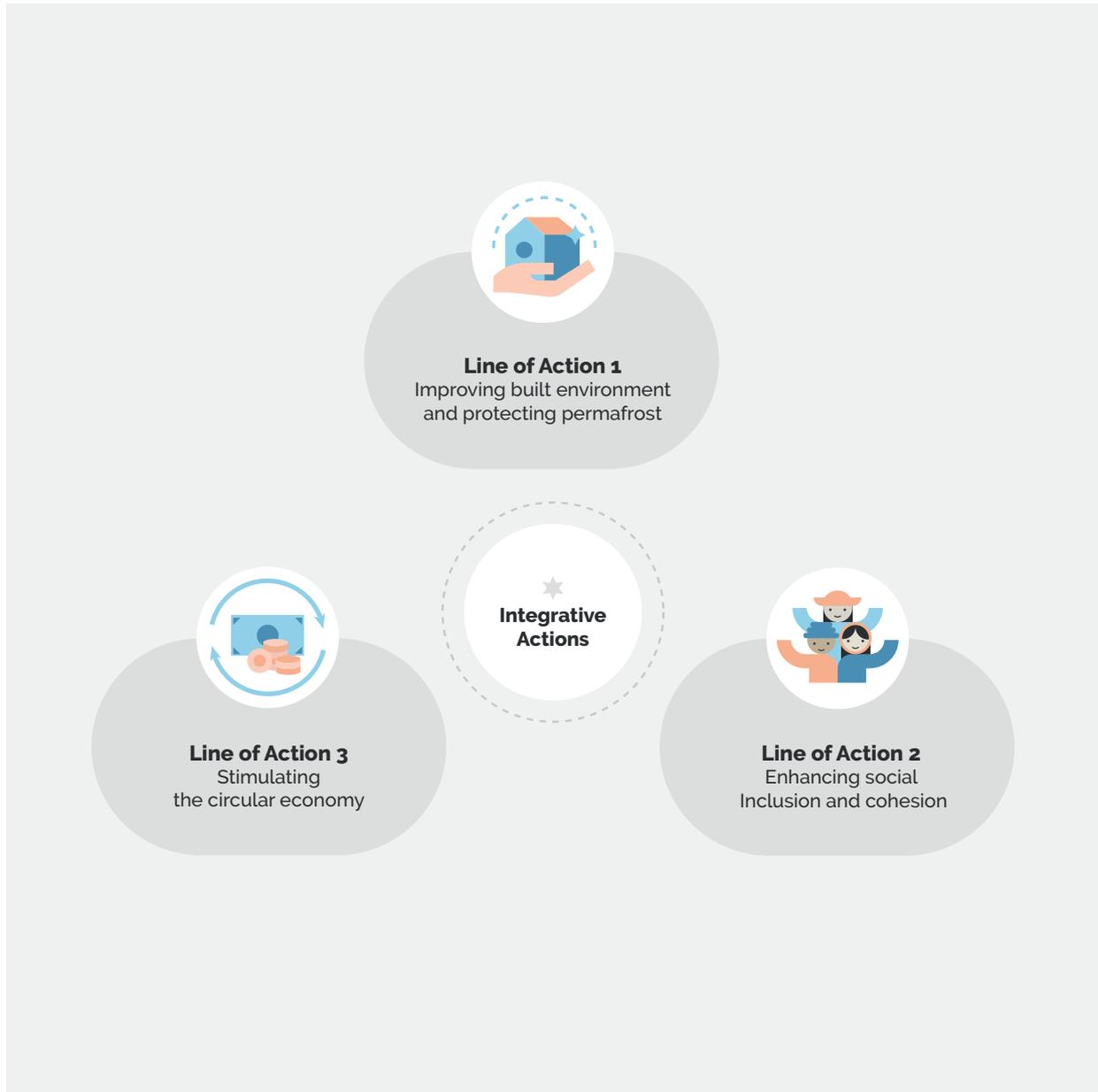
These actions are critical in institutionalising the concept of resilience in the local government and enabling resilience-building actions, whether proposed here or in the future. Integrative actions enhance the capabilities of the local government in the various steps of the governance roadmap, as well as provide supportive mechanisms for the fulfilment of strategic lines of action.



**Figure:** Roadmap of Integrative Resilient and Sustainable Actions for Resilience. Source: CRPT (2020).

## Strategic lines of action

Based on the findings from the current and trend scenario, thematic domains of opportunity which intersect the priority matters (ecosystems management, built assets quality, localised economy, and vulnerable groups inclusion) derived from the CRGP process and the local priorities and capacities of the municipality were determined, including infrastructure development and maintenance, economic diversification and social services provision. However, there are still considerable gaps in the promotion of more environmental and inclusive measures to needs to be addressed to build the city's resilience. These strategic lines of actions are:



**Figure:** Strategic Actions for Resilience and Sustainability. Source: CRPT (2020).

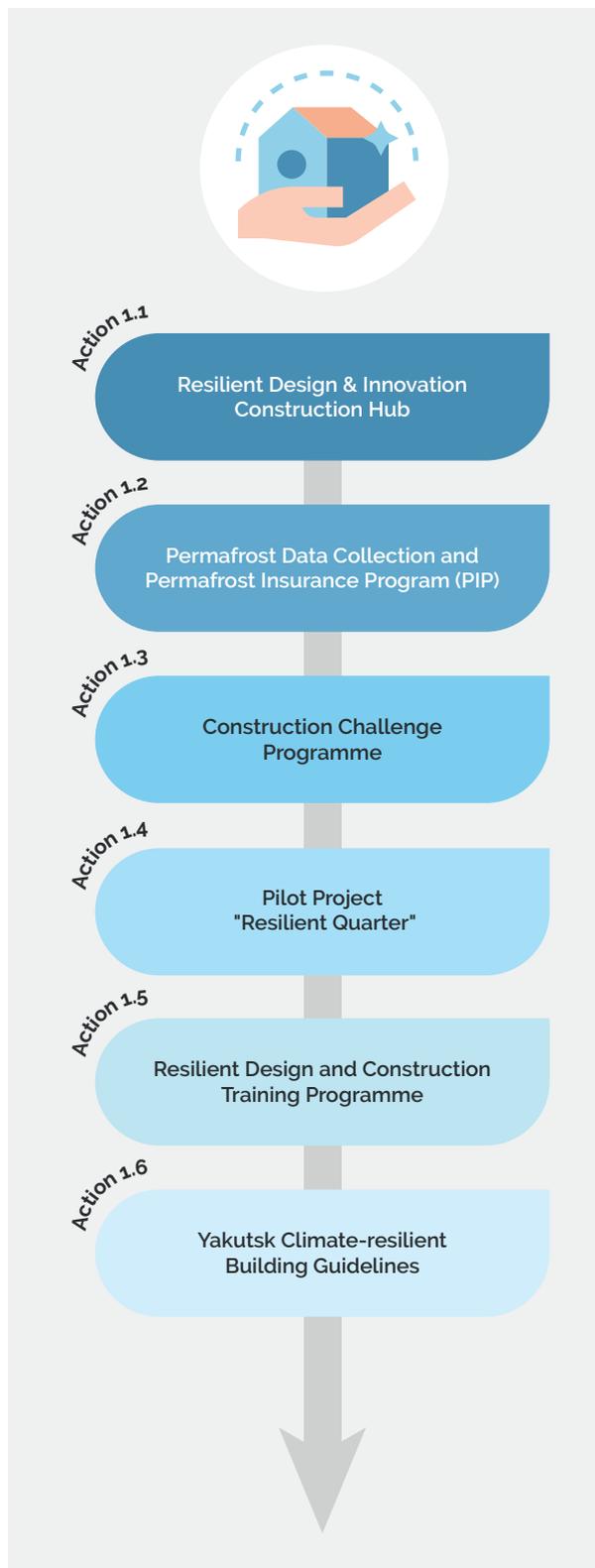
### 3.1. Integrative Actions for Resilience and Sustainability

The first series of actions proposed are aimed at creating an enabling system for resilience-building actions following the governance roadmap. These integrating actions includes the establishment of a **Yakutsk Resilience Board** to encourage multi-stakeholder multi-sector coordination; the creation of an **Open Data Platform** with **City Resilience Indicators** mining, collection and further monitoring, and integrating these in community participation mechanisms, to achieve relevant, up-to-date and accessible data; the promotion of **City-to-City Networks**, to promote knowledge-generation and sharing; and the final development of a **Manifesto** as a public declaration of resilience and sustainability-targeted commitments and policies to stimulate transformative solutions.

	<p><b>Action A:</b> Establishing and operationalizing Yakutsk Resilience Board</p>
	<p><b>Action B:</b> Collecting, monitoring and sharing data through City Resilience Indicators and Open Data Platform</p> <p><b>Action B.1:</b> Collect and monitor City Resilience Indicators <b>Action B.2:</b> Create an Open Data Platform to promote community participation</p>
	<p><b>Action C:</b> Leveraging City-to-City Networks through Arctic Resilient and Sustainable Cities Network proposal</p>
	<p><b>Action D:</b> Committing for transformation through a Manifesto</p>

### 3.2. Strategic Lines of Actions for Resilience and Sustainability

The proposals related to strategic actions are directed towards specific critical issues found in the analysis (both spatial, physical, functional or organizational), through which the greatest impact on people, assets and urban processes is sought, reducing stresses and minimizing the consequences of the identified shocks, while taking into account the main aspects of concern of the city.

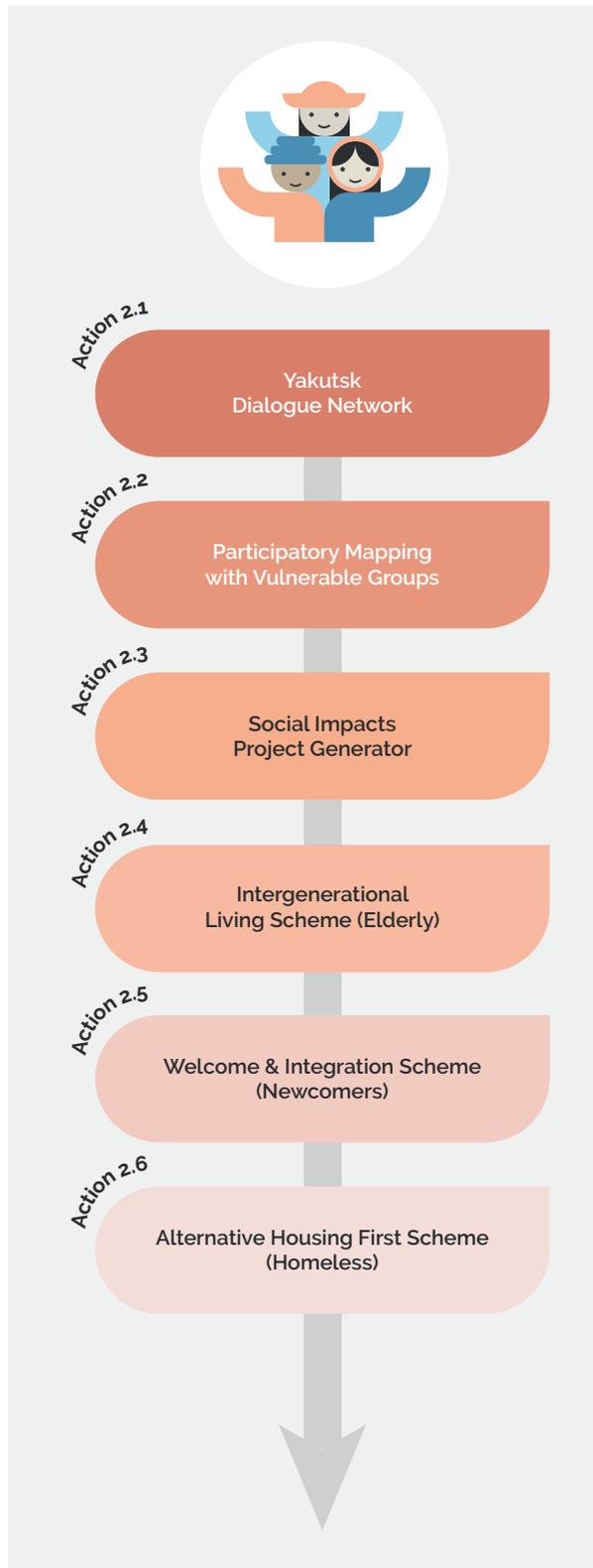


#### Line of Action 1: Improving built environment and protecting permafrost

In Yakutsk, technogenic pressures and the rapidly changing climatic conditions leading to permafrost thawing are a major concern, with a high percentage of the infrastructure and buildings affected. To improve and finally overcome this unstable situation of the built environment in Yakutsk, an iterative process for building a strong knowledge base and learning curve about these matters is proposed through this line of action. This aims to provoke discussion and bring knowledge to the table, as well as find potential solutions for the application and enforcement of laws and rules on permafrost protection.

The final concretion of this specific Line of Action will be the development of **Yakutsk Climate-resilient Building Guidelines**, with a **Resilient Design & Innovation Construction Hub** observing and monitoring them. This would take into consideration the **Permafrost data collection and potential new insurance protocols** related to existing and new buildings, public open spaces and neighbourhood with different specificities and scales. Technical assessments and initiatives regarding construction and operational maintenance are compulsory and should go along with **pilot projects and excellent practices** led by **training programmes** to boost technical knowledge and protect permafrost, with the co-benefits of enhancing employment opportunities for youth and artisans within the city and beyond.

**Figure:** Line of action 1 roadmap: Improving built environment and protecting permafrost. Source: CRPT (2020).

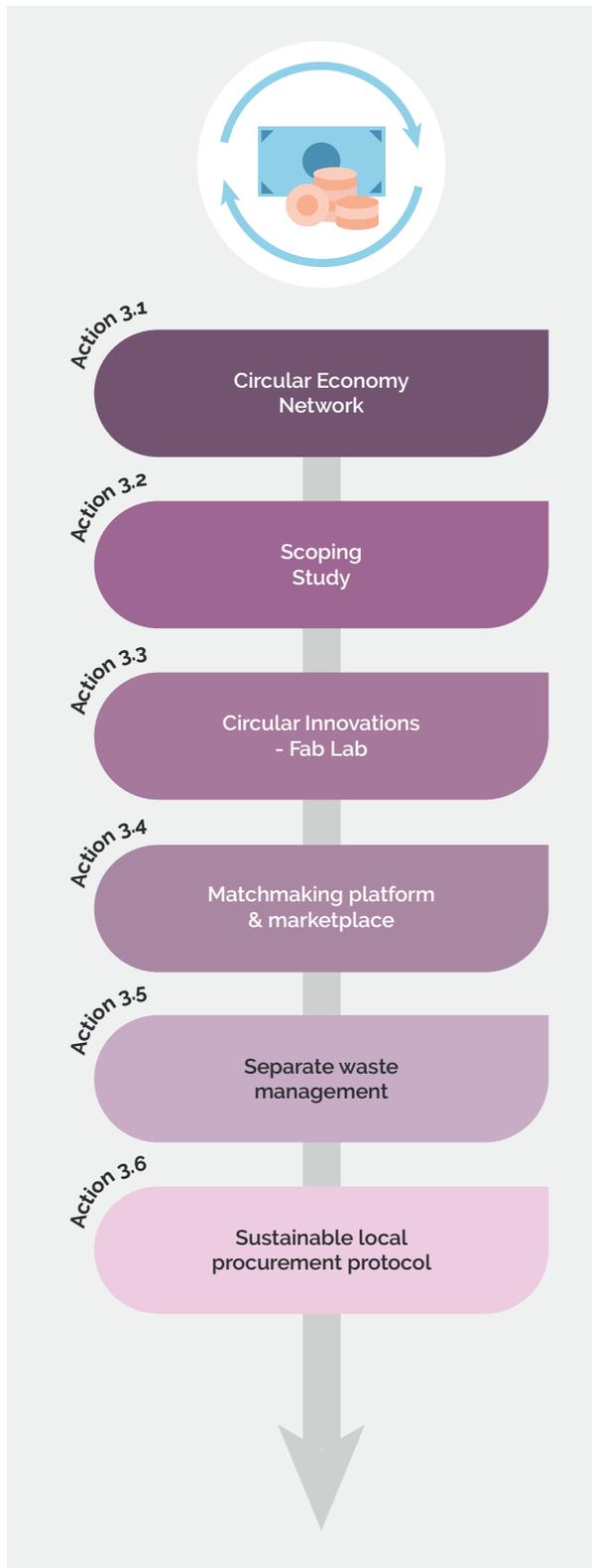


**Figure:** Line of action 2 roadmap: Enhancing social inclusion and cohesion. Source: CRPT (2020).

## Line of Action 2: Enhancing social Inclusion and cohesion

This line of action is designed to build upon the existing measures already being conducted in the city through a series of interlinked actions focused on vulnerable groups who experience various barriers to meaningful engagement and participation. To improve the resilience of the city of Yakutsk, it is essential to intentionally recognise these different categories and increasingly include them in policies and decision-making processes. The **Yakutsk Dialogue Network** corresponds to the need for a multi-stakeholder multi-sector approach that will create a venue for participation particularly for vulnerable groups, while the **Participatory Mapping with Vulnerable Groups** promotes recognition of their knowledge and experiences. Using these platforms as a jumping off point, the municipality can begin to develop more inclusive programmes and projects, which can involve encouraging the ingenuity of their citizens through the **Social Impacts Projects Generator**, and creating transformative actions for specific vulnerable groups.

While there are many categories of people in vulnerable situations that should be addressed and should not be considered less important, this line of action focuses on three that emerged from the study and were found often underserved by existing measures. The actions related to these are an **Intergenerational Living Scheme** for the elderly, an **Alternate Housing First Scheme** for the homeless, and a **Welcome & Integration Scheme** for newcomers to the city. However, these proposed actions should only be considered as catalyst steps. The municipality should continue developing schemes for the various vulnerable groups in the city, particularly as they emerge from the implementation of this line of action.



**Figure:** Line of Action 3: Stimulating the circular economy roadmap. Source: CRPT (2020).

## Line of Action 3: Stimulating the circular economy

The city of Yakutsk has recently placed significant efforts to stimulate its local economy and already has a robust support system capacity both at a local and regional levels in SMEs advisory support, business incubating and entrepreneurship stimulation. However, generally, these initiatives have not prioritised sustainability issues nor focused on circularity concepts. Initiatives with specific sustainability and circular objectives are few, with disperse information available on them.

The proposed line of action on stimulating the circular economy consists of six (6) interlinked actions following the governance roadmap. According to it, the **Circular Economy Network** corresponds to the need for the multi-stakeholder multi-sector approach essential to establish this new paradigm in the city, the **Scoping Study** provides information on the possibilities and contribute to open data generation and decision making, the **Circular Innovations Fab Lab** encourages the participation of citizens to sharing knowledge and creating solutions. The remaining 3 actions: **Matchmaking Platform & Online Marketplace**, to bring people together and create circular opportunities; **Sustainable Local Procurement Protocol**, to promote and support circular measures in all local government activities; and **Separate Waste Management**, to enhance community-level involvement in circularity. Together, these provide concrete mechanisms to support the process of transforming the city to circularity.

Find out more about the **City Resilience Global Programme**  
and **UN-Habitat's partnerships** with other cities at:

[www.unhabitat.org/urbanresilience](http://www.unhabitat.org/urbanresilience)

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## Recommendations of Actions for Resilience and Sustainability

### YAKUTSK

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This report details the findings, analysis, diagnosis, and commitment building, as well as the Recommendations of Actions for Resilience and Sustainability for the city of **Yakutsk**.