Integrating Climate Adaptation into Sustainable Urban Mobility Plans (SUMPs)

Guidelines for MobiliseYourCity geographies

2025

Mobilise Your City

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List of abbreviations

ADEME	Agence de l'Environnement et de la Maîtrise de l'Energie
AFD	Agence Française de Développement
BAU	Business as Usual
BRT	Bus Rapid Transit
CAPEX	Capital Expenditure
CBA	Cost Benefit Analysis
CCKP	Climate Change Knowledge Portal
C40	C40 Cities Climate Leadership Group
DG MOVE	European Commission's Directorate General for Mobility and Transport
EIB	European Investment Bank
GCF	Green Climate Fund
GFDRR	Global Facility for Disaster Reduction and Recovery
GEF	Global Environment Facility
GHG	Greenhouse Gas
GIS	Geographic Information Systems
GlobalABC	Global Alliance for Buildings and Construction
IPCC	Intergovernmental Panel on Climate Change
IFHV	Institute for International Law of Peace and Armed Conflict
NAP	National Adaptation Plan
NPV	Net present value
NUMP	National Urban Mobility Policy or Investment Programme
OECD	Organisation for Economic Co-operation and Development
OPEX	Operational Expenditures
SDGs	Sustainable Development Goals
SUMP	Sustainable Urban Mobility Plan
ToR	Terms of Reference
UNEP	United Nations Environment Programme
UNFCC	United Nations Framework Convention on Climate Change

1. Introduction

1.1. Objectives of the report

Urban areas, home to over 4.2 billion people, face increasing risks from climate change, including more frequent extreme events such as high temperatures and slow onset events like sea-level rise (Dodman, et al., 2022). These risks threaten critical urban infrastructure systems, including transport and mobility, which are essential for access to jobs, education, healthcare, and leisure activities and for reducing travel time, stress, pollution, and greenhouse gas emissions.

The Intergovernmental Panel on Climate Change (IPCC) defines adaptation as reducing climate risks and vulnerability primarily via adjustment of existing systems (IPCC, 2022). Effective climate adaptation in urban mobility is crucial to mitigate climate risks and ensure sustainable urban development. Hence, integrating climate adaptation systematically into urban mobility strategies and projects worldwide is essential.

A review of Sustainable Urban Mobility Plans (SUMPs) developed with MobiliseYourCity's support from 2016 to 2024 in the Global South showed that 4 out of 17 SUMPs considered climate adaptation. This gap may result from limited awareness, capacity, and tools related to adaptation in the urban mobility sector.

This **report integrates climate adaptation within urban mobility planning, referencing on the MobiliseYourCity guidelines for developing sustainable urban mobility plans (SUMPs) in the Global South**.

1.2. Climate Considerations in Sustainable Urban Mobility Plans (SUMPs)

A **Sustainable Urban Mobility Plan** (SUMP) is an initiative developed by the European Commission's Directorate-General for Mobility and Transport (DG MOVE) to help cities design sustainable mobility systems and achieve the Sustainable Development Goals (SDGs). Building on this framework, MobiliseYourCity has supported SUMPs in the Global South since 2016, engaging with 72 cities and 16 countries across Africa, Asia, and Latin America to create scalable mobility solutions. By December 2023, 32 SUMPs were either under development or in implementation, supported by technical and financial partnerships to improve urban mobility.

An analysis of climate change consideration in 17 SUMPs completed with the support of MobiliseYourCity was conducted as part of the present report. This analysis is summarized in the following table.

	Climate component considered in the SUMP				
No.	City	Climate risk diagnosis	Climate adaptation measures	GHG emissions diagnosis	Air quality diagnosis
1	Ahmedabad, India				
2	Ambato, Ecuador				
3	Antofagasta, Chile				
4	Arequipa, Peru				
5	Baixada Santista, Brazil				
6	Bouaké, Ivory Coast				
7	Dire Dawa, Ethiopia				
8	Douala, Cameroon				
9	Guadalajara, Mexico				
10	La Habana, Cuba				
11	Lviv, Ukraine				
12	Medan, Indonesia				
13	Poltava, Ukraine				
14	Santo Domingo, Dominican Republic				
15	Trujillo, Peru				
16	Yaoundé, Cameroon				
17	Zhytomyr, Ukraine				
	TOTAL	4/17	1/17	4/17	5/17

Table 1 Analysis of MobiliseYourCity SUMPs
Source: own elaboration

The analysis of the SUMPs supported by MobiliseYourCity reveals that:

- SUMPs aim to design sustainable mobility systems that should reduce GHG emissions and air quality. However, most of the SUMPs analysed lack quantitative measures of GHG emissions and air quality due to low available information. Improving these measurements is an opportunity to implement more effective mitigation measures.
- Four SUMPs (less than 25%) assessed climate risks. Among, those SUMPS, none accordingly proposed adaptation measures
- The SUMP of Ambato included climate adaptation measures that were not formulated based on a specific climate risk diagnosis. This increases the risk of ineffective climate adaptation measures.

To complement the SUMPs, the MobiliseYourCity Partnership also promotes **National Urban Mobility Policy or Investment Programmes (NUMPs)**, which are strategic frameworks national governments develop to enhance cities' ability to plan, finance, and implement sustainable mobility projects. MobiliseYourCity has supported the development of NUMPs in six countries: Cameroon, Chile, Colombia, Ecuador, the Philippines, and Tunisia. These NUMPs were analysed for their inclusion of climate change adaptation diagnostics and recommendations.

- NUMPs from Cameroon, Chile, and Colombia include GHG emissions diagnostics and are aligned with national climate commitments.
- Ecuador's NUMP assesses GHG emissions and air quality and proposes adaptation measures.
- NUMPs from the Philippines and Tunisia have no mention of GHG emissions.

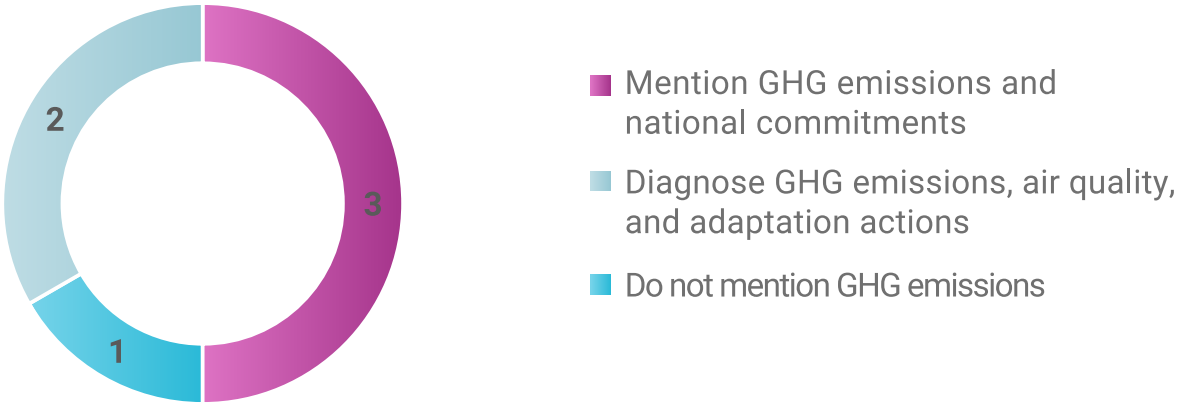

Figure 1 Analysis of MobiliseYourCity NUMPs
Source: own elaboration

This analysis underscores the current lack of climate adaptation in urban mobility planning. This is concerning as integrating climate change adaptation into mobility planning is crucial for two main reasons:

1. **Reducing impacts on infrastructures and people:** Neglecting adaptation in urban mobility planning heightens infrastructure vulnerability and increases population exposure to climate impacts. For instance, Dar es Salaam (Tanzania) launched a new Bus Rapid Transit (BRT) system in 2016 to promote sustainable mobility. However, inadequate infrastructure and operator preparedness for floods resulted in significant material losses. The flooding of the Jangwani bus depot and surrounding roads led to the damage of 79 buses, contributing to the operator's financial difficulties (Shauri & Mimano, 2022; The Citizen, 2021).
2. **Transport is a critical enabler of climate adaptation and disaster risk reduction:** Transportation is vital for emergency response, disaster mitigation, and the continuity of essential services such as healthcare and food supply. It also supports economic stability and post-disaster reconstruction. Since SUMPs aim to enhance service delivery, they must incorporate adaptation measures. For instance, ensuring redundancy and diverse transport options allows people to rely on the metro during extreme heat events when outdoor travel is challenging.

1.3. Climate change adaptation concepts and principles

1.3.1. Key concepts related to climate change adaptation

There is a broad consensus on the importance of considering the interaction between hazards, vulnerability, and exposure to determine the level of risks associated with climate change (Black & Pyatt, 2021). The figure below illustrates these interactions.

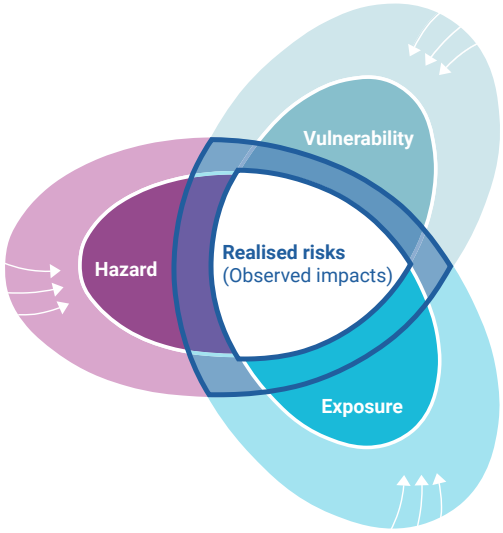

Figure 2 Climate risk assessment framework
Source: adapted from (O'Neill, et al., 2022)

Therefore, it is crucial to identify these elements within the urban context and understand how they impact urban mobility.

1.3.2. Hazard

The IPCC defines hazard as the potential occurrence of a natural or human-induced physical event, trend, or impact that may harm life, property, infrastructure, livelihoods, and ecosystems (IPCC, 2022) (C40 Cities, 2018). **In the context of climate adaptation, 'hazard' refers to climate-related physical trends and events and their physical impacts.**

The most common and relevant hazards for MobiliseYourCity geographies are presented below. Yet, specific local analyses are required to determine how climate change will impact these hazards.

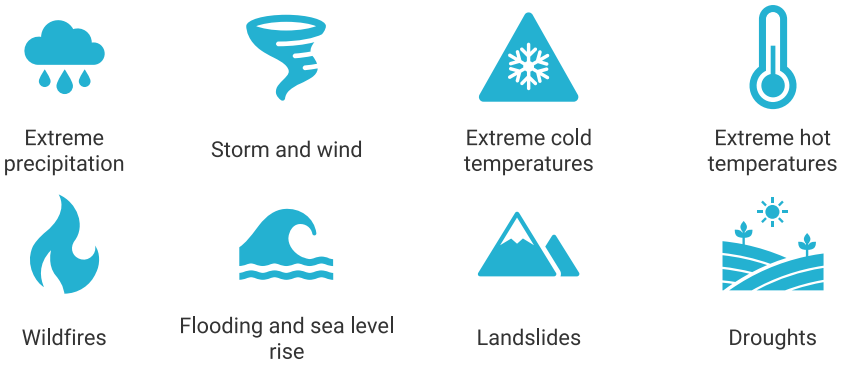

Figure 3 Types of climate hazards considered
Source: own elaboration

1.3.3. Exposure

Exposure is defined as the **"presence of people; livelihoods, ecosystems, services, resources; infrastructure; and economic, social, and cultural assets in locations that may be adversely affected"** (IPCC, 2022).

Analysing urban planning practices, land use changes, and master plans helps identify exposed areas and populations. Contributing factors to high-risk exposure include urbanisation patterns, land use and zoning policies, rural-to-urban migration, and limited land availability. Exposure assessment involves locating physical assets within urban systems, such as roads, water supply networks, canals, electricity grids, communication lines, and hospitals. Whenever possible, these assets should be geo-referenced to support risk evaluation and planning (Dickson, Baker, Hoornweg, & Tiwari, 2012).

1.3.4. Vulnerability

Vulnerability is defined as the **"propensity or predisposition to be adversely affected" and encompasses a variety of concepts and elements, including sensitivity or susceptibility to harm and lack of capacity to cope and adapt** (IPCC, 2022). It depends on socio-economic conditions, physical infrastructure, access to services, and current governance system (C40 Cities, 2018).

Regions with significant development challenges—such as West, Central, and East Africa, South Asia, Central and South America, Small Island Developing States, and the Arctic — face heightened vulnerability due to poverty, weak governance, limited access to resources, and low-quality infrastructure with low maintenance (Bündnis Entwicklung Hilft & IFHV, 2023). Consequently, between 2010 and 2020, mortality from floods, droughts, and storms was 15 times higher in highly vulnerable regions compared to those with very low vulnerability (IPCC, 2022).

1.3.5. Risk

Risk is defined as the potential for consequences when something of value is at stake, and arises from the interaction of vulnerability, exposure, and hazard (IPCC, 2022).

Reducing climate risks to infrastructure involves two key strategies:

1. **Locating assets in less exposed areas** (e.g., avoiding construction in floodplains, implement temporary constructions in vulnerable areas if required).
2. **Enhancing the resilience of assets** to withstand and respond to climate impacts.

Infrastructure planning must account for indirect effects, such as increased flood risks from impermeable surfaces. While climate-resilient infrastructure reduces disruptions, it cannot eliminate them. Managing risk requires balancing reduction efforts with costs, particularly for high-impact events (UNEP, 2024). **Resilience means assessing and managing risks to maintain acceptable performance, ensuring systems can endure and recover from shocks using available information** (OECD, 2018).

1.3.6. Measuring and monitoring climate change risks

There is a growing interest in measuring climate change risk and vulnerability to gauge the risk's magnitude, enable local management, and highlight the urgency for action. Various indices and reports use methodologies that define climate risk as the interaction between hazards, exposure, and vulnerability, including the Territorial Climate Indicator Framework (OECD, 2023), the City Resilience Index (ARUP, 2024), and the World Risk Index (Bündnis Entwicklung Hilft & IFHV, 2023).

The latter is calculated by multiplying exposure and vulnerability. Exposure accounts for the frequency and intensity of natural events, while vulnerability encompasses susceptibility, lack of coping mechanisms, and adaptive capacities (i.e. ability to adjust to potential damage, take advantage of opportunities, or respond to consequences).

Figure 4 shows that countries with very high risk (WRI >10) are concentrated in North Africa, the Americas, East and Southeast Asia, and Oceania. However, when examining vulnerability and exposure separately, it becomes evident that many countries in Africa, Central and South America, and South and Southeast Asia have very high vulnerability levels (>20). Highly developed countries in Europe, North America, and Oceania show significantly lower vulnerability. These findings underscore the critical need to reduce vulnerability to natural events, particularly in the Global South, where heightened susceptibility and limited adaptive capacities exacerbate the risks associated with climate change.

	WRI	Exposure	Vulnerability	Susceptibility	Lack of Coping Capacities	Lack of Adaptive Capacities
Africa	**4.39**	**0.7**	**30.53**	**30.4**	**14.68**	**59.83**
Central Africa	4.52	0.86	51.44	34.66	58.41	59.29
East Africa	3.93	0.55	32.96	33.59	15.08	61.31
North Africa	10.12	3.91	32.88	17.59	48.09	46.12
South Africa	1.97	0.14	26.7	23.92	12.83	51.41
West Africa	2.99	0.44	28.61	31.19	13.48	62.46
The Americas	**9.67**	**4.29**	**20.23**	**21.14**	**11.29**	**45.75**
Caribbean	3.01	0.79	13.41	9.19	8.49	41.57
Central America	15.64	9.36	27.03	31.75	12.22	50.46
North America	20.82	32.74	13.48	10.73	6.78	34.01
South America	13.77	8.96	25.33	26.68	12.47	47.02
Asia	**4.97**	**1.6**	**21.88**	**14.75**	**12.6**	**44.39**
Central Asia	2.15	0.22	18.43	15.1	10.92	41.72
East Asia	12.75	9.96	11.79	14.11	11.54	23.43
South Asia	5.92	1.6	31.12	27.73	55.86	45.75
Southeast Asia	14.04	8.64	22.83	16.01	13.65	46.38
West Asia	3.86	1.02	18.62	12.63	16.37	41.34
Europe	**2.4**	**0.49**	**9.28**	**6.97**	**5.55**	**35.42**
Eastern Europe	1.87	0.21	14.05	8.4	8.67	39.7
Northern Europe	2.52	0.72	7.59	6.41	2.19	27.6
Southern Europe	2.88	0.59	11.89	8.23	7.29	35.7
Western Europe	1.15	0.17	7.75	5.6	3.21	28.91
Oceania	**4.07**	**1.23**	**14**	**9.77**	**10.96**	**39.27**
Australia / New Zealand	17.79	24.6	12.92	7.37	10.32	30.28
Melanesia	12.86	7.71	21.66	17.18	12.19	52.98
Micronesia	2.69	0.5	13.53	9.79	5.44	45.2
Polynesia	2.94	0.81	10.67	9.56	11.02	29.2
World	**4.13**	**1.05**	**20.23**	**14.97**	**11.88**	**45.94**

Figure 4 World Risk Index per group of countries
Source: (Bündnis Entwicklung Hilft & IFHV, 2023)

At infrastructural and operational levels, various methods have been proposed to model climate risks and impacts in transport and mobility networks (Sohouenou, Soto, Vignote, & Selouane, 2022). For example, the module on urban transport adaptation to climate change from GIZ's sourcebook on sustainable transport presents tools and methods for climate risk assessments (Black & Pyatt, 2021). Furthermore, Sohouenou et al. (2022) propose a framework to prioritise critical road segments for climate resilience investments, which was applied to the BRT and bus network project in Ouagadougou.

1.3.7. Principles for effective adaptation actions in urban mobility

This report considers the nine principles for effective adaptation actions, emphasising the interaction between urban mobility and the built environment proposed by ADEME, CODATU, MobiliseYourCity, and RESALLIENCE (2025). These principles guide urban transport planning processes and projects, fostering adaptation strategies across sectors (e.g., transport and housing) and at various levels (from buildings to neighbourhoods, cities, and countries). In practice, these principles can act as a checklist to ensure that climate adaptation is effectively incorporated into urban mobility schemes and projects.

Figure 5 The principles illustrated

Source: (ADEME, CODATU, MobiliseYourCity, & RESALLIENCE, 2025)

This report outlines the integration of climate adaptation into the SUMP cycle, guiding embedding adaptation principles throughout the SUMP formulation process. This approach ensures future SUMPs account for climate adaptation at all stages, minimising climate hazard impacts on infrastructure, citizens, and urban systems.

1.4. Integrating climate adaptation into the SUMP cycle

MobiliseYourCity's "Guidelines for the Development of Sustainable Urban Mobility Plans" provides Global South cities with a framework for SUMP development adapted to their geographies (Cleuet & Jehanno, 2023). Those guidelines form part of the SUMP toolkit, which includes additional topic guides referenced throughout this document. They aim to assist urban mobility practitioners and stakeholders in developing and implementing a SUMP. The planning process is divided into four phases, comprising 13 steps, each concluding with a deliverable to inform decision-makers and transition to the next phase. The figure below provides an overview of these steps and phases.

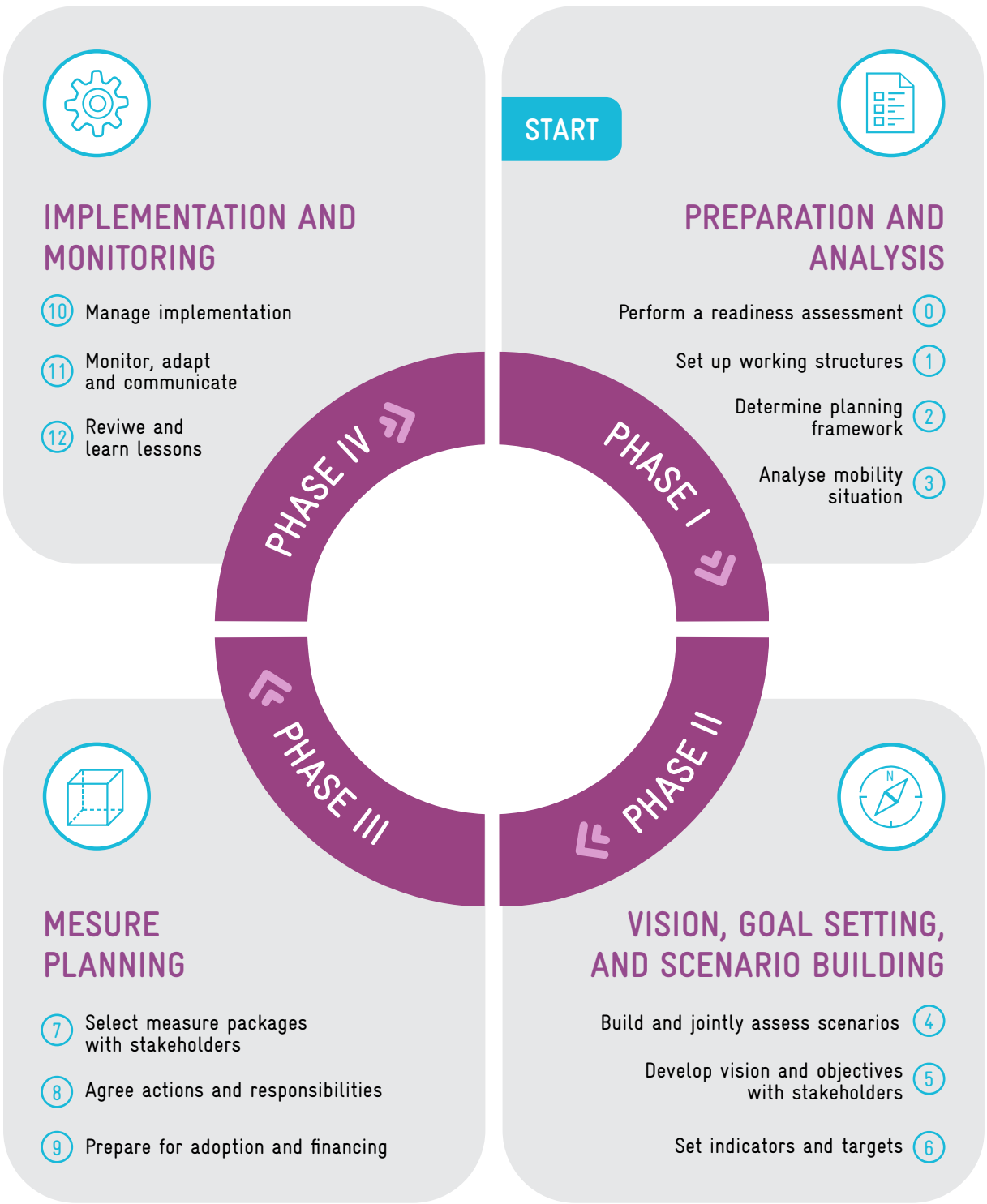

Figure 6 The SUMP Cycle – 4 Phases and 13 Steps
Source: (Cleuet & Jehanno, 2023)

A SUMP that includes climate adaptation systematically integrates climate risk considerations to enhance transport resilience based on the proposed principles (section 1.3.7). This includes assessing climate risks, identifying vulnerabilities in transport infrastructure, and implementing targeted adaptation measures. Key features of an adapted SUMP include:

- **Resilient infrastructure:** designing flood-resistant roads, heat-resilient transit systems, and nature-based solutions to mitigate climate impacts.
- **Redundancy and diversification:** ensuring multiple transport options to maintain mobility during extreme events.
- **Integrated planning:** aligning urban transport strategies with climate adaptation policies to build systemic resilience.

The table below outlines the integration of climate adaptation into the 13 steps of the SUMP Cycle proposed in the SUMP guidelines developed by MobiliseYourCity, from Step 0, "Perform a readiness assessment," to Step 12, "Review and learn lessons". Detailed guidance and examples for each step are provided in the following sections.

Phase	Step in the SUMP cycle	Climate adaptation actions to be considered	Most relevant climate adaptation principles
Phase I: Preparation and analysis	Step 0: Perform a readiness assessment	Evaluate the climate adaptation context by identifying current and future climate risks threatening the city and reviewing relevant climate adaptation policies and regulations.	Develop adaptation solutions informed by local vulnerabilities and capacities. Adopt adaptative governance considering future risks.
	Step 1: Set up working structures	The Terms of Reference for contracting the consultant, the participatory process, and communication should include climate risks and solutions.	Ensure participatory decision-making. Adopt adaptative governance considering future risks.
	Step 2: Determine the planning framework	Identify the climate framework, scenarios, horizons, and hazards relevant during the SUMP implementation period (15 to 20 years) and the lifespan of the SUMP actions (10 to 100 years).	Develop adaptation solutions informed by local vulnerabilities and capacities. Adopt a holistic approach considering other urban systems.
	Step 3: Analyse the mobility situation	Analyse climate change impacts on urban mobility in the targeted city considering primary and secondary information gathered for the SUMP formulation.	Develop adaptation solutions informed by local vulnerabilities and capacities. Consider other sustainable development goals.
Phase II: Vision, goal setting and scenario building	Step 4: Build and jointly assess scenarios	Consider climate change impacts and opportunities in the definition of mobility scenarios.	Build resilient infrastructures and operations. Support response and recovery activities via infrastructures and operations. Consider other sustainable development goals. Adopt a holistic approach considering other urban systems.

	Step 5: Develop vision and objectives with stakeholders	Explicitly mention climate adaptation of urban mobility in the SUMP vision and objectives, indicating the importance of adapting transport systems for the SUMP implementation.	Build resilient infrastructures and operations. Support response and recovery activities via infrastructures and operations. Raise climate risk awareness among decision-makers and the general public.
	Step 6: Set indicators and targets	Include output, outcome, impact adaptation indicators, and targets supporting the SUMP. The indicators shall be crosscutting to the SUMP measures.	Build resilient infrastructures and operations. Support response and recovery activities via infrastructures and operations.
Phase III: Measure planning	Step 7: Select measure packages with stakeholders	Include relevant climate adaptation measures in the measure packages.	Build resilient infrastructures and operations. Ensure participatory decision-making. Leverage multi-level cooperation and governance.
	Step 8: Agree on actions and responsibilities	Assess SUMP measures under adaptation scope. Consider climate adaptation funding opportunities for SUMP implementation.	Adopt adaptative governance considering future risks. Leverage multi-level cooperation and governance.
	Step 9: Prepare for adoption and financing	Ensure the final SUMP document holistically addresses climate adaptation within all its sections.	Raise climate risk awareness among decision-makers and the general public.
Phase IV: Implementation and planning	Step 10: Manage implementation	The approach to this step is similar to the SUMP guidelines.	
	Step 11: Monitor, adapt and communicate	Adapt climate adaptation targets and measures based on up-to-date knowledge of climate change impacts.	Adopt adaptative governance considering future risks. Raise climate risk awareness among decision-makers and the general public.
	Step 12: Review and learn lessons	The approach to this step is similar to the SUMP guidelines. Based on the review, the adaptation actions can be modified and updated.	Adopt adaptative governance considering future risks.

Table 2 Summary of climate adaptation actions and principles within the steps of the SUMP
Source: Own elaboration

2. Phase I: Preparation and analysis

2.1. Step 0: Perform a readiness assessment

MobiliseYourCity has developed a comprehensive checklist to assist local authorities, donors, and banks in identifying the key requirements for initiating a SUMP formulation (Gomez, 2024). That checklist includes climate change adaptation actions in the SUMP process, further reinforced by the following activities.

2.1.1. Evaluate local capacities

Stakeholder mapping for the SUMP should adopt a holistic approach, encompassing entities from urban systems related to adaptation and mobility. These include environment departments, climate change agencies or committees, disaster management units, representatives from civil society, the private sector, academia, and other relevant parties to ensure participatory decision-making. Local trusted intermediaries can support the identification of vulnerable communities. Each entity's role should be assessed as key, primary, or secondary stakeholders.

2.1.2. Evaluate local resources

This step involves identifying policies, regulations, and data relevant to climate change adaptation and its intersection with mobility. These documents provide critical input for developing adaptation strategies tailored to local vulnerabilities and capacities. The figure below lists the data required.

Input data	Policies and regulations
☐ Climate hazards (current and expected) including georeferenced information	☐ National Adaptation Plan (NAP)
☐ Impacts from previous events	☐ Local adaptation plan
☐ Expected changes on vulnerabilities that can accentuate impacts	☐ Sectorial adaptation plans
☐ Policies and regulations	☐ Emergency reduction, response and recovery plan
☐ Cascading effects analysis (emergency response, etc.)	☐ Additional policies and regulations on adaptation

Figure 7 Policies, regulations, and input data required
Source: own elaboration

2.2. Step 1: Set up working structures

2.2.1. Include climate change adaptation in the ToR

The Terms of Reference (ToR) for hiring the consultant in charge of the SUMP formulation should outline the data requirements. MobiliseYourCity Model Terms of Reference can be adapted to include secondary data needs for integrating adaptation into mobility planning (MobiliseYourCity, 2020). Additional primary data collection on climate change can be included within the consultant's scope according to the budget and data availability. Clear documentation of available information ensures participatory decision-making and the adoption of adaptive governance.

Data type	Description	Possible source
Policies	The National Adaptation Plan (NAP) seeks to identify and address medium- and long-term adaptation needs and be informed by the latest climate science and strategies.	Submitted NAPs from developing country Parties | NAP Central (contains the NAPs submitted to the UNFCC). Ministry of Environment, climate change department, among others.
	Local adaptation plans or policies developed by authorities to address climate adaptation needs.	Environmental authorities, city council, and civil society, among others. The city of Buenos Aires in Argentina has developed climate change adaptation plans, which can be consulted as an example.
	Sectorial or specific climate adaptation policies should be identified within this step of the SUMP formulation.	National and local government. The province of Victoria in Australia has developed a "Transport Climate Change Adaptation Action Plan 2022–2026" (The State of Victoria Department of Transport, 2022), which can be consulted as an example.
	Emergency reduction, response and recovery plan documents according to the risks assessed.	Local authorities in charge of emergency response.
Stakeholders	Identification and contact of stakeholders. Identification of climate change and adaptation documents and data that can be used for the SUMP formulation.	Stakeholders identified in step 0
Climate projections	Climate scenarios are proposed according to the IPCC's framework, local documents and local conditions.	NAP, local plans, and information on global databases. (IPCC, 2022) For example, the Sixth Assessment Report of the Intergovernmental Panel on Climate Change
Climate hazards	Current and expected climate hazards in the city include variations in rain patterns and other hazards over time.	Local adaptation plans and historical information on climate events, among others.
Climate risks and impacts	Urban climate change risk assessment presented. Ideally, it should be specific to the mobility sector, but a general analysis of the city can be used.	Local adaptation plans, impact on mobility infrastructure and public space. For example, ADEME has developed a guide to assess the impact of climate change in African cities. C40 has a climate change risk assessment guidance (C40 Cities, 2018) that provides methodologies and data requirements supplemented by a best practice checklist.
Cascading effects analysis	Analysis of cascading effects in the transport system from other syst Analysis of cascading effects in the transport system from other systems and vice versa (health, energy, food, etc.)	Local and national analysis from the sectors involved. Emergency response plans.

Table 3 Data collection to consider adaptation in the SUMP formulation
Source: Own elaboration

The consultant in charge of the SUMP formulation should include climate adaptation in the capacity-building proposal based on the city's assessment. It should link it with disaster risk management, response, and continuity of service. MobiliseYourCity's training materials can support this process. It includes the following modules:

- Introduction to climate change adaptation in urban mobility
- Principles to include adaptation into mobility planning
- Including adaptation in the SUMP process
- Adaptation actions for urban mobility

Training materials are an initial tool for capacity building, allowing consultants to propose additional training as needed. During the ToR preparation, mobility authorities or consultants should assess the availability of information. The ToR should specify available data provided by local authorities.

2.2.2. Include climate change adaptation on working structures

The MobiliseYourCity SUMP guidelines suggest three management levels for SUMP development. At each level, officials responsible for climate change adaptation should be involved.

1. The **steering committee** should include the head of the city's environmental department.
2. The **technical committee** should include the team responsible for implementing climate adaptation strategies and disaster risk reduction.
3. The **core team** should seek advice from the consultant and integrate adaptation considerations throughout the process.

Including adaptation officials, first respondents, and related entities within these structures promotes a holistic approach that accounts for interlinked urban systems. Stakeholders should participate in workshops, presentations, and capacity-building sessions tailored to their roles during the SUMP formulation. This inclusive approach ensures participatory decision-making that involves the most vulnerable citizens. Inclusivity can also help convey the importance of updating the framework as climate adaptation is a continuous process involving risk assessment, strategy development, implementation, monitoring, and reassessment of future climate risks and system resilience.

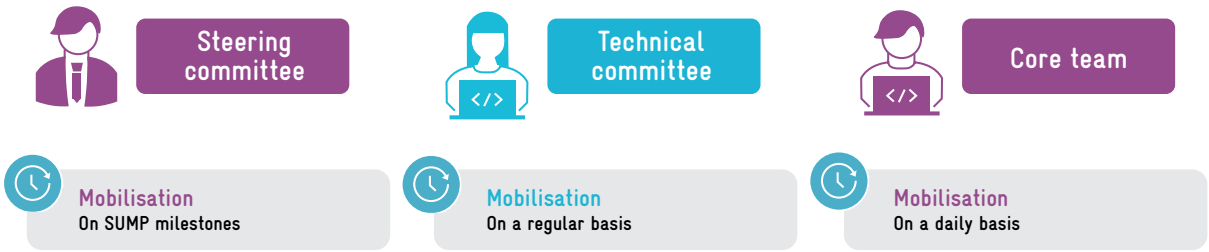

Figure 8 Management instances and mobilisation frequency during SUMP formulation
Source: own elaboration

2.2.3. Stakeholders and citizen engagement and communication

The SUMP formulation process encompasses stages that address the needs and visions of communities and stakeholders while integrating climate adaptation. The MobiliseYourCity topic guide on participatory processes in urban mobility planning provides further guidance on stakeholder engagement and collaboration. Moreover, mapping climate risks and exposure can help identify vulnerable communities and must be a priority in the SUMP formulation.

2.3. Step 2: Determine the planning framework

2.3.1. Planning requirements and geographic scope

Climate scenarios and adaptation actions must align with the implementation period and the lifespan of SUMP measures, typically 15-20 years for implementation and up to 100 years for infrastructure. This approach reflects the IPCC AR6 Climate Report timeframe, which considers projections up to 2100 (IPCC, 2022).

The perimeter of the SUMP must account for climate scenarios and adaptation measures, ensuring that the potential impact of climate hazards informs its definition. The geographic scope should consider the nature of the threat. For example, sea level rise could include the watershed level, operational landscape units, ridge-to-reef, or even clusters of neighbouring cities. Protecting one piece of infrastructure may have externalities affecting others nearby.

Adaptation measures should prioritise resilient infrastructure—such as flood-resistant roads, heat-resilient public transport, and nature-based solutions—and operational strategies like emergency mobility plans and redundancy in transport networks. These measures safeguard mobility and strengthen interconnected urban systems, including energy, water, and communication networks, enhancing overall city resilience. To ensure alignment with broader climate adaptation strategies, local authorities and consultants are thus responsible for defining the planning requirements and geographic scope.

2.3.2. Formalise the participation and capacity building of the technical committee all along the work plan

Participation in working structures should be formalised, particularly for climate adaptation, and may include:

- Involvement of the city's climate or environmental team in households' survey processes.
- Engagement of vulnerable communities through workshops and focus groups.
- Coordination between mobility teams and other urban systems to ensure integrated adaptation measures.
- Communication of climatic risks on urban mobility and collateral impacts on prosperity, economic development and lives to highlight the urgency for action.
- Develop indicators to measure infrastructure robustness, flexibility, and ability to support response and recovery activities.

Sessions on climate adaptation should be organised considering initial assessments and the consultant proposal.

2.4. Step 3: Analyse the mobility situation

2.4.1. Collect information and data

Data collection depends on the available resources, the city's size, and the required level of reliability. Two main data types are identified alongside the information needed to integrate adaptation. In most cases, secondary sources can provide this information, reducing the costs of SUMP formulation.

Quantitative data	Qualitative data
☐ Information about climate hazards, and scenarios	☐ Interviews
☐ GIS and GPS information about climate impacts	☐ Focus groups on climate change adaptation
☐ Population affected and expected costs	☐ Field observations on vulnerable communities

Figure 9 Data to consider climate adaptation on urban mobility planning
Source: own elaboration

The assessment of gathered information, including existing data and additional data collection, should consider criteria such as gender, minority inclusion, and resource availability. It should also incorporate demographic data tailored to the city's or region's characteristics. Furthermore, considering climate scenarios and their potential impacts on the city is essential for developing informed adaptation strategies and addressing future risks in the SUMP formulation.

If the collected data is insufficient, it is possible to draw on additional data proxies as listed below. These proxies can be used for cities lacking data, though the level of aggregation may exceed the geographic scope.

- The World Bank's Climate Change Knowledge Portal (CCKP) provides global data on historical and future climate trends, vulnerabilities, and impacts.
- ThinkHazard!, developed by the World Bank Global Facility for Disaster Reduction and Recovery (GFDRR), provides historic hazard level ratings for all countries and sub-national units.
- The geospatial indicator dashboard from the UrbanShift and Cities4Forests global initiatives helps cities visualise the connections between climate change and the urban environment through various sustainability metrics (WRI, 2023).

2.4.2. Analyse problems and opportunities

This step ensures that adaptation solutions are tailored to local vulnerabilities and capacities. The analysis should account for interconnected systems and cascading effects, such as emergency accessibility for first responders and the public. The table below outlines key questions and expected outputs for diagnosing urban mobility in the context of climate adaptation.

Field	Key questions	Basic outputs
Climate change	• What are the impacts of climate change on urban mobility? • How is the mobility of the most vulnerable communities affected by climatic events? • What is the robustness and flexibility of the mobility system? • What are the cascading effects between transportation and other systems?	• Maps showing infrastructure affected by climate hazards, categorised by type and mode, based on scenarios. Include cascading effects on other systems. • Identification of vulnerable communities and increased travel times due to climate hazards. • Analysis of infrastructure operational capacity during climate events and its potential for alternative uses.

Table 4 Key questions and output expected on climate change during mobility analysis.
Source: Own elaboration

Specific methodologies on climate risk assessment include:

- Climate change risk assessment guidance (C40 Cities, 2018) that provides an assessment methodology, and essential data requirements, supplemented by a best practice checklist for comparison. A Rapid Climate Change Risk Assessment (C40 Cities, 2021) can be done for cities that face data or capacity limitations, as demonstrated in Dar es Salaam, Tanzania (C40 Cities, 2022).
- The Framework for city climate risk assessment outlines a framework for assessing climate risks in cities, focusing on hazards, vulnerabilities, and adaptive capacities, with case studies from Buenos Aires, Delhi, Lagos, and New York City (Mehrotra, et al., 2009).
- The Climate Risk and Vulnerability Assessment training guide for cities provides a training guide for cities on conducting climate risk and vulnerability assessments to enhance climate resilience, with case studies from Quezon City, Surat, and Trondheim (CDP, 2022).

3. Phase II: Vision, goal setting and scenario building

3.1. Step 4: Build and jointly assess scenarios

3.1.1. Develop scenarios of potential futures

Assessing climate impacts on urban mobility infrastructure and services is the basis for constructing mobility scenarios. These scenarios must include forecasted climate hazards, associated uncertainties, and potential impacts on the city and its infrastructure. The scenario-building process must adhere to principles for adapting urban mobility to climate change (see section 1.4).

For instance:

- The **Business as Usual (BAU)** scenario assumes no adaptation actions in the mobility sector.
- Alternative mobility scenarios should evaluate:
  - Changes in CO2 emissions due to shifts in mobility patterns.
  - Required modifications to existing and planned infrastructure to address climate impacts.
  - Specific impacts on vulnerable communities and strategies to enhance their conditions, including indirect ones and those that are difficult to quantify economically.

3.1.2. Discuss scenarios with stakeholders

Once scenarios are proposed, stakeholders should review them in dedicated workshops to ensure alignment with climate considerations and define evaluation criteria for selecting the most appropriate scenario. Workshops will provide a platform to identify specific adaptation actions and integrate climate adaptation impacts as key decision-making criteria when selecting the most preferred scenario.

3.2. Step 5: Develop vision and objectives with stakeholders

3.2.1. Create a common vision and objectives

The vision defines a qualitative description of the city's desired future mobility, acting as a foundation for objectives, strategic indicators, targets, and measures throughout the SUMP process. The vision must incorporate potential climate change hazards and adaptation strategies within the mobility context. Planners must ensure the vision reflects local issues and population concerns while aligning with sustainability goals.

Objectives represent the ultimate aims of the SUMP, addressing social, environmental, or economic improvements. To integrate climate adaptation, objectives should:

- Align with principles for urban mobility adaptation, such as building resilient infrastructure, addressing the needs of vulnerable communities, and tailoring solutions to local contexts.
- Include a dedicated objective for climate change adaptation, where appropriate, and integrate it across other objectives.

3.3. Step 6: Set indicators and targets

3.3.1. Indicators and targets

Indicators must align with the SUMP objectives and be straightforward enough to engage a broad audience, following MobiliseYourCity guidelines. These indicators may be tailored to the characteristics of a city, enabling effective monitoring and evaluation of the SUMP's adaptation measures. Proposed indicators for adaptation include:

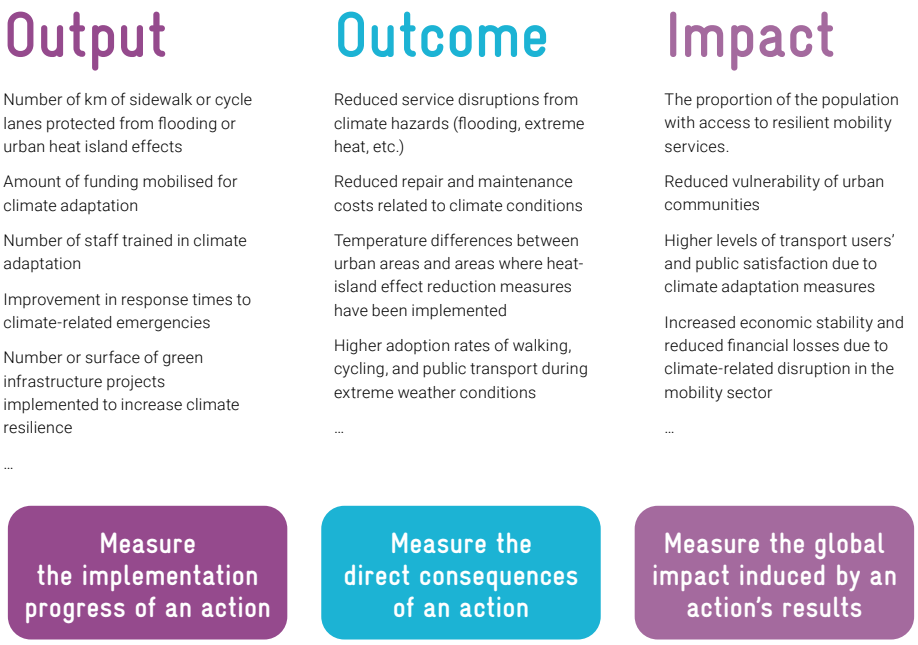

Figure 10 Output, outcome and impact indicators on climate change adaptation
Source: own elaboration

In its guide "Implementation of Climate Adaptation Indicators: Lessons Learned from the Transport Sector", the Environmental Protection Agency of Ireland outlines implementation indicators (output), outcomes, and impacts across roadways, light rail, and cross-cutting transport systems (2024).

SLOCAT proposes a set of resilience and adaptation indicators summarised below, acknowledging that consensus is lacking on which methodologies are most suitable for different situations. These indicators can be useful for local authorities and stakeholders when formulating the SUMP indicators.

Indicator	Description
Service continuity	Tracking cumulative delays from disruptions. For example, the UK's National Highways Authority monitors the difference between observed travel time and speed limit travel time, network availability, and incident clearance times. Travel duration and its monetary value are then used in cost-benefit analyses.
Risk assessments	Risk assessment quantifies the benefits of investing in resilience and the direct and indirect costs of not investing in it. It can help track the effectiveness of the implemented risk reduction and management measures over time.
Adherence to principles of resilience systems	Indicators of a 'proactively protected' system include the number of alternative routes or modes to deliver the same critical service and the extent of formalised emergency management mechanisms for critical infrastructure.
Life-cycle costs	Transport that is cheap to build but expensive to maintain may lack resilience, as maintenance can disrupt service. Investing more initially can increase design and construction costs but save on operational expenses, reducing overall life-cycle costs and enhancing resilience. Monitoring life-cycle costs is a proxy for resilience.
Standards uptake	The uptake of globally recognised standards for resilience and adaptation is a telling rubric for whether transport is moving in the right direction.
Finance allocated	Finance dedicated to resilience and adaptation of transport infrastructure continues to rise but is far short of what is required.
Post-disaster-evaluations	These evaluations assess the transport system's resilience to hazards and ability to maintain or quickly restore service. They identify vulnerabilities in infrastructure design, construction, maintenance, and emergency response or evacuation plans, highlighting dependencies and interdependencies with other systems.
Policy and regulatory changes	Enforcing regulations, construction codes, and procurement rules (e.g., NAPs). Highly exposed to natural hazards, Peru recently adopted a Framework Law on Climate Change and a national disaster risk management plan to foster a prevention culture and an integrated national disaster risk management system.
Triple bottom line	Quantifying co-benefits using triple-bottom-line approaches strengthens the business case of resilience and adaptation. Co-benefits include economic, environmental, and social gains, such as lower maintenance costs, reduced greenhouse gases, and improved accessibility. Demonstrating these benefits can attract funders and investors. San Francisco aimed to make its transport system more equitable and sustainable by using scenario planning and involving external stakeholders early to identify potential benefits (e.g., safety, economic vitality) and trade-offs (e.g., higher taxes, resource allocation).

Table 5 Resilience and adaptation indicators
Source: based on (SLOCAT, 2023)

Consultants are responsible for collaboratively developing these indicators with relevant stakeholders, who will oversee the plan's implementation and monitoring. The final version must incorporate technical input to ensure effective implementation.

4. Phase III: Measure planning

4.1. Step 7: Select measure packages with stakeholders

4.1.1. Define integrated measure packages

The **SUMP guidelines** outline six types of sustainable mobility measures.

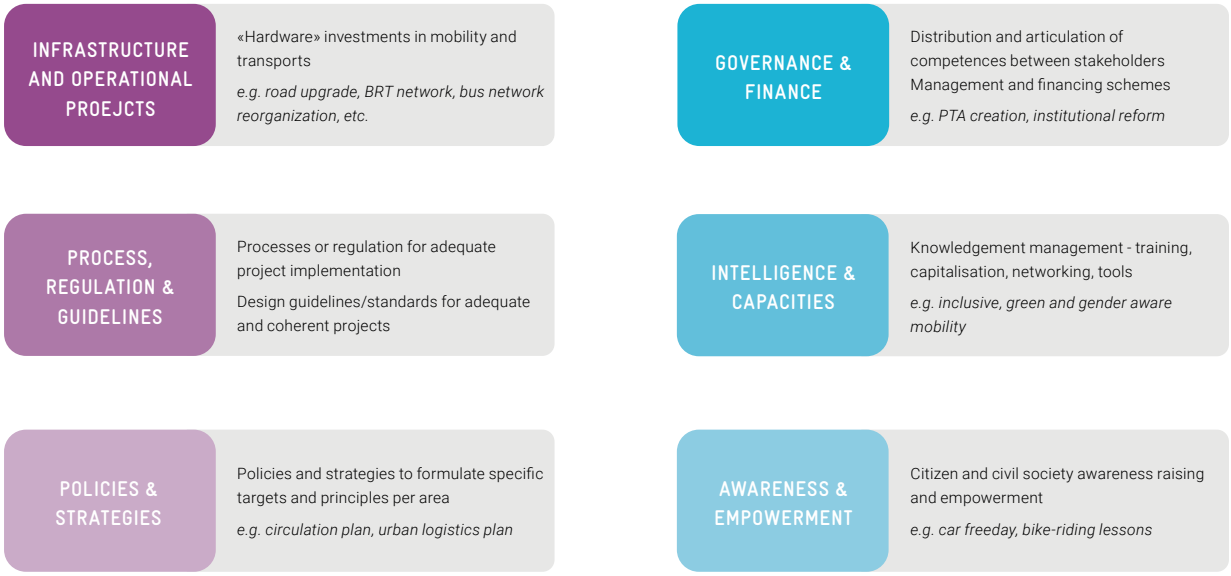

Figure 11 Types of sustainable mobility measures.
Source: MobiliseYourCity SUMP guidelines (Cleuet & Jehanno, 2023)

The following suggestions enhance each type of measure to incorporate climate adaptation. These actions align with the adaptation principles, ensuring their implementation strengthens urban resilience.

Infrastructure and operational projects

- Include climate change comprehensively according to the principles, case studies and actions proposed

Process, regulation & guidelines

- The guidelines and standards for projects must include climate change adaptation as a parameter for evaluation and investment

Policies & strategies

- Actions to respond to a climate event (before, during and after) should be included within policies and strategies such as the circulation plan, urban logistics plan or road safety plan

Governance & finance

- Possibility of creating a climate change committee for the mobility sector.
- Identification of funding and financing sources for climate adaptation actions.

Intelligence & capacities

- Develop city-level training programs to raise awareness of climate change adaptation in urban mobility

Awareness & empowerment

- Communicate the needs and actions to adapt urban mobility to climate change

Figure 12 Recommendations per type of sustainable mobility measures to adapt to climate change
Source: Own elaboration

Two categories of measures to include climate adaptation in the SUMP process are outlined below.

Components of other actions	Specific adaption actions
☐ Planning of new resilient infrastructure projects	☐ Adaptation plans
☐ Incorporation of adaptation into sections of mobility documents and guidelines	☐ Overhauling of infrastructure focused on adaptation
	☐ Awareness raising

Figure 13 Type of actions to include climate change adaptation into SUMP actions
Source: Own elaboration

4.1.2. Assess measures

The following elements must be considered in the economic appraisal of adaptations within the measures proposed:

Figure 14 Criteria evaluation adaptation measures
Source: own elaboration based on (World Bank, 2017)

The financial impacts of reactive responses and proactive adaptation should consider CAPEX, OPEX, revenues, and non-market benefits. Both costs and benefits must be assessed based on available information to calculate the NPV using the specified discount rate. The results should present a range of values across different climate scenarios, identifying this as an uncertainty source. Further assessments can evaluate the costs and benefits of incremental adaptation actions (EIB, 2022).

The "breakeven" value determines if the disruption's value justifies a proactive adaptation approach, providing insights for adaptation planning. It can be identified as the optimal balance between the costs of adaptation action and the costs of climate change impacts.

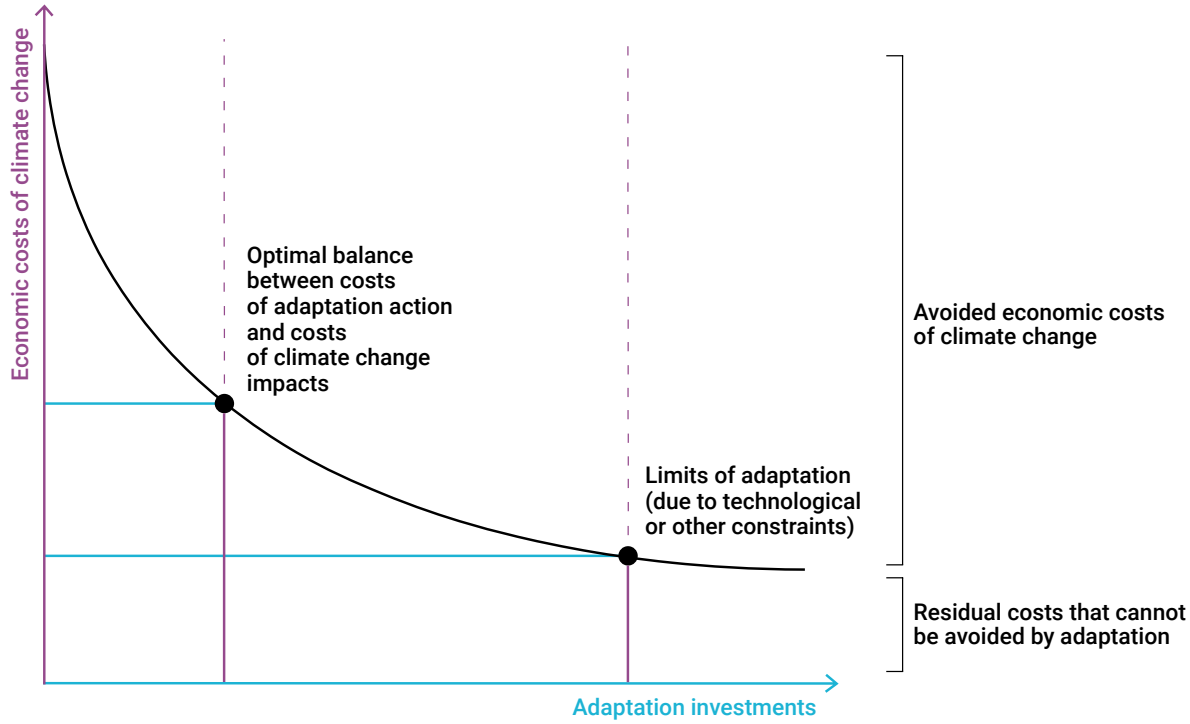

Figure 15 Link between adaptation investments and the economic costs of climate change
Source: (EEA, 2023)

This value will change across climate scenarios (World Bank, 2017):

- In harsher future climates (e.g., more flooding, frequent or intense precipitation), breakeven values will be lower, strengthening the case for adaptation measures.
- In milder climate change scenarios, adaptation is justified only if the value of avoided disruption time is high enough since fewer disruption days will be prevented.

Managing uncertainty in climate risk adaptation demands **robust decision frameworks, iterative learning, flexible adaptation pathways, and inclusive governance** to strengthen resilience in dynamic climate conditions. The **IPCC outlines economic methodologies, enabling mechanisms, and monitoring & evaluation frameworks** to support the implementation of adaptation measures and effectively navigate uncertainty arising from climate change (New, et al., 2022). Considering this uncertainty contributes to assessing and assigning financial resources more efficiently to No-regrets, Low-regrets and Win-win measures.

MobiliseYourCity SUMP guidelines propose a multi-criteria approach for assessing measures, which can be applied to climate adaptation measures.

- **Effectiveness:** Forecast the impact of proposed measures on reducing climate events' risk. Evaluating their effectiveness is critical for building resilient operations and fostering broader urban resilience.
- **Acceptability:** Assess the likelihood of community acceptance, particularly for unpopular adaptation measures. Develop communication strategies to reduce resistance and raise awareness about climate risk among decision-makers and the general public.
- **Value for Money:** Conduct financial and economic analyses, such as cost-benefit analysis (CBA), to ensure cost-effectiveness.
- **CAPEX:** Provide a raw capital expenditure estimate to determine feasibility within local budgets. Identify supplementary funding sources for adaptation projects, incorporating these into the SUMP's financial and implementation framework.

4.2. Step 8: Agree on actions and responsibilities

4.2.1. Consolidate and finalise the actions

The consultant shall estimate the anticipated costs associated with adaptation measures and the climate adaptation components of broader actions, including:

- **Capital Expenditure (CAPEX):** Infrastructure investments and physical adaptations.
- **Operational Expenditure (OPEX):** Costs for maintaining and running adaptation measures.
- **Consultancy and Administrative Costs:** Fees for expertise, project management, and support.
- **Capacity Building:** Training sessions, workshops, and stakeholder engagement activities.

Additional considerations include provisions for human resources to implement, supervise, and monitor the measures. The SUMP must reflect the incremental costs associated with staffing, personnel decisions, and budgeting. The table below sets the timeframes to consider per measure within the SUMP.

	Preparation	Short term	Mid term	Long term
CAPEX				
OPEX				
Consultancy				
Administrative personnel				
Provisions				
Human resources				

Table 6 Time frames and budgeting elements per type of action
Source: own elaboration

Further assessments of projects, including adaptation, are essential during the implementation phase of SUMP measures. Below are some example methodologies that can be adapted to local contexts:

- "Climate change adaptation and economics and investment decision making in the cities" developed by the European Investment Bank (EIB, 2022).
- Integrating climate change in infrastructure project appraisal: A proposed methodology for Ireland (OECD, 2023).
- Transportation Climate and Disaster Risk Screening Reference Guide (World Bank).

4.2.2. Develop a financial plan

Adaptation actions can be incorporated as:

1. **Standalone Measures:** Directly addressing climate adaptation.
2. **Components of Broader Actions:** Integrated into other urban mobility initiatives.

For both approaches, including estimated financial costs is crucial. This is especially relevant given the availability of funding sources specialising in adaptation, including grants, concessional loans, and other financial support mechanisms. The following figure illustrates funding and financing sources for urban mobility projects.

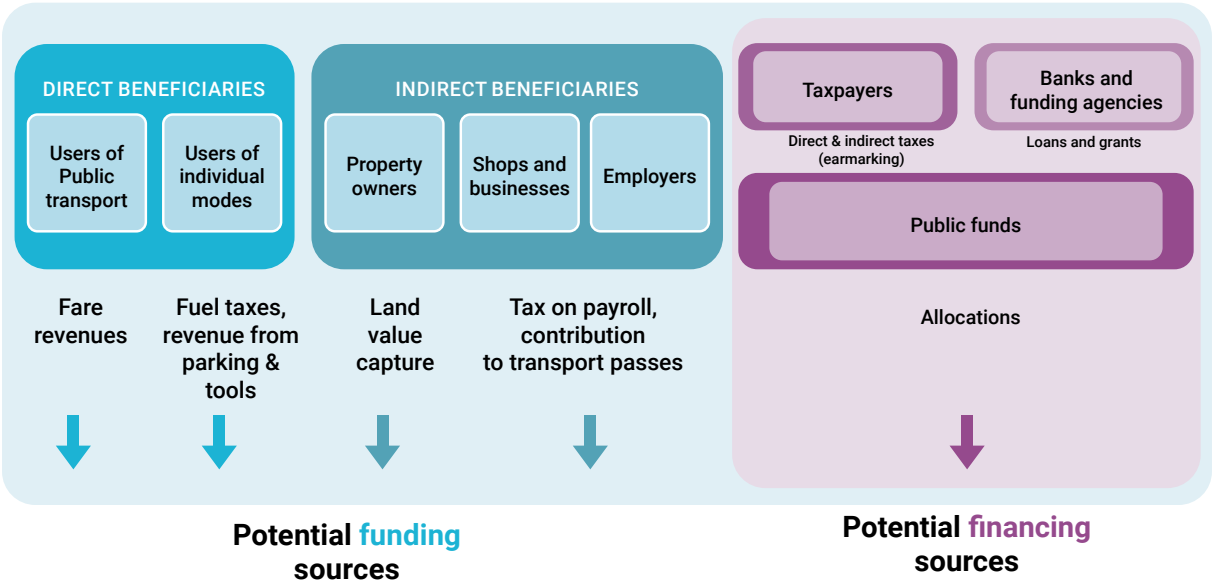

Figure 16 Funding and financing sources
Source: (AFD; ADEME; CODATU;, 2014)

The increasing importance of climate adaptation has led to the emergence of diverse funding sources in recent years. These include options for small-scale pilots, feasibility studies, and financing with favourable terms.
The financial plan should assess:

- Alignment of proposed actions with the city's current and projected financial resources.
- Fiscal viability of implementing these actions.

The figure below outlines potential funding and financing sources for urban mobility projects identified by MobiliseYourCity and its implementation partners.

Figure 17 Selected sources available for projects on climate change adaptation
Source: own elaboration

4.2.3. Plan measure monitoring and evaluation

To ensure effective monitoring and evaluation, each action defined in the SUMP should include SMART indicators:

Specific	Measurable	Achievable	Relevant	Time-bound
Clearly defined and unambiguous.	Use suitable proxy measures for consistent evaluation.	Controllable and not overly influenced by external factors.	The benefits of data collection justify costs relative to alternative solutions.	Responsive in the short term to policy changes or interventions.

Table 7. SMART indicators characteristics
Source: Own elaboration

The process for measuring indicators is summarised as follows:

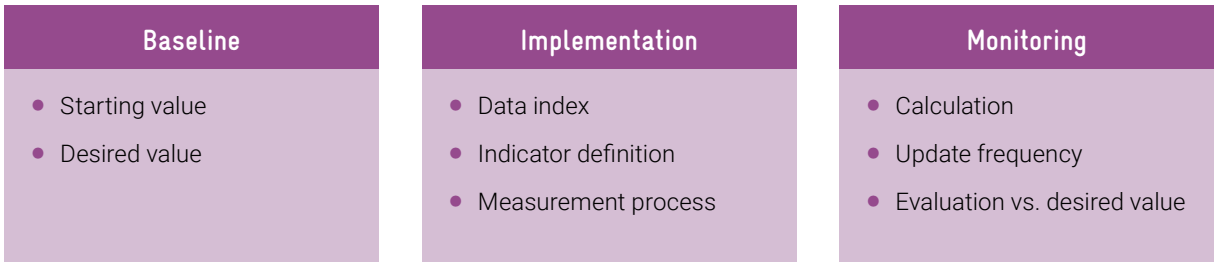

Figure 18 Measurement process of indicators
Source: own elaboration

The adaptation indicators will vary based on the measures adopted. Below are examples:

- **Infrastructure Improvements:**
  - Number of new drainage systems built considering climate scenarios.
  - Percentage increase in the capacity of drainage in existing infrastructure.
- **Environmental Changes:**
  - Reduction in temperature in areas due to increased vegetation coverage.

4.2.4. Agree on priorities, responsibilities, and timeline

Developing the financial plan is an **iterative process** that requires the agreement of priorities, responsibilities, and timelines. Key considerations include:

- All adaptation actions, whether standalone or integrated into mobility measures, must contribute to enhancing infrastructure and urban climate resilience.
- **Prioritisation** will be based on a detailed assessment of measures as outlined in the SUMP.

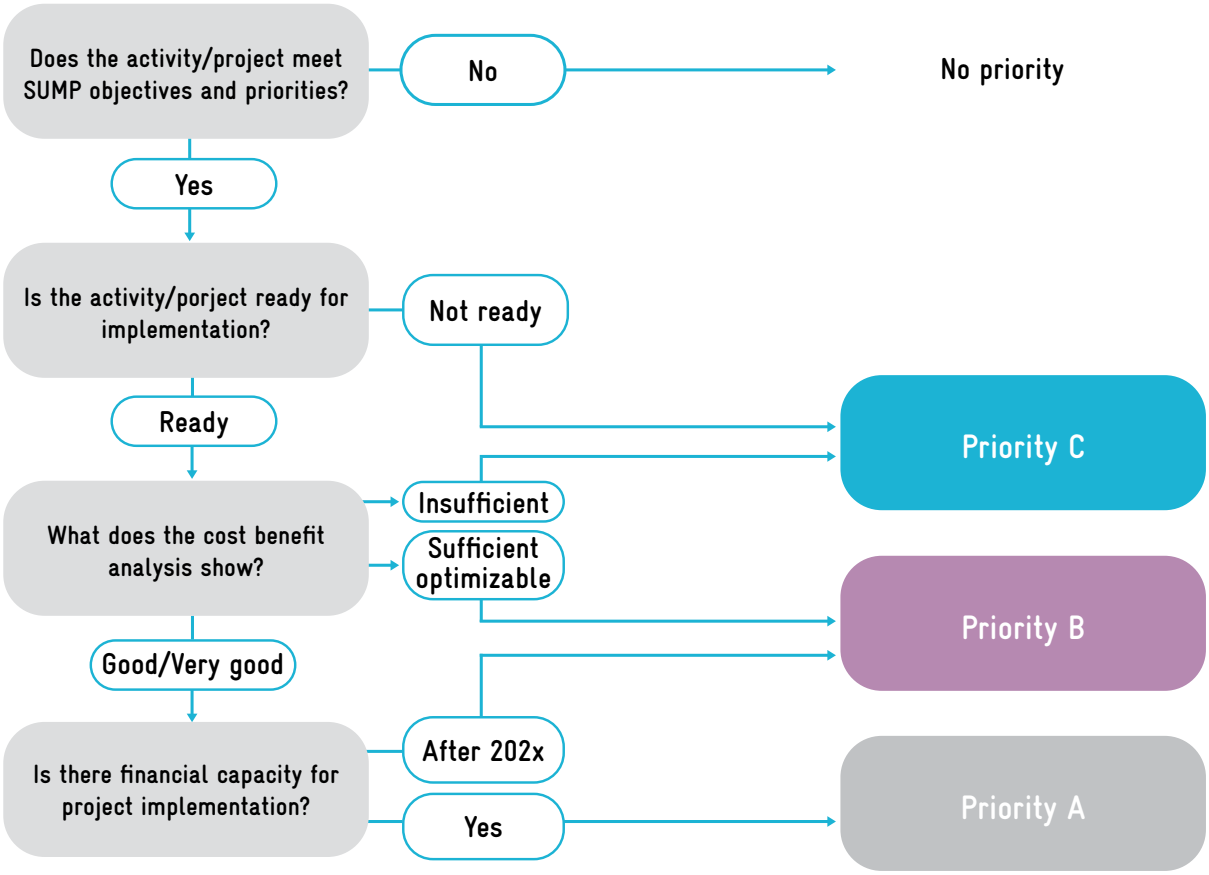

Figure 19 Priority assessment chart
Source: (MobiliseYourCity, 2023)

Measures prioritised within the SUMP must include climate adaptation components aligned with the needs assessment. This ensures that adaptation is integrated into the planning and decision-making process.

Regarding the **timelines**:

- Implementation timelines must be assessed in alignment with financial capacities.
- Detailed planning for measures should include specific actions for the initial and subsequent years of the SUMP.
- Adaptation measures must undergo regular reviews and updates during the scheduled general SUMP revisions every ten years.

4.3. Step 9: Prepare for adoption and financing

4.3.1. Assure the quality of the SUMP document and ensure political and public support

To incorporate climate change adaptation, the final SUMP documents must include:

- Mapping of environmental and climate change stakeholders.
- Institutional and regulatory aspects relevant to adaptation.
- Mapping of current and projected climate hazards and their impacts on infrastructure.
- Quantification of socio-economic impacts related to climate.
- SUMP indicators and targets that include adaptation.
- Adaptation-specific measures and those with adaptation components.
- Costs, descriptions, and financing of SUMP measures.
- A capacity development strategy covering adaptation topics.
- A monitoring and evaluation framework.

A comprehensive SUMP provides a robust technical foundation for sustainable mobility. However, its success depends on securing political and public support. This requires:

- Developing a holistic approach that integrates local contexts and community needs.
- Raising awareness of the consequences of inaction on climate risks.
- Effectively communicating the SUMP document and results to engage stakeholders and foster a commitment to mobility and adaptation actions.

5. Phase IV: Implementation and planning

5.1. Step 10: Manage implementation

5.1.1. Coordinate and plan implementation

The SUMP implementation team will work closely with the city's climate change adaptation team (e.g., committee or department) to:

- Ensure a holistic approach that integrates urban systems.
- Assess the need for additional personnel to support urban mobility adaptation during specific implementation phases.
- Develop operational factsheets detailing the requirements for procurement and additional studies, aligned with departmental roles.

5.1.2. Prepare procurement and ensure linkage with stakeholders

The procurement plan prepared by the city will cover:

- Technical assistance, consultancy, preparatory studies, and necessary purchases.
- Alignment with SUMP guidelines and adaptation methods. Communication with stakeholders is crucial to ensure successful implementation and support.

5.2.1. Step 11: Monitor, adapt and communicate

5.2.1. Monitor, adapt and communicate

Monitoring and evaluation will be conducted at two levels:

1. **SUMP Level:**
   - Focus on outcomes across short, mid, and long-term horizons.
   - Ensure alignment with specific climate change adaptation objectives.
2. **Action Level:**
   - Annual progress evaluations for both adaptation-specific and integrated actions.

Based on the evaluation results, the SUMP strategy may be revised to include adjustments to objectives and the frequency of interventions that address evolving climate risks.

Moreover, highlighting reductions in climate impacts compared to the Business As Usual scenario and monitoring results will help to increase public and stakeholder acceptance.

5.3. Step 12: Review and learn lessons

5.3.1. Review and learn lessons

This step will be implemented in alignment with SUMP guidelines:

- Conduct a thorough evaluation of the plan's successes and failures.
- Document strengths, weaknesses, and unmet objectives to guide future actions.
- Share lessons learned with SUMP management teams to improve subsequent SUMP processes.

6. The way forward

Integrating climate adaptation into SUMPs is vital in ensuring that urban areas are prepared for the challenges posed by climate change. This guide has provided a comprehensive roadmap for embedding climate resilience throughout the SUMP cycle. This section outlines strategic directions and actionable steps for advancing this agenda, emphasising the need for sustained efforts, innovation, and collaboration.

Decision-makers and practitioners must act decisively, leveraging the principles and methodologies outlined here to address these urgent challenges. To operationalise the integration of climate adaptation into SUMPs, cities should consider, among others, the following actions:

- **Capacity building:** Strengthen local technical expertise to assess climate risks and develop tailored adaptation strategies. Urban planners, policymakers, and technical staff training programs should be institutionalised.
- **Resource mobilisation:** Identify and secure funding from domestic budgets, international climate funds, and development agencies to finance climate adaptation initiatives within SUMPs.
- **Document and replicate successes:** Reflect on lessons learned and engage in global networks, such as MobiliseYourCity, to share experiences and access technical assistance.
- **Institutionalise climate adaptation:** Embed climate adaptation considerations into existing urban mobility policies, regulations, and institutional mandates.
- **Establish robust indicators:** Develop and track metrics that measure the effectiveness of adaptation actions within the SUMP implementation indicators.
- **Ensure transparency:** Publish progress reports and engage stakeholders in reviewing outcomes to build trust and accountability.
- **Continuous improvements:** Update plans continuously as climate adaptation is an ongoing process involving risk assessment, strategy development, implementation, monitoring, and reassessment of future climate risks and system resilience.

The path forward demands bold leadership, strategic planning, and unwavering commitment to integrating climate adaptation into urban mobility systems. By following the principles and guidelines outlined in this report, cities can build resilient, inclusive, and sustainable mobility systems that withstand climate and thrive in a changing world. Together, we can ensure that urban mobility is a cornerstone of climate-resilient urban development for future generations. For further information, the report Urban Mobility Adaptation Action presents specific examples and measures for adaptation that can be used as guidelines for cities to implement adaptation actions in the urban

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