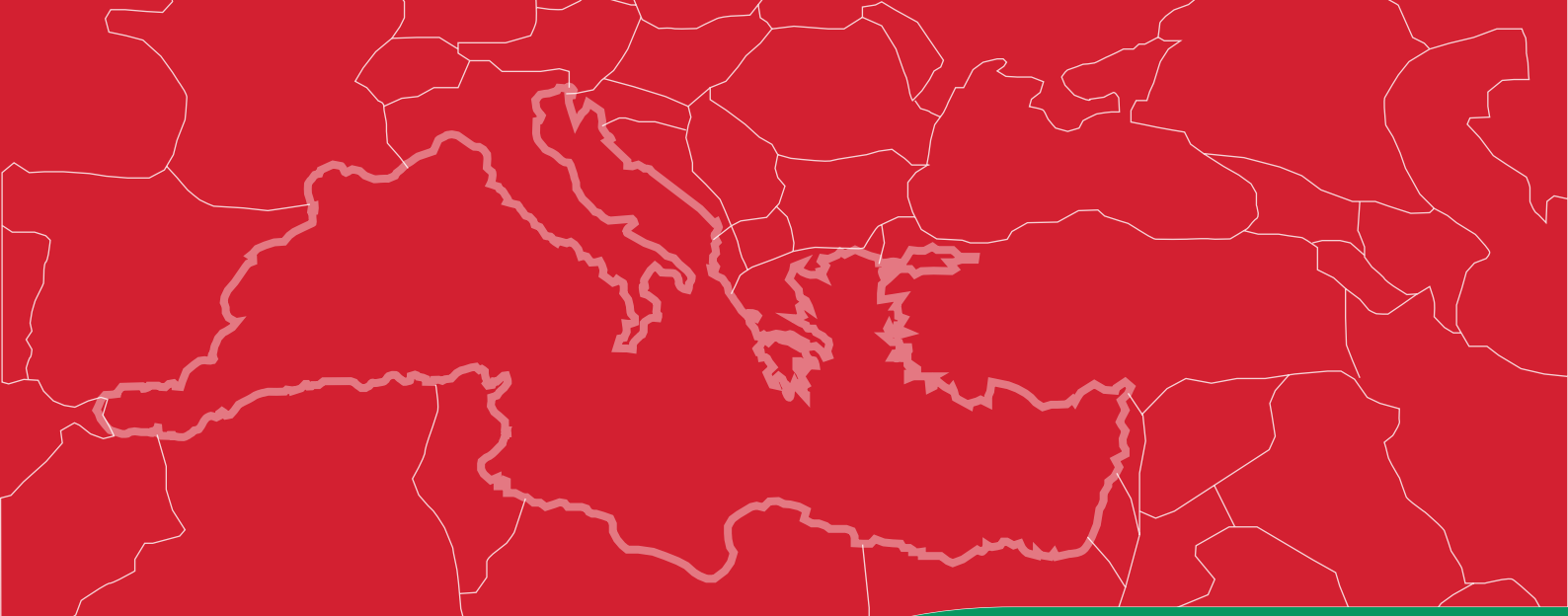

SCTool MED

Sustainable Cities Tool

Integrated tool and assessment methodology for sustainable Cities in MED Countries

Version : 2023-A

ENI CBCMED

Project Funded by the EUROPEAN UNION

Sustainable MED Cities

Sustainable MED Cities - Integrated Tools and Methodologies for Sustainable Mediterranean Cities, is a capitalization project whose main objective is to enhance the capacity of public administration in delivering, implementing and monitoring efficient measures, plans and strategies to improve the sustainability of cities, neighbourhoods and buildings.

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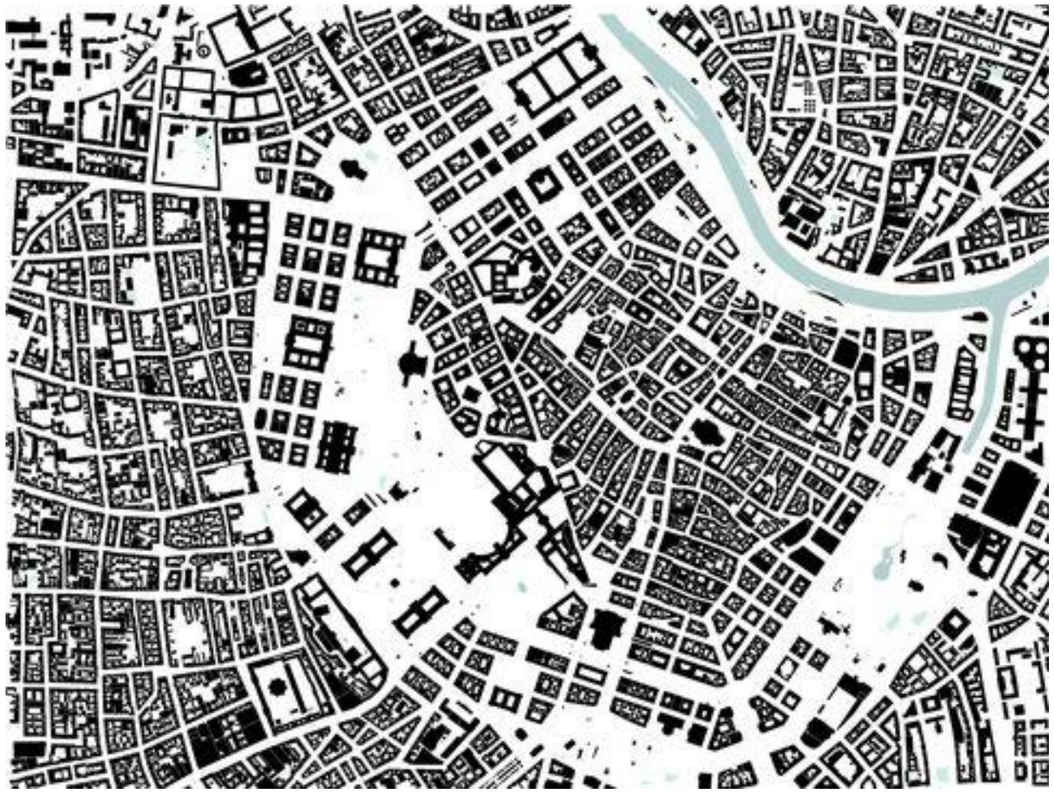


SCTool MED is an assessment system for measuring the sustainability of Mediterranean cities. It can be used by urban planners to support integrative planning processes and by public authorities to establish performance targets in policies, programs, and action plans. SCTool MED can be contextualized and adapted to any Mediterranean city. It is based on a transnational methodology, the SBE Method, developed through the international research process Green Building Challenge launched in 1998 and coordinated by iiSBE (international initiative for a Sustainable Built Environment). Over time, more than 25 national teams from all the continents contributed to the development of SBE Method and tested it the on hundreds of case studies. SBE Method is based on the "think globally, act locally" concept, acting as a common "language" for assessing the sustainability of the built environment. An assessment tool using the SBE Method, such as SCTool, can be adapted to any context reflecting local priorities and peculiarities. The use of SCTool MED allows to evaluate, compare, and aggregate the results of sustainability measures deployed locally and, at the same time, to evaluate the progress towards the global sustainability targets, avoiding the uncertainty and confusion generated using different assessment tools. Any public authority can develop its own SCTool MED that will provide sustainability assessment results comparable and aggregable with the results of any other local version of the tool. The project Sustainable MED Cities developed the first assessment tool at city scale based on SBMethod. SCTool MED has been used to improve the framework of sustainability indicators of the Istanbul Environment Friendly Cities Award promoted by UNEP/MAP. SCTool MED is applicable to the whole Mediterranean region, taking in account the specific issues of the North, South and East shores. This publication illustrates the SBE Method, how to contextualise SCTool MED to a specific city, and how to carry out a sustainability assessment using it. The use of the MED Passport and KPIs for comparing the sustainability of Mediterranean cities is also explained. SCTool MED is freely available to any municipality in the Mediterranean willing to develop its own sustainability assessment tool at city scale. The use of SCTool MED contributes to the achievement of the objectives of the Mediterranean Strategy for Sustainable Development.

Andrea Moro

WP3 Coordinator
iiSBE Italia R&D

1. SBE Method

Sustainable Built Environment Method

Definition:

SBE Method is a multi-criteria analysis method for assessing the sustainability of the built environment.

Starting from a set of assessment criteria, SBE Method provides a final concise score about a cities overall sustainability.

Main elements:

1. A set of assessment criteria.
2. A set of indicators, which allow to quantify the cities performances with respect to each criterion.
3. A normalisation method.
4. An aggregation method.

1.1 Hierarchic levels

The multicriteria analysis method is structured in four hierarchic levels:

1. Issues
2. Categories
3. Criteria
4. Indicators

Issues

1

Describe general themes, recognised as relevant for assessing the sustainability of a city . For instance, the issues of SCTool are:

- A - Use of land and biodiversity
- B - Energy
- C - Water
- D - Solid Waste
- E Environmental quality
- F - Transportation and mobility
- G - Social Aspects
- H - Economy
- I - Climate Change: mitigation and adaptation
- J - Governance

Categories

2

Concern particular aspects of issues. For instance, in the SCTool, the issue A-Use of land and biodiversity contains 3 categories: A1-Use of land, A2- Green urban areas and A3- Biodiversity and ecosystems.

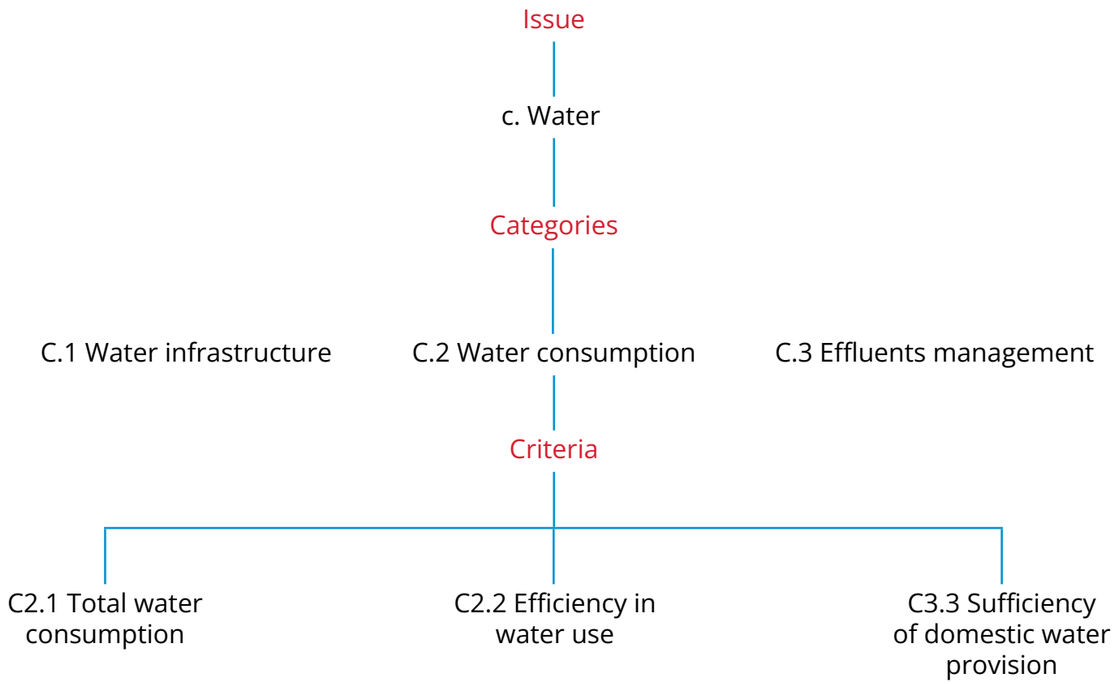
- A.1 Use of land
- A.2 Green urban areas
- A.3 Biodiversity and ecosystems
- B.1 Energy infrastructure
- B.2 Energy consumptions
- B.3 Renewable energy
- C.1 Water infrastructure
- C.2 Water consumption
- C.3 Effluents management
- D.1 Solid waste collection infrastructure
- D.2 Solid wate management
- E.1 Air quality
- E.2 Noise
- E.3 EMF expossure
- F.1 Performance of mobility service
- F.2 Green mobility
- F.3 Safety in mobility
- G.1 Performance of mobility services
- G.2 Housing
- G.3 Availability of public and private facilities and services
- G.4 Education
- G.5 Social inclusion
- G.6 Safety
- G.7 Helath
- G.8 Food security
- H.1 Economic Performance
- H.2 Employment
- H.3 Innovation
- H.4 ICT infrastructure
- I.1 Climate change mitigation
- I.2 Adaptation to the climate action: heat-waves and increase of temperature
- I.3 Adaptation to the climatic action: pluvial flood
- I.4 Adaptation to the climatic action:fluvial and coastal flood
- I.5 Adaptation to the climatic action: drought
- I.6 Adaptation to the climatic hazard: wildfire
- J.1 Urban planning
- J.2 Management and community involvement
- J.3 Public buildings cooperation
- J.4 Equity

Criteria

3

They represent the basic assessment entries used to evaluate the sustainability of the cities.

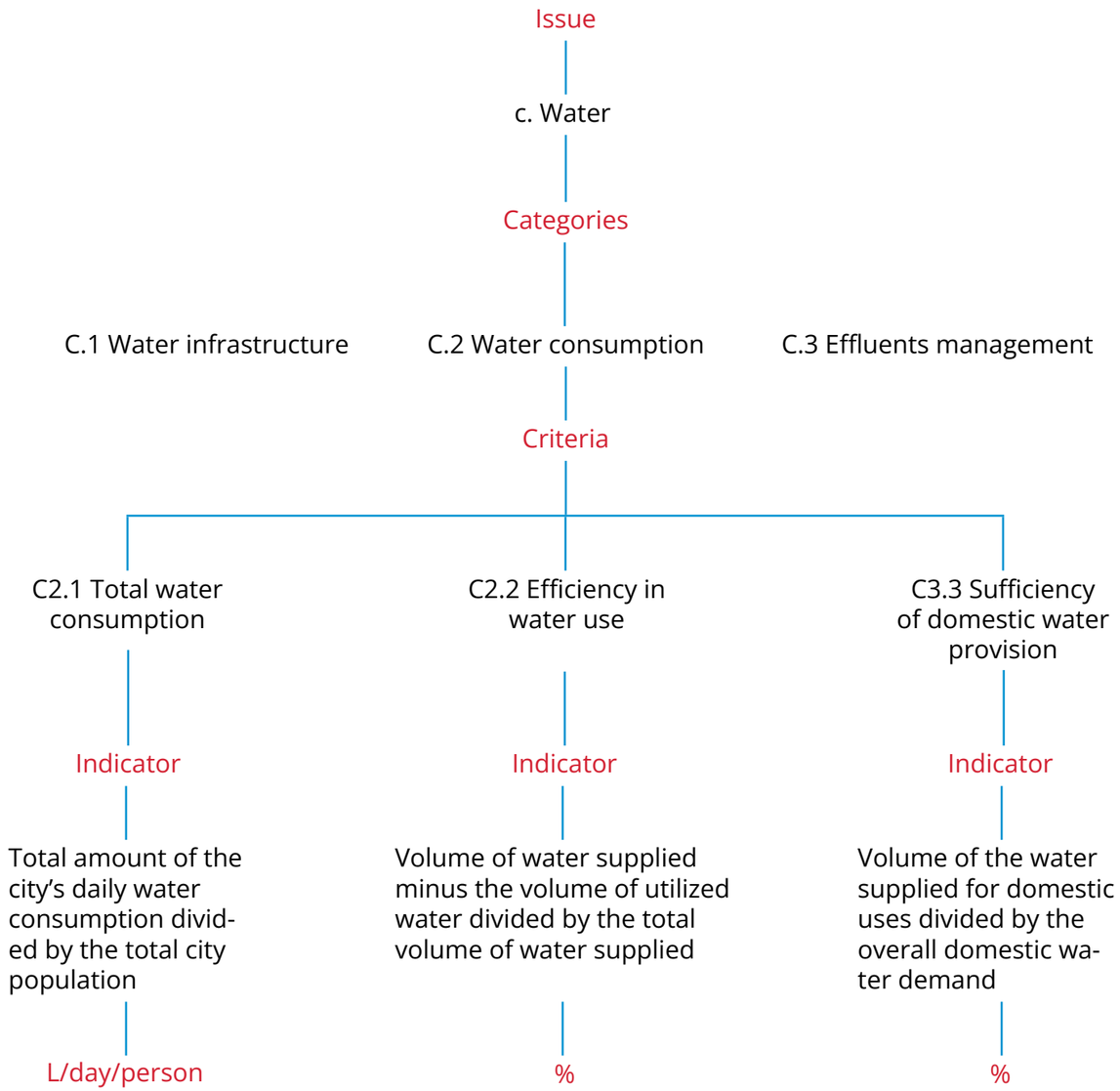
Example:



Indicators

Each criterion is associated to an indicator. They are physical quantities or qualitative scenarios that allow to assess the performance of the cities with respect to the criteria. Quantitative indicators have a unit of measure.

Example:



1.2 Assessment process

Definition and objective:

The main goal of the SBEMethod is to provide a final concise score, which summarises the overall performance of the cities with respect to all criteria.

The assessment procedure is articulated in 3 main steps:

1. Characterization

Calculation/evaluation of the indicators' value.

Input
Experimental data
Design data
Output
Indicators' values and selected escenarios

2. Normalisation

Assignment of a score to the indicators' value.

Input
Indicators' values and selected escenarios
Output
Normalized scores

3 Aggregation

Weighted sum of criteria's scores to calculate the score of categories, issues.

Input
Normalised scores
Output
Final concise score

Step 1: Characterisation

In the first stage of the assessment process, the values of all the quantitative indicators in SCTool are calculated.

For each criterion, SCTool provides the description of an “Assessment Method” that specifies the calculation procedure.

For the qualitative indicators, the performance of the city is assessed through the selection of a reference scenario.

Example:

Code	Criterion	Indicator	Unit of measure	Value
A3.1	Variation of the number of bird species	Percentage change in the number of bird species	%	55
B2.2	Residential final thermal energy consumption	Total consumption of final thermal energy divided by the total number of city inhabitants	MWh/ inhabitant/yr	195
C3.2	Household sanitation	Percentage of households with access to basic sanitation facilities	%	93
D1.1	Availability of solid waste collection	Percentage of population with regular solid waste collection	%	81
E1.2	Particulate matter (PM_{10}) concentration	Annual average fine particulate matter (PM_{10}) concentration	$\mu g/m^3$	230
F2.6	Green public vehicles	Total number of low emission public vehicles divided by total number of public vehicles	%	43
G1.3	Accessibility of public transport network	Percentage of public transport vehicles that are accessible disabled persons	%	66
H4.2	Wireless Broadband Coverage	Percentage of the city served by wireless broadband (3G, 4G, 5G)	%	23
I4.1	Flood risk	Percentage of population exposed to flood risk	%	17
J2.1	Involvement of residents in community affairs	Percentage of resident population above 16 years having an involvement in community affairs	%	57

Step 2: Normalisation

In the second stage of the assessment process, a performance score is associated to the value or scenario of each indicator. This process is named “normalisation”. The indicators are normalised in the interval (-1,+5), where -1 corresponds to a negative performance and +5 to an excellent performance. The better the performance, the higher the normalised score.
The values of quantitative indicators are normalised through linear functions of two kinds: H.I.B. (High Is Better) and L.I.B. (Low is Better). Qualitative indicators are normalised using discrete values corresponding to the reference scenarios.

For each indicator, the normalisation function depends on two parameters: the thresholds assigned to score 0 and 5. These parameters are named “benchmarks” and they define the value or scenario of the indicator associated to the “minimum acceptable performance” (score zero) and to the “excellent and ideal performance” (score five).

Scoring scale:

-1	The score corresponds to a value of the indicator that is under the minimum acceptable performance.
0	The score corresponds to a value of the indicator that represents the minimum acceptable performance. It is usually defined on the base of regulations and standards.
1	The score corresponds to a value of the indicator that represents a minimum increase of performance with regards to the minimum acceptable performance.
2	The score corresponds to a value of the indicator that represents a substantial increase of performance with to the minimum acceptable performance.
3	The score corresponds to a value of the indicator that represents a best practice.
4	The score corresponds to a value of the indicator that represents an improvement towards the best practice level.
5	The score corresponds to a value of the indicator that represents an excellent and ideal performance.

Normalisation H.I.B. Criteria (Higher Is Better)

All criteria such that the higher the numerical value of the corresponding indicator, the higher the performance level.

Since the normalised score must fulfil the requirement “the better the performance, the higher the normalized score”, normalisation functions associated with H.I.B. criteria must be increasing functions.

The normalised score is -1 if the value of the indicator is lower than the benchmark corresponding to score 0.

The normalised score is 5 if the value of the indicator is equal of higher than the benchmark corresponding to score 5.

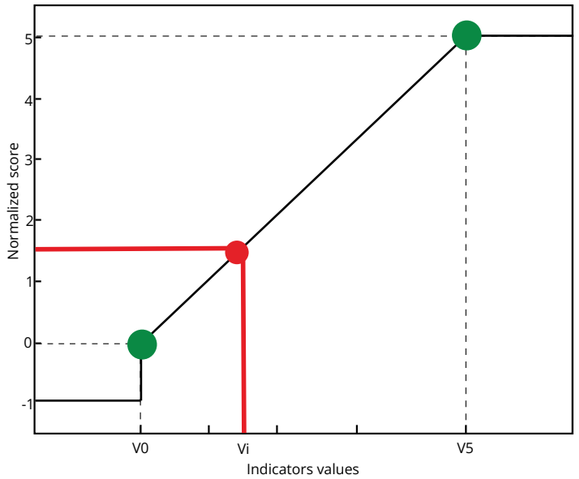
In the other cases, the value of the indicator is normalised through an interpolation.

Base representation:

V0 = value of the indicator for benchmark zero

V5 = value of the indicator for benchmark five

Vi = value of the indicator

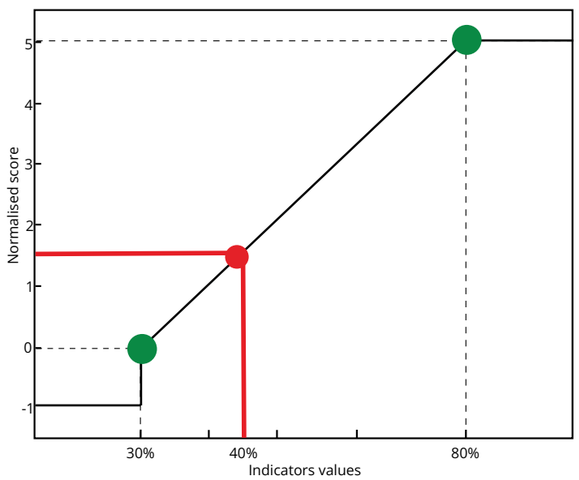


Example:

Criterion:
A3.1 - Variation of the number of bird species

Indicator:
Percentage change in the number of bird species.

Value of the indicator: 40%
Normalised score: 1,5



Normalisation L.I.B. Criteria (Lower Is Better)

All criteria such that the lower the numerical value of the corresponding indicator, the higher the performance level. Normalisation functions associated with L.I.B. criteria must be decreasing functions.

The normalised score is 5 if the value of the indicator is equal or lower than the benchmark corresponding to score 5.

The normalised score is -1 if the value of the indicator is higher than the benchmark corresponding to score 0.

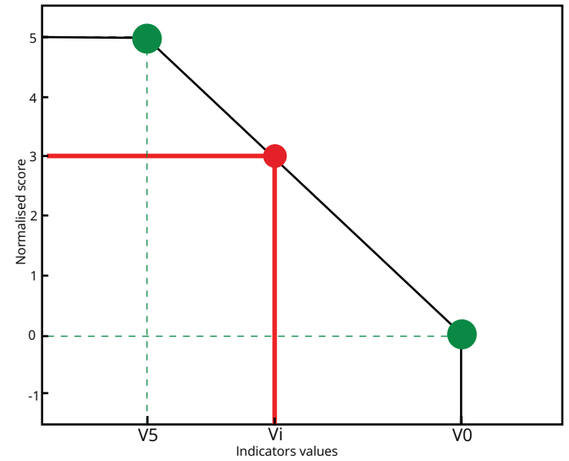
In the other cases, the value of the indicator is normalised through an interpolation.

Base representation:

V0 = value of the indicator for benchmark zero

V5 = value of the indicator for benchmark five

Vi = value of the indicator

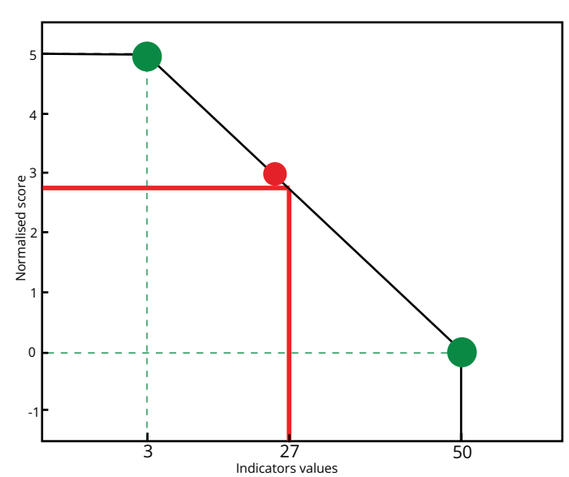


Example:

Criterion:
E1.2 - Particulate matter (PM_{10}) concentration

Indicator:
Annual average fine particulate matter (PM_{10}) concentration

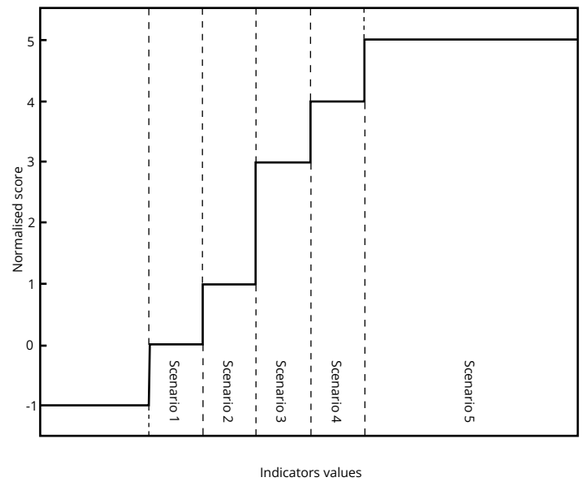
Value of the indicator: 27 µg/m^3
Normalised score: 2,7



Normalisation qualitative criteria

All criteria such that the normalised score can only attain discrete values in the normalisation interval, each of them corresponding to a reference scenario defined by the corresponding indicator.

The normalised score is computed by comparing the neighbourhood's performance with reference scenarios which are defined by the indicator associated with the criterion.

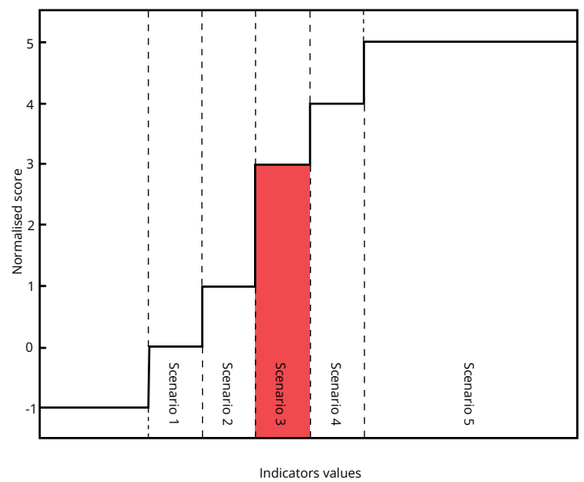


Example:

Criterion:

Community involvement in urban planning activities

Normalisation of the indicator's value: 3



Step 3: Aggregation

In the third step the normalised scores of criteria are aggregated to calculate the overall sustainability score of the city.

The aggregation takes place in 3 phases:

3.1 Aggregation through criteria: the scores of the criteria in the same category are aggregated to calculate the score of each category.

3.2 Aggregation though categories: the scores of the categories in the same issue are aggregated to calculate the score of each issue.

3.3 Aggregation through issues: the scores of the issues are aggregated to calculate the overall sustainability score of the city.

In what follows are used the symbols:

a. Xi the i-th issue. The issues in SCTool are 10, consequently i=1,10. NI is the number of the issues included in SNTool

b. $C_{i,j}$ the j-th category of the issue X_i, j=1, ……., $N_c^{(i)}$, where $N_c^{(i)}$ is the number of the categories in the i-th issue

c. $c_{i,j,k}$ is the k-th criterion of the j-th category in the i-th issue, k=1,…… $N_c^{(l,j)}$, where $N_c^{(l,j)}$ is the number of the criteria in the category $C_{i,j}$

Through criteria

The main goal of aggregation through criteria is to provide a single normalised score for each category. This is computed for each category aggregating the normalised score of all criteria included in that category.

Aggregation is performed by linear aggregation of scores through weights. These quantify the relative weight of each criterion in percentage with respect to all criteria in the same category.

$$S_{i,j} = \sum_{k=1}^{N_c^{(i,j)}} w_{i,j,k}\, Si,j,k$$

$\omega_{i,j,k}$: the weight of the criterion ci,j,k in the category $C_{i,j}$
$s_{i,j,k}$: the score of the criterion ci,j,k in the category $C_{i,j}$
$S_{i,j}$: the score of resulting from the aggregation of criteria's scores included in the category $C_{i,j}$.

Example

Calculation of the score for the SCTool category G2 **Housing:**

Code	Criteria	Score	Weight
G2.1	Affordability of housing property	3,1	24%
G2.2	Affordability of housing rental	2,2	34%
G2.3	Vacant residential units	1,3	16%
G2.4	Informal settlements	0,5	26%

Calculation of the category's score as weighted sum:

Code	Criteria	Score X Weight	Weighted Score
G2.1	Affordability of housing property	3,1*0,24	0,7
G2.2	Affordability of housing rental	2,2*0,34	0,8
G2.3	Vacant residential units	1,3*0,16	0,2
G2.4	Informal settlements	0,5*0,26	0,1
		Score of the category	1,8

Through categories

The scores of categories are aggregated to calculate the score of each issue (A,B,C,D,E,F,G,H,I,J). The calculation consists in a linear aggregation of the scores of the categories included in that issue.

$w_{i,j}$: the weight of each category included in issue Xi;
$S_{i,j}$: the score of each category included in issue Xi;
S_i: the score resulting from the aggregation of the categorie's scores included in issue Xi.

$$S_i = \sum_{j=1}^{N_c^{(i,)}} w_{i,j}\, Si,j$$

Example:

calculation of the score for the SCTool issue G **Social Aspects:**

Code	Category	Score	Weight
G1	Performance of mobility services	1,6	12%
G2	Housing	2,6	8%
G3	Availability of public and private facilities and services	2,2	20%
G4	Education	3,2	15%
G5	Social inclusion	2,3	12%
G6	Safety	1,5	5%
G7	Health	3,8	20%
G8	Food security	4,1	8%

Calculation of the issue's score as weighted sum:

Code	Category	Score X Weight	Weighted Score
G1	Performance of mobility services	1,6*0,12	0,19
G2	Housing	2,6*0,08	0,04
G3	Availability of public and private facilities and services	2,2*0,2	0,44
G4	Education	3,2*0,15	0,48
G5	Social inclusion	2,3*0,12	0,27
G6	Safety	1,5*0,05	0,07
G7	Health	3,8*0,2	0,76
G8	Food security	4,1*0,08	0,32
	Total score of the issue		2,57

Through issues

The scores of issues are aggregated to calculate the overall sustainability score of the city). The calculation consists in a linear aggregation of the scores of the issues include in SCTool.

W_i = the weight of each issue included in SCTool

S_i = the score of each issue included in SCTool

$$\sum = \sum_{i=1}^{N_A} w_{i,si}$$

Example:

Calculation of the first trhee issues overall score for a **City:**

Code	Issue	Score	Weight
A	Use of land and biodiversity	2,2	8%
B	Energy	1,9	13%
C	Water	2,3	10%

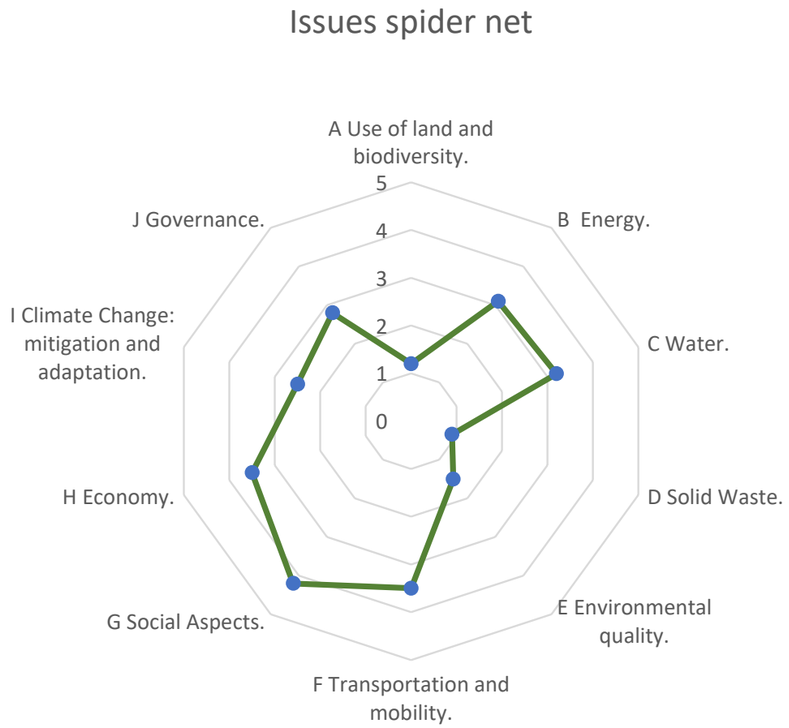
Calculation of the issues overall score as weighted sum:

Code	Issue	Score X Weight	Weighted Score
A	Use of land and biodiversity	2,2*0,08	0,2
B	Energy	1,9*1,3	0,2
C	Water	2,3*0,1	0,2
		Sustainability score	0,6

Assessment`s results

Spider chart:

Easy-to-read representation of the 10 issues score on a scale from 0 (minimum acceptable performance) to 5 (best performance).



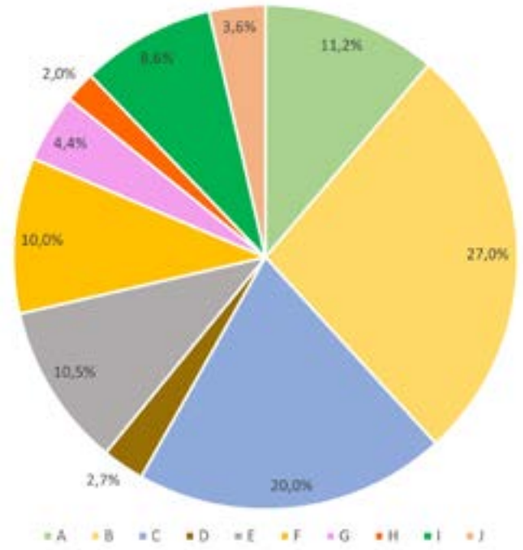
Number of active indicators:

Total number of indicators available in SCTool and number of indicators selected (including KPI- key performance indicators) in the assessment.

The number available criteria is:	99	The number active criteria is:	80

Pie chart:

Percentual contribution weight of each issue to the overall score.



Final score:

Detail of the scores and weights for the 10 issues and overall score.

Issue	Score	Weight	Weighted scores
A Use of land and biodiversity.	1,2	11,2%	0,13
B Energy	3,1	27,0%	0,83
C Water	3,2	20,0%	0,64
D Solid Waste.	0,9	2,7%	0,02
E Environmental quality.	1,5	10,5%	0,45
F Transportation and mobility.	3,5	10,0%	0,15
G Social Aspects.	4,2	4,4%	0,18
H Economy.	3,5	2,0%	0,07
I Climate Change: mitigation and adaptation.	2,5	8,6%	0,21
J Governance.	2,8	3,6%	0,10
		100% Total weight	2,78/5 Total score

Description of the KPIs:

Value of Key performance indicators.

Example:

KPIs City scale		Value	Unit of measure
A2.1	Availability of Green Urban Areas	40	%
B2.1	Final energy consumption	11	MWh/inhabitant/yr
B3.1	Final energy derived from renewable sources	50	%
C2.1	Total water consumption	100	L/day/person
D2.2	Solid waste recycling	70%	%
E1.2	Particulate matter (PM_{10}) concentration	22	$\mu g/m^3$
F1.1	Public transport network	40	km/1000 inhabitants
F2.4	Bicycle network	15	m/inhabitant
I1.1	Greenhouse gas emissions	5	t $CO_{2\ eq}$/ inhabitant/yr
I3.1	Permeability of land	22%	%

2. Contextualisation

Definition:

SCTool is a generic multicriteria sustainability assessment.

Users need to adapt it to local conditions.

The result of the contextualisation process is a local version of SCTool, ready to be used for assessing the sustainability at city scale.

Objectives:

Develop a contextualised version of SCTool to take in account local priorities, history, climatic conditions, socio-economic conditions, and advancement state in relation to sustainability issues.

The contextualisation process takes place in 3 steps:

1. Selection of criteria
2. Benchmarking
3. Weighting

2.1 Selection of the active criteria

Definition:

In the first step of the contextualisation process, users shall select the criteria that will compose the local version of SCTool. Criteria are selected from the whole list of the generic framework. There isn't a fixed number of criteria to be selected.

Only a core set of criteria, the Key Performance Indicators (KPIs) are mandatory for all. They represent the core criteria linked to the transnational global sustainability goals.

Objectives:

The rationale behind the selection could depend on regional policies, targets, specific characteristics of the territory (e.g. touristic area, agricultural area, etc.…). The selection of criteria can be documented and justified, using the following tables.

The selection of the active criteria can be documented and justified, using the following tables.

Generic table to report the criteria selection

Name of the issue

AX	Name of the category	Justification
AX.X	Name of the criterion	Text

Example selection of active criterias:

A. Use of land and biodiversity

A2	Green urban areas	Justification
A2.4	Distribution of Green Urban Areas	Green urban Areas is a policy priority

B. Energy

B2	Energy consumptions	Justification
B2.1	Final energy consumption	Achievement of the objectives set by the covenant of Mayors

D. Solid waste

D1	Solid waste collection infrastructure	Justification
D1.1	Availability of solid waste collection	Support to waste management policies; consistency with the regional waste management plan.

G. Social aspects

G3	Availability of public and private facilities and services	Justification
G3.1	Basic service proximity	Support to sustainable mobility policies consistency with the draft revision of the general regulation plan (P.R.G.) of the City

H. Economy

H1	Economic performance	Justification
H1.1	Average annual per-capita income of residents	Support to social and welfare policies

I. Climate change: mitigation and adaptation

I1	Greenhouse gas emissions	Justification
I1.1	Total amount of greenhouse gases (equivalent carbon dioxide units) generated from building operations over a calendar year per inhabitant	Achievement of the objectives set by the covenant of Mayors/ EU targets

2.2 Benchmarking

Definition:

Consists in the definition of the scoring scale for each selected criterion.

The value of benchmarks assigned to the different criteria for score zero (minimum acceptable performance) and for score 5 (excellent and ideal performance). The value of indicators corresponding to score zero is usually depends on regulations, standards or a typical performance in the region. Score 3 represents a best practice performance.

Objectives:

Set the benchmarks for each criteria following the priority order:

1. National, regional laws
2. National, regional, municipal regulations
3. Technical standards (national or international9
4. Statistical data
5. Scientific literature
6. Local reference values
7. Simulations

The selection of benchmarks can be documented and justified, using the following tables.

Generic table to report the benchmarks assignment

Name of the issue

Criteria	Indicator	Unit of measurment	Benchmark	Rationale	sources
AX.X	Text	Text	0 (min): number 5 (max): number	Text	Text

Example benchmarking

A. Use of land and biodiversity

Green urban areas	A2.4	Unit of measurment	Benchmark	Rationale
A2	Distribution of Green Urban Areas	%	0 (min): 30 5 (max): 50	Technical evaluation of municipal offices

B. Energy

Energy consumptions	B2.1	Unit of measurment	Benchmark	Rationale
B2	Final energy consumption	MWh/inhabitant/ yr	0 (min): 140 5 (max): 100	Technical evaluation

D. Solid waste

Solid waste collection infrastructure	D1.1	Unit of measurment	Benchmark	Rationale
D1	Availability of solid waste collection	%	0 (min): 75 5 (max): 98	Represents a minimum standard on average in the whole city (city center, peripherical areas, ...)

G. Social aspects

Availability of public and private facilities and services	G3.1	Unit of measurment	Benchmark	Rationale
G3	Basic service proximity	%	0 (min): 30 5 (max): 60	Technical evaluation

H. Economy

Economic performance	H1.1	Unit of measurment	Benchmark	Rationale
H1	Average annual per-capita income of residents	%	0 (min): 80 5 (max): 90	Based on technical report (Rapporto Rota)

I. Climate change: mitigation and adaptation

Greenhouse gas emissions	I1.1	Unit of measurment	Benchmark	Rationale
I1	Total amount of green-house gases (equivalent carbon dioxide units) generated from building operations over a calendar year per inhabitant	$kgCO_2$/ $1000m^2$	0 (min): 22,5 5 (max): 0	Technical evaluation

2.3 Weighting

Definition:

Consists in setting the weights at criterion, category and issue level through the assignment of priorities.

Priorites are set in relation to local policies and sustainability goals. The priority of criteria, categories and issues are context dependent.

The weighting process takes place in 3 steps:

1. Assignment of priority values to issues and weights calculation.

2. Assignment of priority values to categories and weights calculation.

3. Assignment of impact factors to criteria and weights calculation.

Weighting of issues

To set the weight s at issue level, it is necessary to define a priority factor for each of them.

The priority factor indicates the relevance of the issue in relation to the context.

A value of 1 means a low priority, a level 5 represents the higher priority.

When all the priority factors have been set, it is possible to calculate the weight of each issue as:

$$W_i = \frac{Pi}{\sum_{i=1}^{N} Pi} \times 100$$

Where:
wi = weight of the issue Ai
Pi = priority level of the Ai issue

Example:

Issue	Priority factor (1 to 5)	Formula	Weight
A.Use of land and biodiversity	3	W=(3/26)*100	11.6%
B.Energy	3	W=(3/26)*100	11.6%
D.Water	2	W=(2/26)*100	7,6%
D.Solid Waste	2	W=(2/26)*100	7,6%
E. Environmental quality	3	W=(3/26)*100	11.6%
F Transportation and mobility	4	W=(4/26)*100	15.3%
G.Social aspects	3	W=(3/26)*100	11.5%
H.Economy	1	W=(1/26)*100	3.8%
I.Climate change	3	W=(3/26)*100	11.6%
J Governance	2	W=(2/26)*100	7,6%
			100%

Weighting of categories:

To set the weight for category level, it is necessary to define a priority factor for each of them.

The priority factor indicates the relevance of the issue in relation to the context.

A value of 1 means a low priority, a level 5 represents the higher priority.

When all the priority factors have been set, it is possible to calculate the weight of each category as:

$$W_{i,j} = \frac{Lj}{\sum_{j=1}^{N_c^{(i)}} Lj} \times 100$$

Where:
Wi,j= weight of category Cj,k included in issue Ai
Lj = priority factor of category Cj,k included in issue

Example:

Category: Social aspects

Category	Priority factor(PF)	Formula	Weight
G1. Performance of mobility services	3	W=(3/30)*100	10%
G2. Housing	4	W=(4/30)*100	13,3%
G3. Availability of public and private facilities and services	2	W=(2/30)*100	6,6%
G4. Education	4	W=(4/30)*100	13,3%
G5. Social inclusion	4	W=(4/30)*100	13,3%
G6. Safety	5	W=(5/30)*100	16,6%
G7. Health	5	W=(5/30)*100	16,6%
G8. Food and security	3	W=(3/30)*100	10%
			100%

Weighting of criteria

To weight the criteria is necessary to assign an impact level to each assessment criterion.

The weighting of criteria takes place in 2 steps.
Firstly, users assign an impact level (Pk) to each criterion.
The impact level is defined as

Step 1: Calculated Pk
The impact level is defined as: $P_k = I_k * E_k * D_k * A_k$

I= Intensity of the potential Effect (1-3)
E= Extent of potential effect (1-5)
D= Duration of potential effect (1-5)
A= Adjustment factor in relation to local priorities (1-3)

Impact of the potential effect (Ik)

It can get from 1 to 3 points depending on the intensity of the extent of an effect. The impact is considered very relevant for all the energy criteria whose effect is very strong on the territory, but also economical and air quality criteria may have a big impact in that sense.

Impact of potential effect	
Minimum	1
Moderation	2
High	3

Extent of potential effect (Ek)

It can get from 1 to 5 points; this factor examines the extent of the effect of the criterion, for example, the road connectivity is an aspect that could strongly affect the larger scale in terms of extent and also the pollutant emissions whose effect is perceived on a large scale.

Extent of potential effect	
Block	1
Neighborhood	2
Cluster	3
Urban/Region	4
Global	5

Duration of potential effect (Dk)

It can get from 1 to 5 points; it measures the durability of the effect evaluated by the criterion. Land consumption criterion confirms that an urbanized soil will remain as it is over time, also other aspects related to the urban planning have a strongly duration impact like for example, green areas provision, street connections, pedestrian areas, etc.

Duration of potential effect	
1 - 3 years	1
3 - 10 Years	2
10- 30 Years	3
30- 75 years	4
>75 years	5

A = Adjustment factor in relation to local priorities (1-3) (Ak)

It can get from 1 to 3 points; it is a factor that can be used if there is the need to adjust the priority factor of the criterion in relation to specific local priorities. Maybe in a region a particular sustainability issue has a dramatic importance in relation to other issues. In this case the adjustment factor can be used to take in account the local context.

Step 2: the weight of each criterion in its category is calculated as:

$$W_{i,j} = \frac{Pk}{\sum_{k=1}^{N_c^{(i.j)}} Pk}$$

$\omega_{i,j,k}$: weight of the criterion $c_{i,j,k}$ included in the category $C_{i,j}$
P_k = impact level of the criterion $c_{i,j,k}$ included in the category Ci

Example step 1: Impact level assignment

F1. Performance of mobility services

Criterion	Impact (Pk)	Intensity (Ik)	Extent (Ek)	Duration (Dk)	Adjustment (Ak)
F1.1 Public transport network	12	2	3	2	1
F1.2 Accessibility of public transportation service	12	2	3	2	1
F1.3 Usage of public transportation by population	24	2	3	2	1

Example step 2: Weights assignment in the category F1

Criterion	Formula	Weight
F1.1 Public transport network	(12/48)*100	25%
F1.2 Accessibility of public transportation service	(12/48)*100	25%
F1.3 Usage of public transportation by population	(24/48)*100	50%
		100%

3.Sustainable Cities Tool

Defintion:

Complete list of the criteria which make up the Sustainable MED Cities SCTool are described below. The table also includes for each criterion, the information related to the name of the indicator and the unit of measure.

Main elements:

10 Issues
39 Categories
99 Criteria

SCTool criteria list

A Use of land and biodiversity

A1 Use of land

CODE	CRITERION	INDICATOR	UNIT
A1.1	Population density	Population density in built-up areas (city area minus green and blue)	Inhabitants per km²

A2 Green urban areas

CODE	CRITERION	INDICATOR	UNIT
A2.1	Availability of green urban areas	Total amount of Green Urban Areas in the city's boundaries divided by the total area of the city	%
A2.2	Green areas in relation to the city population	Total extension of green areas in the city divided by city's total population	m²/inhabitant
A2.3	Green Area Accessibility	Percentage of inhabitants with accessibility to green areas	%
A2.4	Distribution of Green Urban Areas	Total length of green area boundaries (edges) divided by the city's urban area	%
A2.5	Green zones and ecosystemic services	Share of natural green areas on total green areas	%

A3 Biodiversity and ecosystems

CODE	CRITERION	INDICATOR	UNIT
A3.1	Variation of the number of bird species	Share of natural areas that are connected	%
A3.2	Native biodiversity in built up area	This indicator is the number of bird species that is listed in the urban area (natural protected area excluded)	n
A3.3	Connectivity measures for natural areas	Amount of natural connected areas in the city divided by the total amount of natural areas in the city	%

B Energy

B1 Energy infrastructure

CODE	CRITERION	INDICATOR	UNIT
B1.1	Access to authorized electrical service	Number of people in the city with authorized electrical service divided by the total population of the city	%
B1.2	Electrical service interruptions	Total sum of hours of interruption multiplied by the number of households impacted divided by the total number of households	hrs/household

B2 Energy consumptions

CODE	CRITERION	INDICATOR	UNIT
B2.1	Final energy consumption	Total final energy consumed by a city divided by the total population of the city	MWh/inhabitant/yr
B2.2	Residential final thermal energy consumption	Total consumption of final thermal energy divided by the total number of city inhabitants	MWh/inhabitant/yr
B2.3	Public street lighting	Total electricity consumption of public street lighting divided by the total distance of streets where streetlights are present	kWh/km yr

B3 Renewable Energy

CODE	CRITERION	INDICATOR	UNIT
B3.1	Final energy derived from renewable sources	Share of renewable energies in final energy demand	%
B3.2	Renewable energy locally produced	Share of locally produced renewable energies of final energy demand	%

C Water

C1 Water infrastructure

CODE	CRITERION	INDICATOR	UNIT
C1.1	Availability of a public municipal water supply	Total number of people with potable water supply service divided by total city population	%
C1.2	Access to wastewater collection	Number of people within the city that are served by wastewater collection divided by the city population	%

C2 Water Consumption

CODE	CRITERION	INDICATOR	UNIT
C2.1	Total water consumption	Total amount of the city's daily water consumption divided by the total city population	L/day/person
C2.2	Efficiency in water use	Volume of water supplied minus the volume of utilized water divided by the total volume of water supplied	%
C2.3	Sufficiency of domestic water provision	Volume of the water supplied for domestic uses divided by the overall domestic water demand	%

C3 Effluents management

CODE	CRITERION	INDICATOR	UNIT
C3.1	Centralized wastewater treatment	Total volume of city wastewater collected for primary, secondary and tertiary treatment in centralized wastewater treatment facilities divided by the total volume of wastewater produced in the city	%
C3.2	Household sanitation	Percentage of households with access to basic sanitation facilities	%

D Solid Waste

D1 Solid waste collection infrastructure

CODE	CRITERION	INDICATOR	UNIT
D1.1	Availability of solid waste collection	Percentage of population with regular solid waste collection	%

D2 Solid waste management

CODE	CRITERION	INDICATOR	UNIT
D2.1	Solid waste generation	Total amount of solid waste generated divided by the total city population	tonnes/inhabitant/yr
D2.2	Solid waste recycling	Total amount of solid waste that is recycled divided by the total amount of solid waste produced in the city	%

E Environmental quality

E1 Air quality

CODE	CRITERION	INDICATOR	UNIT
E1.1	Fine particulate matter (PM2.5) concentration	Annual average fine particulate matter (PM2.5) concentration	µg/m³
E1.2	Particulate matter (PM10) concentration	Annual average fine particulate matter (PM10) concentration	µg/m³
E1.3	Nitrogen Dioxide concentration (NO2)	Sum of daily concentrations for the whole year divided by 365 days	µg/m³
E1.4	Sulfur Dioxide concentration (SO2)	Sum of daily concentrations for the whole year divided by 365 days	µg/m³
E1.5	Ozone concentration (O3)	Sum of daily concentrations for the whole year divided by 365 days	µg/m³

E2 Noise

CODE	CRITERION	INDICATOR	UNIT
E2.1	Noise pollution	Population exposed to noise pollution divided by the total population of the city	%

E3 EMF exposure

CODE	CRITERION	INDICATOR	UNIT
E3.1	Exposure to high frequency electro-magnetic fields	Percentage of mobile network antenna sites in compliance with EMF exposure guidelines	%
E3.2	Percentage of buildings exposed to ELF magnetic fields	Percentage of buildings in the area located not respecting the safety distance from high voltage lines	%

F Transportation and mobility

F1 Performance of mobility services

CODE	CRITERION	INDICATOR	UNIT
F1.1	Public transport network	Length of public transport system per 1000 population	km/1000 inhabitants
F1.2	Accessibility of public transportation service	Percentage of inhabitants that are within 500 meters walking distance of at public transportation service stop running at least every 20 minutes during peak periods	%
F1.3	Usage of public transportation by population	Total annual number of public transport trips originating in the city divided by the total city population	trips/inhabitant

F2 Green mobility

CODE	CRITERION	INDICATOR	UNIT
F2.1	Shared vehicles	Number of shared vehicles per 1.000 inhabitants	n/1.000 inhabitants
F2.2	Electric-vehicle infrastructure (charging stations)	Electric vehicle charging stations per inhabitant	n/inhabitant
F2.3	Low-Carbon Emission Passenger Vehicles	Percentage of low-carbon emission passenger vehicles	%
F2.4	Bicycle network	Total length of bicycle paths and lanes divided by the city's total population	m/inhabitant
F2.5	Shared bicycles	Number of shared bicycles per 1.000 inhabitants	n/1.000 inhabitants
F2.6	Green public vehicles	Total number of low emission public vehicles divided by total number of public vehicle	%

F3 Safety in mobility

CODE	CRITERION	INDICATOR	UNIT
F3.1	Pedestrian infrastructure	Total area of pedestrian streets and walkways divided by the total area of streets and roads in the city	%
F3.2	Availability of sidewalks	Percentage of roads' length that has dedicated sidewalks	%
F3.3	Safety of bicycle lines	Percentage of bicycle paths physically separated from traffic roads	%
F3.4	Traffic fatalities	Traffic fatalities per 1.000 inhabitants	n/1.000 inhabitants
F3.5	Private transportation services	Number of taxi licenses divided by 1000th of the city's population	n/1.000 inhabitants

G Social Aspects

G1 Performance of mobility services

CODE	CRITERION	INDICATOR	UNIT
G1.1	Accessibility of public buildings	Total number of public buildings accessible by disabled persons divided by the total number of public buildings	%
G1.2	Barrier-free accessibility in local outdoor public areas	Percentage of accessible public outdoor areas that are barrier-free compared to the total public area	%
G1.3	Accessibility of public transport network	Percentage of public transport vehicles that are accessible disabled persons	%

G2 Housing

CODE	CRITERION	INDICATOR	UNIT
G2.1	Affordability of housing property	Housing properties in the city that are financially accessible to the lowest quintile of area population	%
G2.2	Affordability of housing rental	Percentage of the average salary of the lowest quintile of the population used for rental payments	%
G2.3	Vacant residential units	Percentage of vacant residential units	%
G2.4	Informal settlements	Area of informal settlements within the city boundary divided by the city area	%

G3 Availability of public and private facilities and services

CODE	CRITERION	INDICATOR	UNIT
G3.1	Basic service proximity	Number of inhabitants who live near at least one basic service divided by the total population of the city	%
G3.2	Open space for public use	Average share of the built-up area of the city that is open space for public use	%
G3.3	Accessibility of shores/beaches	Total area of shores/beaches in the city area that are accessible by inhabitants divided by the total area of shores/beaches in the city's urban area	%

G4 Education

CODE	CRITERION	INDICATOR	UNIT
G4.1	Primary enrollment rate	Net primary enrollment rate	%
G4.2	Female school-aged population enrolled in schools	Number of city's female school-aged population enrolled at primary and secondary levels in public and private schools divided by the total number of a city's female school-aged population	%
G4.3	Secondary school enrollment	Lower secondary completion rate	%
G4.4	Tertiary education	Population age 25-34 with tertiary educational attainment	%

G5 Social inclusion

CODE	CRITERION	INDICATOR	UNIT
G5.1	Gender pay gap	Difference between average gross hourly earnings of male and female paid employees as a percentage of average gross hourly earnings of male paid employees	%
G5.2	Energy poverty of households	Percentage of households unable to afford the most basic levels of energy (more than 10% of the income spent on energy bills)	%
G5.3	Population living below poverty line	Number of people living below the national poverty line set at country level divided by the total current population of the city	%
G5.4	Inequality	Gini coefficient of inequality	n
G5.5	Voter participation	Percentage of the eligible population that voted during the last municipal election	%

G6 Safety

CODE	CRITERION	INDICATOR	UNIT
G6.1	Police service	Number of police officers per 1.000 inhabitants	n/1.000 inhabitants
G6.1	Fire service	Number of firefighters per 1.000 inhabitants	n/1.000 inhabitants
G6.1	Population living in disaster prone areas	Percentage of inhabitants living in a zone subject to natural hazards	%

G7 Health

CODE	CRITERION	INDICATOR	UNIT
G7.1	Life expectancy	Average number of years that a new-born is expected to live if current mortality rates continue to apply	years
G7.2	Physicians	Number of physicians per 1.000 inhabitants	n/1000 inhabitant
G7.3	In-Patient Hospital Beds	Number of in-patient public hospital beds per 1,000 inhabitants	n/1000 inhabitant

G8 Food security

CODE	CRITERION	INDICATOR	UNIT
G8.1	Local production of food	Percentage of local food supplied from within 100 km of the urban area	%
G8.2	Urban agricultural land	Total urban agricultural area used for food production located within city boundaries divided by one 1000 th of the city's total population	he/1000 inhabitants

H Economy

H1 Economic performance

CODE	CRITERION	INDICATOR	UNIT
H1.1	Average annual per-capita income of residents	Average per-capita income of residents in the local area relative to that of the urban region as a whole	%
H1.2	Economic contribution from tourism activity	Sum of overnight visitor stays divided by the area's total population	stays/resident

H2 Employment

CODE	CRITERION	INDICATOR	UNIT
H2.1	Unemployment rate	Total number of working-age primary residents not in paid employment or self-employment, but available for work and seeking work divided by the total labour force	%
H2.2	Youth unemployment rate	Total number of a city's unemployed youth divided by the city's youth labour force	%
H2.3	Female employment	Total number of working age women in employment divided by the total female labour force	%

H3 Innovation

CODE	CRITERION	INDICATOR	UNIT
H3.1	New business registration rate	Proportion of business registrations per 10.000 inhabitants aged 16 and above	n

H4 ICT infrastructure

CODE	CRITERION	INDICATOR	UNIT
H4.1	Fixed Broadband Subscriptions	Percentage of households with fixed (wired) broadbandvv	%
H4.2	Wireless Broadband Coverage	Percentage of the city served by wireless broadband (3G, 4G, 5G)	%
H4.3	Availability of WIFI in Public Areas	Number of public WIFI hotspots in the city per 1000 inhabitants	n/1.000 inhabitants
H4.4	Mobile phone subscriptions	Total number of mobile phone subscriptions in the area divided by one 1000th of the area's total population	n/1.000 inhabitants

I Climate Change: mitigation and adaptation

I1 Climate change mitigation

CODE	CRITERION	INDICATOR	UNIT
I1.1	Greenhouse gas emissions	Total amount of greenhouse gases (equivalent carbon dioxide units) generated over a calendar year for all sectors, divided by the current city population	t $CO_{2\,eq}$ / inhabitant/yr
I1.2	CO2 sequestration	Potential CO2 sequestraion in the neighborhood per hectare	kg $CO_{2\,eq}$ / m^2

I2 Adaptation to the climatic action: heatwaves and increase of temperature

CODE	CRITERION	INDICATOR	UNIT
I2.1	Albedo	Mean Solar Reflectance Index of paved surfaces and roofs in the neighborhood	SRI

I3 Adaptation to the climatic action: pluvial flood

CODE	CRITERION	INDICATOR	UNIT
I3.3	Permeability of land	Percentage of weighted ground permeability	%

I4 Adaptation to the climatic action: fluvial and coastal flood

CODE	CRITERION	INDICATOR	UNIT
I4.1	Flood risk	Percentage of population exposed to flood risk	%

I5 Adaptation to the climatic action: drought

CODE	CRITERION	INDICATOR	UNIT
I5.1	Rainwater collection and storage from buildings for non-potable uses	Share of buildings in the neighborhood with a rainwater collection system	%
I5.2	Local vegetation	Share of landscape (green areas) plated with local vegetation	%

I6 Adaptation to the climatic hazard: wildfire

CODE	CRITERION	INDICATOR	UNIT
I6.1	Wildfire risk	Percentage of population exposed to wildfire risk	%

J Governance

J1 Urban Planning

CODE	CRITERION	INDICATOR	UNIT
J1.1	Community involvement in urban planning activities	Percentage of residents active in public urban planning	Level

J2 Management and community involvement

CODE	CRITERION	INDICATOR	UNIT
J2.1	Involvement of residents in community affairs	Percentage of resident population above 16 years having an involvement in community affairs	%

J3 Public buildings operation

CODE	CRITERION	INDICATOR	UNIT
J3.1	Public buildings sustainability	Percentage area of public buildings with recognized sustainability certifications for ongoing operations	%
J3.2	Operating energy costs for public buildings	Aggregated annual operating energy cost per aggregated indoor useful floor area	€/m^2/yr
J3.3	Energy consumption of public buildings	Total end use of energy in public buildings within a city divided by total indoor useful area of these buildings	kWh/m^2

J4 Equity

CODE	CRITERION	INDICATOR	UNIT
J4.1	Women elected to city level office	Total number of elected city-level positions held by women divided by the total number of elected city-level positions	%

A.Use of Land & Biodiversity

Description of the Information

A: Issue.

Ax: Category.

- **A1: Urban Structure and Form.**
- **A2: Green Urban Areas.**
- **A3: Biodiversity and Ecosystems.**

Ax.x: Criterion.

Intent: Description of the objective of the criterion.

Indicator: Name of the indicator to be calculated.

Unit of Measure: Measuring unit of each indicator.

Standard: The calculation standard for the criterion.

References: The acquiring source of information.

★ Key Performance Indicator

A. Use of Land and Biodiversity — SCTool

A1 Use of land

A1.1 Population Density

Intent: To evaluate the increase of the proximity between residents and local goods and services.

Indicator	Unit of Measure
City population in relation to the city's land area.	Inhabitants / km²

Assessment Methodology:

1. Calculate the total city population (A) - numerator
2. Calculate the total land area of the city (B) - denominator
3. Calculate the value of the indicator as A/B

The result shall be expressed as number of persons per square kilometre.

Standard: -

Reference: ISO 37120: Sustainable cities and communities - Indicators for city services and quality of life

A. Use of Land and Biodiversity — SCTool

A2 Green urban areas

A2.3 Green Area Accessibility

Intent: To go towards a higher quality of life for the city's inhabitants and to reduce negative effects of urbanisation

Indicator	Unit of Measure
Percentage of inhabitants with accessibility to green areas	%

Assessment Methodology:

1. Calculate the number of inhabitants living with 300m of a publicly accessible green space of at least 0.5ha (A) - numerator
2. Calculate the city's total population (B) - denominator
3. Calculate the value of the indicator as A/B (%)

Standard: -

Reference: UNECE - Collection Methodology for Key Performance Indicators for Smart Sustainable Cities.

A. Use of Land and Biodiversity — SCTool

A2 Green urban areas

A2.4 Distribution of Green Urban Areas

Intent: Evaluate the distribution of green urban area to promote the equal distribution

Indicator	Unit of Measure
Total length of green area boundaries (edges) divided by the city's urban area	%

Assessment Methodology:

1. Calculate the total length of green area boundaries (A) - numerator
2. Calculate the total area of the city (B) - denominator
3. Calculate the value of the indicator as A/B (%)

Standard: -

Reference: 1.CESBA MED Project 2 SNTool Assessment System.

A. Use of Land and Biodiversity — SCTool

A2 Green urban areas

★ A2.1 Availability of Green Urban Areas

Intent: To facilitate climate change adaptation and mitigation, to improve health and quality of life, favoring biodiversity conservation

Indicator	Unit of Measure
Proportion of all vegetated areas within the city boundaries in relation to the total area	%

Assessment Methodology:

1. Calculate total amount of Green Urban Areas in the city's boundaries (A) - numerator
2. Calculate the total area of the city (B) - denominator
3. Calculate the value of the indicator as A/B (%)

Note: A Green Urban Area is defined as an urban land covered by vegetation of any kind, for instance natural zones, parks, public and private garden.

Standard: -

Reference: IEFCA – Calculation Guideline

A. Use of Land and Biodiversity — SCTool

A2 Green urban areas

A2.2 Green areas in relation to the city population

Intent: To improve the urban environment helping regulate air quality and climate, recharging groundwater supplies and protecting lakes and streams from polluted runoff.

Indicator	Unit of Measure
Total extension of green areas in the city divided by city's total population	m²/inhabitant

Assessment Methodology:

1. Calculate the total amount of vegetated areas in the city's boundaries. (A) - numerator
2. Calculate the city's total population (B) - denominator
3. Calculate the value of the indicator as A/B (m²/inhabitants)

Standard: -

Reference: IEFCA – Calculation Guideline

A. Use of Land and Biodiversity — SCTool

A2 Green urban areas

A2.5 Green zones and ecosystemic services

Intent: To improve the benefits from green zones availability (capturing pollutants, reducing the " heat island" effect, providing recreational spaces, etc.)

Indicator	Unit of Measure
Share of natural green areas on total green areas	%

Assessment Methodology:

1. Calculate the amount of natural green areas (in hectares) in the city (A) - numerator
2. Calculate the total green area of the city (B) - denominator
3. Calculate the value of the indicator as A/B (%)

Standard: -

Reference: -

A. Use of Land and Biodiversity — SCTool

A3 Biodiversity and ecosystems

A3.1 Variation of the number of bird species

Intent: To preserve biodiversity of bird species

Indicator	Unit of Measure
Percentage change in the number of bird species	%

Assessment Methodology:

1. Calculate the total net change in species (A) - numerator
2. Calculate the total number of species from most recent survey (B) - denominator
3. Calculate the value of the indicator as A/B (%)

Standard: -

Reference: Reference Framework for Sustainable Cities - RFSC

A. Use of Land and Biodiversity

SCTool

A3 Biodiversity and ecosystems

A3.2 Native biodiversity in built up area

Intent: To protect native species to maintain biodiversity

Indicator	Unit of Measure
This indicator is the number of bird species that is listed in the urban area (natural protected area excluded)	n

Assessment Methodology:

Calculate the number of bird species that is listed in the urban area (natural protected area excluded)

Standard:

-

Reference:

ISO 37120: Sustainable cities and communities - Indicators for city services and quality of life

A. Use of Land and Biodiversity

SCTool

A3 Biodiversity and ecosystems

A3.3 Connectivity measures for natural areas

Intent: To maximise the connectivity measures for natural areas

Indicator	Unit of Measure
Amount of natural connected areas in the city divided by the total amount of natural areas in the city	%

Assessment Methodology:

1. Calculate the amount of natural connected areas (in hectares) in the city
   (A) - numerator
2. Calculate the total amount of natural area in the city
   (B) - denominator
3. Calculate the value of the indicator as
   A/B (%)

Note: To be connected, Green Urban Areas shall be less than 100 meters apart.

Standard:

-

Reference:

Reference Framework for Sustainable Cities - RFSC

B.Energy

Description of the Information

B: Issue.

Bx: Category.

- **B1: Energy infrastructure.**
- **B2: Energy consumptions**
- **B3: Renewable energy**

Bx.x: Criterion.

Intent: Description of the objective of the criterion.

Indicator: Name of the indicator to be calculated.

Unit of Measure: Measuring unit of each indicator.

Standard: The calculation standard for the criterion.

References: The acquiring source of information.

★ Key Performance Indicator

Energy — SCTool

B1 Energy infrastructure

B1.1 Access to authorized electrical service

Intent: To evaluate electrical service as a contributing indicator of sustainability, resilience and economic productivity

Indicator	Unit of Measure
Number of people in the city with authorized electrical service divided by the total population of the city	%

Assessment Methodology:

1. Calculate the number of people in the city with authorized electrical service in residential buildings (A) - numerator
2. Calculate the total population of the city (B) - denominator
3. Calculate the value of the indicator as A/B (%)

Standard: -

Reference: ISO 37120: Sustainable cities and communities - Indicators for city services and quality of life

Energy — SCTool

B2 Energy consumptions

B2.2 Residential final thermal energy consumption

Intent: To estimate city thermal energy consumption for building operations

Indicator	Unit of Measure
Total consumption of final thermal energy divided by the total number of city inhabitants	MWh/inhabitant/yr

Assessment Methodology:

1. Calculate the final thermal energy consumption for building operations in MWh (A) - numerator
2. Calculate the total population of the city (B) - denominator
3. Calculate the value of the indicator as A/B

Standard: EN ISO 13790 - Energy performance of buildings

Reference: CESBA MED Project – SNTool assessment system

Energy — SCTool

B2 Energy consumptions

B2. 3 Public street lighting

Intent: To improve the efficiency of street lighting for cost-effective steps and energy efficiency

Indicator	Unit of Measure
Total electricity consumption of public street lighting divided by the total distance of streets where streetlights are present	kWh/km yr

Assessment Methodology:

1. Calculate the total electricity consumption of public street lighting kWh (A) - numerator
2. Calculate the length of streets where streetlights are present in the city (B) - denominator
3. Calculate the value of the indicator as A/B

Standard: -

Reference: ISO 37120: Sustainable cities and communities - Indicators for city services and quality of life

Energy — SCTool

B1 Energy infrastructure

B1.2 Electrical service interruptions

Intent: To track and benchmark reliability performance in electric utility services and resource constraints

Indicator	Unit of Measure
Total sum of hours of interruption multiplied by the number of households impacted divided by the total number of households	hours/household

Assessment Methodology:

1. Calculate the total sum of hours of interruption multiplied by the number of households impacted (A) - numerator
2. Calculate the total number of households in the city (B) - denominator
3. Calculate the value of the indicator as A/B

Standard: -

Reference: ISO 37120: Sustainable cities and communities - Indicators for city services and quality of life

Energy — SCTool

B2 Energy consumptions

B2. 1 Access to authorized electrical service

Intent: To estimate the final energy consumption for all energy sectors

Indicator	Unit of Measure
Total final energy consumed by a city divided by the total population of the city	MWh/inhabitant/yr

Assessment Methodology:

1. Calculate the final energy consumption for all energy sectors in MWh (A) - numerator
2. Calculate the total population of the city (B) - denominator
3. Calculate the value of the indicator as A/B

Standard: -

Reference: ISO 37120: Sustainable cities and communities - Indicators for city services and quality of life

Energy — SCTool

B3 Renewable energy

★B3.1 Final energy derived from renewable sources

Intent: To incentive the consumption and production of renewable energy

Indicator	Unit of Measure
Share of renewable energies in final energy demand	%

Assessment Methodology:

1. Calculate the total consumption of end-use energy generated from renewable sources for all energy sectors MWh (A) - numerator
2. Calculate the total final energy demand MWh (B) - denominator
3. Calculate the value of the indicator as A/B (%)

Standard: -

Reference: CESBA MED Project – SNTool assessment system

Energy — SCTool

B3 Renewable energy

B3. 2 Renewable energy locally produced

Intent: To incentive the production of renewable energy

Indicator	Unit of Measure
Share of locally produced renewable energies of final energy demand	%

Assessment Methodology:

1. Calculate the total locally production of energy generated from renewable sources MWh (A) - numerator
2. Calculate the total final energy demand MWh (B) - denominator
3. Calculate the value of the indicator as A/B (%)

Standard: -

Reference: -

C. Water

Description of the Information

C: Issue.

Cx: Category.
- **C1: Water infrastructure.**
- **C2: Water consumption.**
- **C3: Effluents management.**

Cx.x: Criterion.

Intent: Description of the objective of the criterion.

Indicator: Name of the indicator to be calculated.

Unit of Measure: Measuring unit of each indicator.

Standard: The calculation standard for the criterion.

References: The acquiring source of information.

★ Key Performance Indicator

C. Water — SCTool

C1 Water infrastructure

C1. 1 Availability of a public municipal water supply

Intent: To evaluate city health and quality of life

Indicator	Unit of Measure
Total number of people with potable water supply service divided by total city population	%

Assessment Methodology:

1. Calculate the total number of people with potable water supply service (A) - numerator
2. Calculate the total city population (B) - denominator
3. Calculate the value of the indicator as A/B (%)

Note: The total number of people with potable water supply service shall be calculated as the total number of households in the city connected to a potable water supply service multiplied by the current average household size for the city.
A house shall not be considered to have access to potable water when an individual house or group is served by a conduit system built with, for example, wood, bamboo, or rubber hose, connected directly to a river, well or another house.

Standard: -

Reference: ISO 37120: Sustainable cities and communities - Indicators for city services and quality of life

C. Water — SCTool

C2 Water consumption

C2.2 Efficiency in water use

Intent: To make efficient use of water resources

Indicator	Unit of Measure
Volume of water supplied minus the volume of utilized water divided by the total volume of water supplied	%

Assessment Methodology:

1. Calculate the volume of water supplied minus the volume of utilized water
(A) - numerator
2. Calculate the total volume of water supplied
(B) - denominator
3. Calculate the value of the indicator as
A/B (%)

Standard: -

Reference: IEFCA – Calculation Guideline

C. Water — SCTool

C1 Water consumption

C2. 3 Sufficiency of domestic water provision

Intent: To make efficient use of water resources

Indicator	Unit of Measure
Volume of the water supplied for domestic uses divided by the overall domestic water demand	%

Assessment Methodology:

1. Calculate the volume of water supplied for domestic uses
(A) - numerator
2. Calculate the total volume of domestic water demand
(B) - denominator
3. Calculate the value of the indicator as
A/B

Standard: -

Reference: ISO 37120: Sustainable cities and communities - Indicators for city services and quality of life

C. Water — SCTool

C1 Water infrastructure

C1. 2 Access to wastewater collection

Intent: To evaluate city health, cleanliness and quality of life

Indicator	Unit of Measure
Number of people within the city that are served by wastewater collection divided by the city population	%

Assessment Methodology:

1. Calculate the number of people within the city who are served by wastewater collection
(A) - numerator
2. Calculate the total city population
(B) - denominator
3. Calculate the value of the indicator as
A/B (%)

Standard: -

Reference: ISO 37120: Sustainable cities and communities - Indicators for city services and quality of life

C. Water — SCTool

C2 Water consumption

C2.1 Total water consumption

Intent: To evaluate water resources in the city

Indicator	Unit of Measure
Total amount of the city's daily water consumption divided by the total city population	L/day/person

Assessment Methodology:

1. Calculate the total amount of the city's water consumption in litres per day
(A) - numerator
2. Calculate the total city population
(B) - denominator
3. Calculate the value of the indicator as
A/B

Standard: -

Reference: ISO 37120: Sustainable cities and communities - Indicators for city services and quality of life

C. Water — SCTool

C3 Effluents management

C3.1 Centralized wastewater treatment

Intent: To reduce the incidence of a variety of waterborne diseases

Indicator	Unit of Measure
Total volume of city wastewater collected for primary, secondary and tertiary treatment in centralized wastewater treatment facilities divided by the total volume of wastewater produced in the city	%

Assessment Methodology:

1. Calculate the total volume of city wastewater collected for primary, secondary and tertiary treatment in centralized wastewater treatment facilities
(A) - numerator
2. Calculate the total volume of wastewater produced in the city
(B) - denominator
3. Calculate the value of the indicator as
A/B (%)

Standard: -

Reference: UNECE - Collection Methodology for Key Performance Indicators for Smart Sustainable Cities

C. Water — SCTool

C3 Effluents management

C3. 2 Household sanitation

Intent: To maintain certain levels of hygiene

Indicator	Unit of Measure
Percentage of households with access to basic sanitation facilities	%

Assessment Methodology:

1. Calculate the total number of city households with access to basic sanitation and facilities
(A) - numerator
2. Calculate the total number of city households
(B) - denominator
3. Calculate the value of the indicator as
A/B (%)

Standard: -

Reference: UNECE - Collection Methodology for Key Performance Indicators for Smart Sustainable Cities

D. Solid waste

Description of the Information

D: Issue.

Dx: Category.

D1: Solid waste collection infrastructure

D2: Solid waste management.

Dx.x: Criterion.

Intent: Description of the objective of the criterion.

Indicator: Name of the indicator to be calculated.

Unit of Measure: Measuring unit of each indicator.

Standard: The calculation standard for the criterion.

References: The acquiring source of information.

★ Key Performance Indicator

D. Solid waste — SCTool

D1 Solid waste collection infrastructure

D1.1 Availability of solid waste collection

Intent: To evaluate city health, cleanliness and quality of life

Indicator	Unit of Measure
Percentage of population with regular solid waste collection	%

Assessment Methodology:

1. Calculate the number of city households that are served by solid waste collection (A) - numerator
2. Calculate the total number of city households (B) - denominator
3. Calculate the value of the indicator as A/B (%)

Note: Regular solid waste collection shall be defined as having the solid waste picked up from collection points, transported and dropped at a proper treatment facility (recycling or landfill sites) on at least a weekly basis or every two weeks. If the solid waste is collected in any moving vehicle by persons who have not constituted a legally established entity, the house shall not be considered as a household serviced with a solid waste collection service.

Standard: -

Reference: UNECE - Collection Methodology for Key Performance Indicators for Smart Sustainable Cities

D. Solid waste — SCTool

D2 Solid waste management

D2.1 Solid waste generation

Intent: To assess the production of waste in the city

Indicator	Unit of Measure
Total amount of solid waste generated divided by the total city population	tonnes/inhabitant/yr

Assessment Methodology:

1. Calculate total amount of solid waste (household and commercial) generated in tonnes per year (A) - numerator
2. Calculate the total city population (B) - denominator
3. Calculate the value of the indicator as A/B

Note: Municipal waste shall include waste originating from:
households;
commerce and trade, small businesses, office buildings and institutions (e.g. schools, hospitals, government buildings).
Municipal waste also includes:
bulky waste (e.g. white goods, old furniture, mattresses); garden waste, leaves, grass clippings, street sweepings, the content of litter containers, and market cleansing waste, if managed as waste;
waste from selected municipal services, i.e. waste from park and garden maintenance, waste from street cleaning services (e.g. street sweepings, the content of litter containers, market cleansing waste), if managed as waste.
Not to include in the calculation:
waste from municipal sewage network and treatment;
municipal construction and demolition waste.

Standard: -

Reference: ISO 37120: Sustainable cities and communities - Indicators for city services and quality of life

D. Solid waste — SCTool

D2 Solid waste management

D2.2 Solid waste recycling

Intent: To improve separate collection disposal, avoiding burning waste

Indicator	Unit of Measure
Total amount of solid waste that is recycled divided by the total amount of solid waste produced in the city	%

Assessment Methodology:

1. Calculate the total amount of the city's solid waste that is recycled in tonnes (A) - numerator
2. Calculate the total amount of solid waste produced in the city in tonnes in the city (B) - denominator
3. Calculate the value of the indicator as A/B (%)

Note: Recycled materials shall refer to those materials diverted from the waste stream, recovered and processed into new products following local government permits and regulations.

Standard: -

Reference: UNECE - Collection Methodology for Key Performance Indicators for Smart Sustainable Cities

E. Envirionamental quality

Description of the Information

E: Issue.

Ex : Category.

E1: Air quality.

E2: Noise.

E3: EMF exposure.

Ex.x : Criterion.

Intent: Description of the objective of the criterion.

Indicator: Name of the indicator to be calculated.

Unit of Measure: Measuring unit of each indicator.

Standard: The calculation standard for the criterion.

References: The acquiring source of information.

★ Key Performance Indicator

E. Environmental quality — SCTool

E1 Air quality

E1. 1 Fine particulate matter (PM2.5) concentration

Intent: To evaluate the quality of the air through the exceeded daily limits of pollutants (PM2.5)

Indicator	Unit of Measure
Annual average fine particulate matter (PM2.5) concentration	$\mu g/m^3$

Assessment Methodology:

1. Collect the annual mean of PM2.5 concentration values measured over one year by each monitoring station installed in the city's boundaries

2. Calculate the average of the values collected in the previous step as the sum of the annual mean PM2.5 concentration values (A) - numerator

3. Calculate the number of monitoring stations (B) - denominator

4. The result shall be expressed as the concentration of PM2.5 in micrograms per standard cubic metre ($\mu g/m^3$)

Standard: -

Reference: ISO 37120: Sustainable cities and communities - Indicators for city services and quality of life

E. Environmental quality — SCTool

E1 Air quality

E1. 4 Sulfur Dioxide concentration (SO^2)

Intent: To evaluate the quality of the air through the exceeded daily limits of pollutants (SO^2)

Indicator	Unit of Measure
Sum of daily concentrations for the whole year divided by 365 days	$\mu g/m^3$

Assessment Methodology:

1. Calculate the mass of pollutant collected SO2 (μg)

(A) - numerator

2. Calculate the volume of air sampled in standard cubic metres (μg/m3)

(B) - denominator

3. The result shall be expressed as the concentration of SO^2 in micrograms per standard cubic metre ($\mu g/m^3$)

Standard: -

Reference: UNECE - Collection Methodology for Key Performance Indicators for Smart Sustainable Cities

E. Environmental quality — SCTool

E1 Air quality

E1. 5 Ozone concentration (O^3)

Intent: To evaluate the quality of the air through the exceeded daily limits of pollutants (O^3)

Indicator	Unit of Measure
Sum of daily concentrations for the whole year divided by 365 days	$\mu g/m^3$

Assessment Methodology:

Assessment method:

1. Calculate the mass of pollutant collected O^3 (μg)

(A) - numerator

2. Calculate the volume of air sampled in standard cubic metres (μg/m3)

(B) - denominator

3. The result shall be expressed as the concentration of O3 in micrograms per standard cubic metre ($\mu g/m^3$)

Standard: -

Reference: UNECE - Collection Methodology for Key Performance Indicators for Smart Sustainable Cities

E. Environmental quality — SCTool

E1 Air quality

★E1.2 Particulate matter (PM10) concentration

Intent: To evaluate the quality of the air through the exceeded daily limits of pollutants (PM10)

Indicator	Unit of Measure
Annual average fine particulate matter (PM10) concentration	$\mu g/m^3$

Assessment Methodology:

1. Collect the annual mean of PM10 concentration values measured over one year by each monitoring station installed in the city's boundaries
2. Calculate the average of the values collected in the previous step as the sum of the annual mean PM10 concentration values (A) - numerator
3. Calculate the number of monitoring stations (B) - denominator
4. The result shall be expressed as the concentration of PM10 in micrograms per standard cubic metre ($\mu g/m^3$)
5. The result shall be expressed as the concentration of PM10 in micrograms per standard cubic metre ($\mu g/m^3$)

Standard: -

Reference: ISO 37120: Sustainable cities and communities - Indicators for city services and quality of life

E. Environmental quality — SCTool

E1 Air quality

E1. 3 Nitrogen Dioxide concentration (NO2)

Intent: To evaluate the quality of the air through the exceeded daily limits of pollutants (NO2)

Indicator	Unit of Measure
Sum of daily concentrations for the whole year divided by 365 days	$\mu g/m^3$

Assessment Methodology:

1. Calculate the mass of pollutant collected NO2 (μg)
(A) - numerator

2. Calculate the volume of air sampled in standard cubic metres (μg/m3)
(B) - denominator

3. The result shall be expressed as the concentration of NO2 in micrograms per standard cubic metre ($\mu g/m^3$)

Standard: -

Reference: ISO 37120: Sustainable cities and communities - Indicators for city services and quality of life

E. Environmental quality — SCTool

E2 Noise

E2.1 Noise pollution

Intent: To promote acoustic comfort, for a healthy and safe environment

Indicator	Unit of Measure
Population exposed to noise pollution divided by the total population of the city	%

Assessment Methodology:

1. Calculate the population exposed to noise pollution

(A) - numerator

2. Calculate the total population of the city

(B) - denominator

3. Calculate the value of the indicator as

A/B (%)

Standard: -

Reference: ISO 37120: Sustainable cities and communities - Indicators for city services and quality of life

E. Environmental quality — SCTool

E3 EMF exposure

E3. 1 Exposure to high frequency electromagnetic fields

Intent: To evaluate the exposure to high frequency electromagnetic fields

Indicator	Unit of Measure
Percentage of mobile network antenna sites in compliance with EMF exposure	%

Assessment Methodology:

1. Calculate the number of mobile network antenna sites in compliance with EMF exposure

(A) - numerator

2. Calculate the total number mobile network antenna sites in the city

(B) - denominator

3. Calculate the value of the indicator as

A/B (%)

Standard: -

Reference: ISO 37120: Sustainable cities and communities - Indicators for city services and quality of life

E. Environmental quality

SCTool

E3 EMF exposure

E3. 2 Percentage of buildings exposed to ELF magnetic fields

Intent: To assess the quantity of buildings exposed to ELF magnetic fields

Indicator	Unit of Measure
Percentage of buildings in the area located not respecting the safety distance from high voltage lines	%

Assessment Methodology:

1. Calculate the buildings located in the city not respecting the safety distance from high voltage lines

(A) - numerator

2. Calculate the total number of buildings in the city

(B) - denominator

3. Calculate the value of the indicator as

A/B (%)

Standard:
-

Reference:
UNECE - Collection Methodology for Key Performance Indicators for Smart Sustainable Cities

F. Transportation and mobility

Description of the Information

F: Issue.

Fx : Category.

F1: Performance of mobility services.

F2: Green mobility.

F3: Safety in mobility.

Fx.x : Criterion.

Intent: Description of the objective of the criterion.

Indicator: Name of the indicator to be calculated.

Unit of Measure: Measuring unit of each indicator.

Standard: The calculation standard for the criterion.

References: The acquiring source of information.

★ Key Performance Indicator

Transportation and mobility — SCTool

F1 Performance of mobility services

F1. 1 Public transport network

Intent: To assess city's transportation network availability

Indicator	Unit of Measure
Length of public transport system per 1000 population	km/1000 inhabitants

Assessment Methodology:

1. Calculate the total length (in kilometres) of the public transport systems operating within the city

(A) - numerator

2. Calculate the one 1.000th of the city's total population

(B) - denominator

3. Calculate the value of the indicator as

A/B

Standard: -

Reference: ISO 37120: Sustainable cities and communities - Indicators for city services and quality of life

Transportation and mobility — SCTool

F1 Performance of mobility services

F1.2 Accessibility of public transportation service

Intent: To evaluate the proximity and connectivity of public transportation service

Indicator	Unit of Measure
Percentage of inhabitants that are within 500 meters walking distance of at public transportation service stop running at least every 20 minutes during peak periods	%

Assessment Methodology:

1. Calculate the total number of inhabitants living within 0,5 km of public transit running at least every 20 min during peak periods

(A) - numerator

2. Calculate the total city population

(B) - denominator

3. Calculate the value of the indicator as

A/B (%)

Standard: -

Reference: ISO 37120: Sustainable cities and communities - Indicators for city services and quality of life

Transportation and mobility — SCTool

F1 Performance of mobility services

F1.3 Usage of public transportation by population

Intent: To evaluate the usage of public transport

Indicator	Unit of Measure
Total annual number of public transport trips originating in the city divided by the total city population	trips/inhabitant

Assessment Methodology:

1. Calculate the total annual number of public transport trips originating in the city

(A) - numerator

2. Calculate the total city population

(B) - denominator

3. Calculate the value of the indicator as

A/B

Standard: -

Reference: ISO 37120: Sustainable cities and communities - Indicators for city services and quality of life

Transportation and mobility — SCTool

F2 Green mobility

F2.1 Shared vehicles

Intent: To promote an alternative form of transportation

Indicator	Unit of Measure
Number of shared vehicles per 1000 inhabitants	n/1000 inhabitants

Assessment Methodology:

1. Calculate the number of shared vehicles

(A) - numerator

2. Calculate the one 1.000th of the city's population

(B) - denominator

3. Calculate the value of the indicator as

A/B

Standard: -

Reference: UNECE - Collection Methodology for Key Performance Indicators for Smart Sustainable Cities

Transportation and mobility — SCTool

F2 Green mobility

F2. 3 Low-Carbon Emission Passenger Vehicles

Intent: To reduce fossil fuel consumption

Indicator	Unit of Measure
Percentage of low-carbon emission passenger vehicles	%

Assessment Methodology:

1. Calculate the number of low emission vehicles registered (PHEV & EV)

(A) - numerator

2. Calculate the number of total vehicles

(B) - denominator

3. Calculate the value of the indicator as

A/B (%)

Standard: -

Reference: UNECE - Collection Methodology for Key Performance Indicators for Smart Sustainable Cities

Transportation and mobility — SCTool

F2 Green mobility

F2. 2 Electric-vehicle infrastructure (charging stations)

Intent: To promote the use of electric vehicles

Indicator	Unit of Measure
Electric vehicle charging stations per inhabitant	n/inhabitant

Assessment Methodology:

1. Calculate the number of charging stations for electric vehicles

(A) - numerator

2. Calculate the city's population

(B) - denominator

3. Calculate the value of the indicator as

A/B

Standard: -

Reference: -

Transportation and mobility — SCTool

F2 Green mobility

F2. 4 Bicycle network

Intent: To emphasise the use of bicycles as method to reduce traffic congestion and pollution

Indicator	Unit of Measure
Total length of bicycle paths and lanes divided by the city's total population	m/inhabitant

Assessment Methodology:

1. Calculate total length of bicycle paths/lanes in the city (A) - numerator

2. Estimate/Calculate the total city's population

(B) - denominator

3. Calculate the value of the indicator as

A/B

Standard: -

Reference: UNECE - Collection Methodology for Key Performance Indicators for Smart Sustainable Cities

Transportation and mobility

SCTool

F2 Green mobility

F2. 5 Shared bicycles

Intent: To emphasise the use of bicycles as method to reduce traffic congestion and pollution

Indicator	Unit of Measure
Number of shared bicycles per 1.000 inhabitants	n/1000 inhabitants

Assessment Methodology:

1. Calculate the number of shared bicycles available

(A) - numerator

2. Calculate the one 1.000 of the city's population

(B) - denominator

3. Calculate the value of the indicator as

A/B

Standard: -

Reference: UNECE - Collection Methodology for Key Performance Indicators for Smart Sustainable Cities

Transportation and mobility

SCTool

F2 Green mobility

F2.6 Green public vehicles

Intent: To reduce fossil fuel consumption

Indicator	Unit of Measure
Total number of low emission public vehicles divided by total number of public vehicles	%

Assessment Methodology:

1. Calculate the number of low emission public vehicles
(A) - numerator

2. Calculate the city's total number of public vehicles
(B) - denominator

3. Calculate the value of the indicator as
A/B (%)

Note:
Low emission vehicles are:
Electric Vehicles (EVs)
Plug-in Hybrid-Electric Vehicles (PHEVs)

Standard: -

Reference: UNECE - Collection Methodology for Key Performance Indicators for Smart Sustainable Cities

Transportation and mobility

SCTool

F3 Safety in mobility

F3. 1 Pedestrian infrastructure

Intent: To improve the city in terms of liveability and safety for pedestrians

Indicator	Unit of Measure
Total area of pedestrian streets and walkways divided by the total area of streets and roads in the city	%

Assessment Methodology:

1. Calculate the total of pedestrian streets and walkways

(A) - numerator
2. Calculate the total area of streets and roads in the city

(B) - denominator
3. Calculate the value of the indicator as

A/B (%)

Standard: -

Reference: UNECE - Collection Methodology for Key Performance Indicators for Smart Sustainable Cities

Transportation and mobility

SCTool

F3 Safety in mobility

F3. 2 Availability of sidewalks

Intent: To promote road connectivity, as a key element of spatial accessibility

Indicator	Unit of Measure
Percentage of roads' length that has dedicated sidewalks	%

Assessment Methodology:

1. Calculate the roads' length that has dedicated sidewalks

(A) - numerator
2. Calculate the total length of the roads in the city

(B) - denominator
3. Calculate the value of the indicator as

A/B (%)

Standard: -

Reference: CESBA MED Project – SNTool assessment system

Transportation and mobility

SCTool

F3 Safety in mobility

F3. 3 Safety of bicycle lines

Intent: To promote bicycle as alternative vehicle from car

Indicator	Unit of Measure
Percentage of bicycle paths physically separated from traffic roads	%

Assessment Methodology:

1. Calculate the length of bicycle paths physically separated from traffic roads

(A) - numerator

2. Calculate the total length of bicycle paths in the city

(B) - denominator

3. Calculate the value of the indicator as

A/B (%)

Standard: -

Reference: CESBA MED Project – SNTool assessment system

Transportation and mobility

SCTool

F3 Safety in mobility

F3. 4 Traffic fatalities

Intent: To assess road safety

Indicator	Unit of Measure
Traffic fatalities divided by 1000th of the city's population	n/1000 inhabitants

Assessment Methodology:

1. Calculate the number of traffic fatalities

(A) - numerator

2. Calculate one 1.000 of the city's population

(B) - denominator

3. Calculate the value of the indicator as

A/B (%)

Standard: -

Reference: UNECE - Collection Methodology for Key Performance Indicators for Smart Sustainable Cities

Transportation and mobility

SCTool

F3 Safety in mobility

F3. 5 Traffic fatalities

Intent: To reduce the need to use private cars

Indicator	Unit of Measure
Number of taxi licenses divided by 1000th of the city's population	n/1000 inhabitants

Assessment Methodology:

1. Calculate the number of taxi licenses

(A) - numerator

2. Calculate one 1.000 of the city's population

(B) - denominator

3. Calculate the value of the indicator as

A/B (%)

Standard: -

Reference: UNECE - Collection Methodology for Key Performance Indicators for Smart Sustainable Cities

G. Social Aspects

Description of the Information

G: Issue.

Gx : Category.

- G1: Accessibility (disabled persons) .
- G2: Housing.
- G3: Availability of public and private facilities and services.
- G4: Education.
- G5: Social inclusion.
- G6: Safety.
- G7: Health.
- G8: Food security .

Gx.x : Criterion.

Intent: Description of the objective of the criterion.

Indicator: Name of the indicator to be calculated.

Unit of Measure: Measuring unit of each indicator.

Standard: The calculation standard for the criterion.

References: The acquiring source of information.

★ Key Performance Indicator

G1 Accessibility (disabled persons)

G1.1 Accessibility of public buildings

Intent: To assess the ability of residents, workers or visitors with physical disabilities to be able to have physical access to key buildings

Indicator	Unit of Measure
Total number of public buildings accessible by disabled persons divided by the total number of public buildings	%

Assessment Methodology:

The indicator shall be calculated as the total number of public buildings accessible by disabled persons divided by the total number of public buildings.

Note: An accessible building is a building where a person with a disability is afforded the opportunity to acquire the same information, engage in the same interactions, and enjoy the same services as a person without a disability in an equally effective and equally integrated manner, with substantially equivalent ease of use.
A disability refers to a physical, sensory or mental limitation that interferes with a person's ability to move, see, hear or learn.

Standard: -

Reference: CESBA MED Project – SNTool assessment system

G1 Accessibility (disabled persons)

G1.2 Barrier-free accessibility in local outdoor public areas

Intent: To evaluate the accessibility of various urban resources using spatial data analysis

Indicator	Unit of Measure
Percentage of accessible public outdoor areas that are barrier-free compared to the total public area	%

Assessment Methodology:

1. Identify key outdoor public facilities that may be frequently used by persons with physical disabilities.

2. Assess the accessibility of pedestrian routes, considering all major disability types

3. Establish the percent of public outdoor facilities that may be considered accessible.

Standard: -

Reference: CESBA MED Project – SNTool assessment system

G1 Accessibility (disabled persons)

G1.3 Accessibility of public transport network

Intent: To facilitate the access to public transport by physically disabled persons

Indicator	Unit of Measure
Total number of public vehicles accessible to disabled persons divided by total number of public vehicles	%

Assessment Methodology:

1. Calculate the number of public transport vehicles that are accessible disabled persons
(A) - numerator
2. Calculate the total number of public transport vehicles in the city
(B) - denominator
3. Calculate the value of the indicator as
A/B (%)

Note: An accessible vehicle is barrier-free and can be used by people who have disabilities, including those who use wheelchairs.

Standard: -

Reference: CESBA MED Project – SNTool assessment system

G2 Housing

G2.1 Affordability of housing property

Intent: To assess the affordability of housing property in the city

Indicator	Unit of Measure
Housing properties in the city that are financially accessible to the lowest quintile of area population	%

Assessment Methodology:

1. Calculate the number of housing properties in the city that are financially accessible to the lowest quintile of area population
(A) - numerator

2. Calculate the total number of housing properties in the city
(B) - denominator

3. Calculate the value of the indicator as
A/B (%)

Standard: -

Reference: CESBA MED Project – SNTool assessment system

G2 Housing

G2.2 Affordability of housing rental

Intent: To assess the affordability of housing rental property for low-income residents in the city

Indicator	Unit of Measure
Percentage of the average salary of the lowest quintile of the population used for rental payments	%

Assessment Methodology:

1. Calculate the number of housing rental property in the city that are financially accessible to low-income residents
(A) - numerator

2. Calculate the total number of housing rental property in the city
(B) - denominator

3. Calculate the value of the indicator as
A/B (%)

Standard: -

Reference: CESBA MED Project – SNTool assessment system

G2 Housing

G2.3 Vacant residential units

Intent: To understand the current and future housing needs in the city

Indicator	Unit of Measure
Percentage of vacant residential units	%

Assessment Methodology:

1. Calculate the number of unoccupied dwellings
(A) - numerator

2. Calculate the total number of dwellings in the city
(B) - denominator

3. Calculate the value of the indicator as
A/B (%)

Standard: -

Reference: ISO 37120: Sustainable cities and communities - Indicators for city services and quality of life

G2 Housing

G2.4 Informal settlements

Intent: To evaluate the extent of the challenges for the reporting city in meeting shelter needs and demand

Indicator	Unit of Measure
Area of informal settlements within the city boundary divided by the city area	%

Assessment Methodology:

1. Calculate the area of informal settlements within the city boundary (in square kilometres) (A) - numerator
2. Calculate the city area in square kilometres (B) - denominator
3. Calculate the value of the indicator as A/B (%)
Note: The UN Statistics Division has developed the following definitions of informal settlements:
a) Areas where groups of housing units have been constructed on land that the occupants have no formal legal claim to.
b) Unplanned settlements and areas where housing is not in compliance with current planning and building regulations (unauthorized housing).
While many informal settlements also meet the definition of slum, the terms are not synonymous. Slums might exist in areas that do not meet the definition of informal settlements.

Standard: -

Reference: ISO 37120: Sustainable cities and communities - Indicators for city services and quality of life

G. Social Aspects

SCTool

G3 Availability of public and private facilities and services

G3.1 Basic service proximity

Intent: To assess the overall liveability and quality of life

Indicator	Unit of Measure
Number of inhabitants who live near at least one basic service divided by the total population of the city	%

Assessment Methodology:

1. Calculate the number of inhabitants who live near at least one basic service

(A) - numerator

2. Calculate the total population of the city

(B) - denominator

3. Calculate the value of the indicator as

A/B (%)

Standard: -

Reference: ISO 37120: Sustainable cities and communities - Indicators for city services and quality of life

G. Social Aspects

SCTool

G3 Availability of public and private facilities and services

G3.2 Open space for public use

Intent: To ensure that public open space compatible with local cultural values is provided in large projects

Indicator	Unit of Measure
Average share of the built-up area of the city that is open space for public use	%

Assessment Methodology:

1. Calculate the share of the built-up area of the city that is open space for public use

(A) - numerator

2. Calculate the total area of the city

(B) - denominator

3. Calculate the value of the indicator as

A/B (%)

Standard: -

Reference: CESBA MED Project – SNTool assessment system

G. Social Aspects

SCTool

G3 Availability of public and private facilities and services

G3.3 Open space for public use

Intent: To provide important recreation opportunities accessible by inhabitants

Indicator	Unit of Measure
Total area of shores/beaches in the city area that are accessible by inhabitants divided by the total area of shores/beaches in the city's urban area	%

Assessment Methodology:

1. Calculate the total area of shores/beaches in the city area that are accessible by inhabitants

(A) - numerator

2. Calculate the total area of shores/beaches in the city's urban area

(B) - denominator

3. Calculate the value of the indicator as

A/B (%)

Standard: -

Reference: IEFCA – Calculation Guideline

G. Social Aspects

SCTool

G4 Education

G4.1 Primary enrollment rate

Intent: To expand and transform the educational systems of countries achieving universal standards of learning outcomes, reducing inequalities

Indicator	Unit of Measure
Net primary enrolment rate	%

Assessment Methodology:

1. Calculate the net primary enrolment rate of people in the city

(A) - numerator

2. Calculate the total number of people of the city

(B) - denominator

3. Calculate the value of the indicator as

A/B (%)

Standard: -

Reference: Sustainable Development in the Mediterranean Report 2020

G. Social Aspects

SCTool

G4 Education

G4.2 Female school-aged population enrolled in schools

Intent: To monitor woman rights

Indicator	Unit of Measure
Number of city's female school-aged population enrolled at primary and secondary levels in public and private schools divided by the total number of a city's female school-aged population	%

Assessment Methodology:

1. Calculate the number of city's female school-aged population enrolled at primary and secondary levels in public and private schools

(A) - numerator

2. Calculate the total number of a city's female school-aged population

(B) - denominator

3. Calculate the value of the indicator as

A/B (%)

Note: Part-time enrolment of a half-day or more shall be counted as a full-time enrolment.

Standard: -

Reference: Sustainable Development in the Mediterranean Report

G. Social Aspects

SCTool

G4 Education

G4.3 Secondary school enrollment

Intent: To expand and transform the educational systems of countries achieving universal standards of learning outcomes, reducing inequalities

Indicator	Unit of Measure
Lower secondary completion rate	%

Assessment Methodology:

1. Calculate the secondary enrolment rate of people in the city

(A) - numerator

2. Calculate the total number of people of the city

(B) - denominator

3. Calculate the value of the indicator as

A/B (%)

Standard: -

Reference: Sustainable Development in the Mediterranean Report

G. Social Aspects

SCTool

G4 Education

G4.4 Tertiary education

Intent: To expand and transform the educational systems of countries achieving universal standards of learning outcomes, reducing inequalities

Indicator	Unit of Measure
Population age 25-34 with tertiary educational attainment	%

Assessment Methodology:

1. Calculate the population age 25-34 with tertiary educational attainment in the city

(A) - numerator

2. Calculate the total number of population age 25-34 of the city

(B) - denominator

3. Calculate the value of the indicator as

A/B (%)

Standard: -

Reference: Sustainable Development in the Mediterranean Report

G. Social Aspects

SCTool

G5 Social inclusion

G5.1 Gender pay gap

Intent: To assess an overall picture of gender discrimination and the inequalities in the labour market that explain gender differences in pay

Indicator	Unit of Measure
Difference between average gross hourly earnings of male and female paid employees as a percentage of average gross hourly earnings of male paid employees	%

Assessment Methodology:

1. Calculate the average hourly earnings of female employees

(A) - numerator

2. Calculate average hourly earnings of male employees

(B) - denominator

3. Calculate the value of the indicator as

A/B (%)

Standard: -

Reference: UNECE - Collection Methodology for Key Performance Indicators for Smart Sustainable Cities

G. Social Aspects

SCTool

G5 Social inclusion

G5.2 Energy poverty of households

Intent: To assess poverty risk

Indicator	Unit of Measure
Percentage of households unable to afford the most basic levels of energy (more than 10% of the income spent on energy bills)	%

Assessment Methodology:

1. Calculate the number of households unable to afford the most basic levels of energy (more than 10% of the income spent on energy bills)
(A) - numerator

2. Calculate the total number of households in the city
(B) - denominator

3. Calculate the value of the indicator as
A/B (%)

Standard: -

Reference: -

G. Social Aspects

SCTool

G5 Social inclusion

G5.3 Population living below poverty line

Intent: To assess poverty risk

Indicator	Unit of Measure
Number of people living below the national poverty line set at country level divided by the total current population of the city	%

Assessment Methodology:

1. Calculate the number of people living below the national poverty line set at country level (A) - numerator
2. Calculate the total current population of the city (B) - denominator
3. Calculate the value of the indicator as A/B (%)

Note: The total number of people in the city living below the national poverty line shall be determined by multiplying the number of city households at or below the national poverty line by the current average number of persons per household for that city.
The poverty line refers to the minimum level of income deemed adequate in a particular country. It is the minimum level of income considered adequate in a country.

Standard: -

Reference: Sustainable Development in the Mediterranean Report

G. Social Aspects

SCTool

G5 Social inclusion

G5.4 Inequality

Intent: To assess the distribution of income or consumption across a population, to be able to quantify a society's relative inequality

Indicator	Unit of Measure
Gini coefficient of inequality	n

Assessment Methodology:

The Gini coefficient (also known as the "Gini Index" or "Gini Ratio") is a measure of statistical dispersion that quantifies inequality among incomes or levels of consumption.

The Gini coefficient is defined as a ratio of the areas on the Lorenz curve diagram. If the area between the line of perfect equality and Lorenz curve is A, and the area under the Lorenz curve is B, then the Gini coefficient is A / (A + B).

A coefficient of zero expresses perfect equality, where all income or consumption values are the same. Conversely, a coefficient of one expresses maximal inequality.

Standard: -

Reference: ISO 37120: Sustainable cities and communities - Indicators for city services and quality of life

G. Social Aspects

SCTool

G5 Social inclusion

G5.5 Voter participation

Intent: To assess public's level of participation and degree of interest in local government

Indicator	Unit of Measure
Percentage of the eligible population that voted during the last municipal election	%

Assessment Methodology:

1. Calculate the number of persons who voted in the last municipal election
(A) - numerator

2. Calculate the total number of registered voters in the city
(B) - denominator

3. Calculate the value of the indicator as
A/B (%)

Standard: -

Reference: ISO 37120: Sustainable cities and communities - Indicators for city services and quality of life

G. Social Aspects

SCTool

G6 Safety

G6.1 Police service

Intent: To assess the overall crime prevention in place in a city

Indicator	Unit of Measure
Number of police officers per 1000 inhabitants	n/1000 inhabitants

Assessment Methodology:

1. Calculate the number of permanent full-time (or FTE) sworn-in police officers
(A) - numerator

2. Calculate one 1.000 of the city's total population
(B) - denominator

3. Calculate the value of the indicator as
A/B (%)

Standard: -

Reference: ISO 37120: Sustainable cities and communities - Indicators for city services and quality of life

G. Social Aspects

SCTool

G6 Safety

G6.2 Fire service

Intent: To assess the overall fire security/prevention in place in a city

Indicator	Unit of Measure
Number of firefighters per 1000 inhabitants	n/1000 inhabitants

Assessment Methodology:

1. Calculate the number of permanent full-time (or FTE) sworn-in firefighters
(A) - numerator

2. Calculate one 1.000 of the city's total population
(B) - denominator

3. Calculate the value of the indicator as
A/B (%)

Standard: -

Reference: ISO 37120: Sustainable cities and communities - Indicators for city services and quality of life

G. Social Aspects

SCTool

G6 Safety

G6.3 Population living in disaster prone areas

Intent: To assess population living in areas subject to significant risk of death or damage caused by prominent hazards: cyclones, drought, floods, earthquakes, volcanoes and landslides

Indicator	Unit of Measure
Percentage of inhabitants living in a zone subject to natural hazards	%

Assessment Methodology:

1. Calculate the total number of city inhabitants living in areas subject to significant risk of death or damage caused by prominent hazards
(A) - numerator

2. Calculate total number of city inhabitants
(B) - denominator

3. Calculate the value of the indicator as
A/B (%)

Standard: -

Reference: UNECE - Collection Methodology for Key Performance Indicators for Smart Sustainable Cities

G. Social Aspects

SCTool

G7 Health

G7.1 Life expectancy

Intent: To assess life expectancy

Indicator	Unit of Measure
Average number of years that a new-born is expected to live if current mortality rates continue to apply	Years

Assessment Methodology:

average number of years that a new-born is expected to live if current mortality rates continue to apply

Standard: -

Reference: UNECE - Collection Methodology for Key Performance Indicators for Smart Sustainable Cities

G. Social Aspects

SCTool

G7 Health

G7.2 Physicians

Intent: To assess the strength of a city's health system. There is evidence that the number of physicians is positively associated with immunization coverage, outreach of primary care, and infant, child and maternal survival

Indicator	Unit of Measure
Number of physicians per 1000 inhabitants	n/1000 inhabitants

Assessment Methodology:

1. Calculate the number of general or specialized physicians working in the city (FTE)
(A) - numerator
2. Calculate one 1.000 of the city's population
(B) - denominator
3. Calculate the value of the indicator as
A/B (%)

Standard:
-

Reference:
UNECE - Collection Methodology for Key Performance Indicators for Smart Sustainable Cities

G. Social Aspects

SCTool

G7 Health

G7.3 In-Patient Hospital Beds

Intent: To monitor the level of a health service delivery

Indicator	Unit of Measure
Number of in-patient public hospital beds per 1000 inhabitants	n/1000 inhabitants

Assessment Methodology:

1. Calculate the total number of in-patient hospital beds (public and private)
(A) - numerator
2. Calculate one 1.000 of the city's population
(B) - denominator
3. Calculate the value of the indicator as
A/B (%)

Standard:
-

Reference:
UNECE - Collection Methodology for Key Performance Indicators for Smart Sustainable Cities

G. Social Aspects

SCTool

G8 Food security

G8.1 Local production of food

Intent: To assess the physical availability of food in terms of adequate supply

Indicator	Unit of Measure
Percentage of local food supplied from within 100 km of the urban area	%

Assessment Methodology:

1. Calculate the amount of local food supplied to the city (within 100 km) (tonnes)
(A) - numerator
2. Calculate the amount of total food supplied to the city (tonnes)
(B) - denominator
3. Calculate the value of the indicator as
A/B (%)

Standard:
-

Reference:
UNECE - Collection Methodology for Key Performance Indicators for Smart Sustainable Cities

G. Social Aspects

SCTool

G8 Food security

G8.2 Urban agricultural land

Intent: To promote inclusion of areas devoted to urban agriculture and also plans of new urban development projects with the goal of producing food through reutilization of urban resources

Indicator	Unit of Measure
Total urban agricultural area used for food production located within city boundaries divided by one 1000 of the city's total population	he/1000 inhabitants

Assessment Methodology:

1. Calculate the total designated urban agricultural area used for food production located within city boundaries
(A) - numerator
2. Calculate one 1.000 of the city's total population
(B) - denominator
3. Calculate the value of the indicator as
A/B

Standard:
-

Reference:
ISO 37120: Sustainable cities and communities - Indicators for city services and quality of life

H. Economy

Description of the Information

H: Issue.

Hx: Category.

- **H1: Economic performance.**
- **H2: Employment.**
- **H3: Innovation.**
- **H4: ICT infrastructure.**

Hx.x: Criterion.

Intent: Description of the objective of the criterion.

Indicator: Name of the indicator to be calculated.

Unit of Measure: Measuring unit of each indicator.

Standard: The calculation standard for the criterion.

References: The acquiring source of information.

★ Key Performance Indicator

H. Economy — SCTool

H1 Economic performance

H1.1 Average annual per-capita income of residents

Intent: To evaluate the economic well-being

Indicator	Unit of Measure
Average per-capita income of residents in the city relative to that of the urban region as a whole	%

Assessment Methodology:

1. Calculate the per-capita income of residents in the city

(A) - numerator

2. Calculate the per-capita income of the whole urban region

(B) - denominator

3. Calculate the value of the indicator as

A/B (%)

Standard: -

Reference: CESBA MED Project – SNTool assessment system

H. Economy — SCTool

H2 Employment

H2.2 Youth unemployment rate

Intent: To quantify and analyse the current labour market trends and challenges of young people

Indicator	Unit of Measure
Total number of a city's unemployed youth divided by the city's youth labour force	%

Assessment Methodology:

1. Calculate the total number of a city's unemployed youth (A) - numerator
2. Calculate the city's youth labour force (B) - denominator
3. Calculate the value of the indicator as A/B (%)

Note: Unemployed youth shall refer to individuals above the legal working age and under 24 years of age who are without work, actively seeking work in a recent period (past four weeks) and currently available for work (registered students are not counted).
Youth labour force shall refer to all persons above the legal working age and under 24 years of age who are either employed or unemployed over a specified reference period.

Standard: -

Reference: ISO 37120: Sustainable cities and communities - Indicators for city services and quality of life

H. Economy — SCTool

H2 Employment

H2.3 Female employment

Intent: To assess working opportunities for women

Indicator	Unit of Measure
Total number of working age women in employ-ment divided by the total female labour force	%

Assessment Methodology:

1. Calculate the number of working-age women in employment

A) - numerator

2. Calculate the total female labour force

(B) - denominator

3. Calculate the value of the indicator as

A/B (%)

Note: Female labour force shall refer to the sum of the total female persons employed and unemployed who are legally eligible to work and who are primary residents of the city.

Standard: -

Reference: Sustainable Development in the Mediterranean - Report 2020

H. Economy — SCTool

H1 Economic performance

H1.2 Economic contribution from tourism activity

Intent: To assess the evolution of the tourist frequency

Indicator	Unit of Measure
Sum of overnight visitor stays divided by the city's total population	stays/resident

Assessment Methodology:

1. Calculate the sum of overnight visitor stays in the city

(A) - numerator

2. Calculate the city's total population

(B) - denominator

3. Calculate the value of the indicator as

A/B

Standard: -

Reference: CESBA MED Project – SNTool assessment system

H. Economy — SCTool

H2 Employment

H2.1 Unemployment rate

Intent: To assess the labour market status, the economy development and citizens' quality of life

Indicator	Unit of Measure
Total number of working-age primary residents not in paid employment or self-employ-ment, but available for work and seeking work divided by the total labour force	%

Assessment Methodology:

1. Calculate the number of working-age primary residents who during the survey reference period were not in paid employment or self-employment, but available for work and seeking work (A) - numerator
2. Calculate the total labour force (B) - denominator
3. Calculate the value of the indicator as A/B (%)

Note: Unemployment shall refer to individuals without work, actively seeking work in a recent period (past four weeks) and currently available for work.
Labour force shall refer to the sum of the total persons employed and unemployed who are legally eligible to work and who are primary residents of the city.

Standard: -

Reference: CESBA MED Project – SNTool assessment system

H. Economy — SCTool

H3 Innovation

H3.1 New business registration rate

Intent: To assess city's level of economic activity and economic performance

Indicator	Unit of Measure
The proportion of business registrations per 10.000 inhabitants aged 16 and above	n

Assessment Methodology:

1. Calculate the number of business registrations per 10.000 inhabitants aged 16 and above

Standard: -

Reference: ISO 37120: Sustainable cities and communities - Indicators for city services and quality of life

H. Economy — SCTool

H4 ICT infrastructure

H4.1 Fixed Broadband Subscriptions

Intent: To assess the access to information and technology connectivity

Indicator	Unit of Measure
Percentage of households with fixed (wired) broadband	%

Assessment Methodology:

1. Calculate the number of fixed broadband subscriptions in the city

(A) - numerator

2. Calculate the total number of households in the city

(B) - denominator

3. Calculate the value of the indicator as

A/B (%)

Standard: -

Reference: UNECE - Collection Methodology for Key Performance Indicators for Smart Sustainable Cities

H. Economy

SCTool

H4 ICT infrastructure

H4.2 Wireless Broadband Coverage

Intent: To assess the access to information and technology connectivity

Indicator	Unit of Measure
Percentage of the city served by wireless broadband (3G, 4G, 5G)	%

Assessment Methodology:

1. Calculate the area of city covered by mobile services (km2)

(A) - numerator

2. Calculate the Total area of the city (km2)

(B) - denominator

3. Calculate the value of the indicator as

A/B (%)

Note: each service should be reported on separately (3G and 4G)

Standard:

-

Reference:
UNECE - Collection Methodology for Key Performance Indicators for Smart Sustainable Cities

H. Economy

SCTool

H4 ICT infrastructure

H4.3 Availability of WIFI in Public Areas

Intent: To increase access to internet at little or no cost

Indicator	Unit of Measure
Number of public WIFI hotspots in the city per 1000 inhabitants	n/1000 inhabitants

Assessment Methodology:

1. Calculate the total number of WIFI hotspots provided by the city administration

(A) - numerator

2. Calculate the one 1.000 of the city's total population

(B) - denominator

3. Calculate the value of the indicator as

A/B

Standard:

-

Reference:
UNECE - Collection Methodology for Key Performance Indicators for Smart Sustainable Cities

H. Economy

SCTool

H4 ICT infrastructure

H4.4 Mobile phone subscriptions

Intent: T o evaluate the levels of telecommunication technology, information, communication technology and innovation

Indicator	Unit of Measure
Total number of mobile phone subscriptions in the area divided by one 1000th of the area's total population	n/1000 inhabitants

Assessment Methodology:

1. Calculate the total number of mobile phone connections in the city

(A) - numerator

2. Calculate the one 1.000th of the city's total population

(B) - denominator

3. Calculate the value of the indicator as

A/B

Standard:

-

Reference:
ISO 37120: Sustainable cities and communities - Indicators for city services and quality of life

I. Climate change: mitigation and adaptation

Description of the Information
I: Issue.
Ix: Category.
I1: Climate change mitigation.
I2: Adaptation to the climatic action: heatwaves and increase of temperature.
I3: Adaptation to the climatic action: pluvial flood.
I4: Adaptation to the climatic action: fluvial and coast flood.
I5: Adaptation to the climatic action: drought .
I6: Adaptation to the climatic hazard: wildfire .

Ix.x : Criterion.

Intent: Description of the objective of the criterion.
Indicator: Name of the indicator to be calculated.
Unit of Measure: Measuring unit of each indicator.
Standard: The calculation standard for the criterion.
References: The acquiring source of information.

★ Key Performance Indicator

I. Climate change: mitigation and adaptation — SCTool

I1 Climate change mitigation

I1.1 Greenhouse gas emissions

Intent: To assess the adverse contribution the city is making to climate change

Indicator	Unit of Measure
Total amount of greenhouse gases (equivalent carbon dioxide units) generated over a calendar year for all sectors, divided by the current city population	t CO^2 eq. / inhabitant /yr

Assessment Methodology:

1. Calculate the total amount of greenhouse gases in tonnes (equivalent carbon dioxide units) generated over a calendar year by all activities within the city, including indirect emissions outside city boundaries

(A) - numerator

2. Calculate the current population of the city

(B) - denominator

3. Calculate the value of the indicator as

A/B

Standard: -

Reference: ISO 37120: Sustainable cities and communities - Indicators for city services and quality of life

I. Climate change: mitigation and adaptation — SCTool

I1 Climate change mitigation

I1.2 CO^2 sequestration

Intent: To promote the CO^2 sequestration in the city

Indicator	Unit of Measure
Potential CO2 sequestration in the city per he	$tepCO^2$/he

Assessment Methodology:

1. Calculate the amount of CO2 sequestration in the city

(A) - numerator

2. Calculate the area of the city (he)

(B) - denominator

3. Calculate the value of the indicator as

A/B

Standard: -

Reference: CESBA Alps project

I. Climate change: mitigation and adaptation — SCTool

I2 Adaptation to the climatic action: heatwaves and increase of temperature

I2.1 Albedo

Intent: To estimate the extent of the Urban Heat Island effect in the city

Indicator	Unit of Measure
Mean Solar Reflectance Index of paved surfaces and roofs in the area	SRI

Assessment Methodology:

1. Identify the boundaries of the area being assessed

2. Obtain records of local ambient temperatures and wind speeds during summer conditions over a 3-year period

3. Obtain similar data for the larger urban region

4. Identify differences between the local and regional UHI effects

5. Identify factors in configuration of buildings, vegetation, surface albedo and other local factors that may explain the differences

Standard: -

Reference: CESBA MED Project – SNTool assessment system

I. Climate change: mitigation and adaptation — SCTool

I3 Adaptation to the climatic action: pluvial flood

★ I3.1 Permeability of land

Intent: To improve the permeability of the area

Indicator	Unit of Measure
Percentage of weighted ground permeability	%

Assessment Methodology:

1. Calculate the size (Sa) of the city area (m2)

2. Calculate the size of the surfaces with a different paving or occupied by constructions in the city area (i.e. green areas, surfaces paved with asphalt, surfaces occupied by buildings, etc.). Include all the surfaces in the city

Standard: -

Reference: CESBA MED Project – SNTool assessment system

I. Climate change: mitigation and adaptation — SCTool

I4 Adaptation to the climatic action: fluvial and coastal flood

I4.1 Flood risk

Intent: To assess flood risk of the city

Indicator	Unit of Measure
Percentage of population exposed to flood risk	%

Assessment Methodology:

1. Calculate the number of inhabitants exposed to a flood risk with medium probability in the city

(A) - numerator

2. Calculate the total population of the city

(B) - denominator

3. Calculate the value of the indicator as

A/B (%)

Standard: -

Reference: Reference Framework for Sustainable Cities - RFSC

I. Climate change: mitigation and adaptation — SCTool

I5 Adaptation to the climatic action: drought

I5.1 Rainwater collection and storage from buildings for non-potable uses

Intent: To promote rainwater collection for re-use

Indicator	Unit of Measure
Share of buildings in the city with a rainwater collection system	%

Assessment Methodology:

1. Calculate the number of buildings in the city with a rainwater collection system

(A) - numerator

2. Calculate the total number of buildings in the city

(B) - denominator

3. Calculate the value of the indicator as

A/B (%)

Standard: -

Reference: CESBA MED Project – SNTool assessment system

I. Climate change: mitigation and adaptation — SCTool

I5 Adaptation to the climatic action: drought

I5.2 Local vegetation

Intent: To promote the use of local vegetation

Indicator	Unit of Measure
Share of landscape (green areas) plated with local vegetation	%

Assessment Methodology:

1. Calculate the extent of green areas planted with local vegetation in the city

(A) - numerator

2. Calculate the total extent of green areas in the city

(B) - denominator

3. Calculate the value of the indicator as

A/B (%)

Standard: -

Reference: CESBA MED Project – SNTool assessment system

1. Climate change: mitigation and adaptation

SCTool

16 Adaptation to the climatic hazard: wildfire

16.1 Wildfire risk

Intent: To assess wildfire risk of the city

Indicator	Unit of Measure
Percentage of population exposed to wildfire risk	%

Assessment Methodology:

1. Calculate the amount of population exposed to wildfire risk in the city

(A) - numerator

2. Calculate the total population of the city

(B) - denominator

3. Calculate the value of the indicator as

A/B (%)

Standard: -

Reference: -

J. Governance

Description of the Information
J: Issue.
Jx : Category.

J1: Urban Planning.

J2: Management and community involvement .

J3: Public buildings operation.

Jx.x : Criterion.

Intent: Description of the objective of the criterion.

Indicator: Name of the indicator to be calculated.

Unit of Measure: Measuring unit of each indicator.

Standard: The calculation standard for the criterion.

References: The acquiring source of information.

★ Key Performance Indicator

J. Governance — SCTool

J1 Urban Planning

J1.1 Community involvement in urban planning activities

Intent: To raise the level of community involvement in planning through the redistribution of power

Indicator	Unit of Measure
Percentage of residents active in public urban planning	Level

Assessment Methodology:

Use of the Sherry Arnstein ladder on citizen participation. Rate the level of users' involvement on planning.

SCORE -1 (LEVEL 1) Non-participation or manipulation and therapy (in the Arnstein ladder).

SCORE 0 (LEVEL 2) Degrees of tokenism: Information / Consultation / Placation (in the Arnstein ladder).

SCORE 3 (LEVEL 3) Degrees of citizen power: Partnership, delegated power and citizen power (in the Arnstein ladder) in one phase, like diagnosis or after delivery.

SCORE 5 (LEVEL 4) Degrees of citizen power: Partnership, delegated power and citizen power (in the Arnstein ladder), at every stages.

Standard: Sherry Arnstein

Reference: CESBA MED Project – SNTool assessment system

J. Governance — SCTool

J3 Public buildings operation

J3.2 Operating energy costs for public buildings

Intent: To evaluate the operational energy costs amount for public buildings

Indicator	Unit of Measure
Aggregated annual operating energy cost per aggregated indoor useful floor area	€/m²/yr

Assessment Methodology:

1. Calculate the aggregated annual operating energy cost per aggregated indoor useful floor area (m²)

Standard: -

Reference: CESBA MED Project – SNTool assessment system

J. Governance — SCTool

J3 Public buildings operation

J3.3 Energy consumption of public buildings

Intent: To evaluate the energy efficiency of public buildings

Indicator	Unit of Measure
Total end use of energy in public buildings within a city divided by total indoor useful area of these buildings	kWh/m²

Assessment Methodology:

1. Calculate the total end use of energy in public buildings within the city (kWh)

(A) - numerator

2. Calculate the total indoor useful area of these buildings (m²)

(B) - denominator

3. Calculate the value of the indicator as

A/B

Standard: -

Reference: CESBA MED Project – SNTool assessment system

J. Governance — SCTool

J2 Management and community involvement

J2.1 Involvement of residents in community affairs

Intent: To promote involvement of citizens in community affairs

Indicator	Unit of Measure
Percentage of resident population above 16 years having an involvement in community affairs	%

Assessment Methodology:

1. Calculate the amount of resident population above 16 years having an involvement in community affairs

(A) - numerator

2. Calculate the total population above 16 years of the city

(B) - denominator

3. Calculate the value of the indicator as

A/B (%)

Standard: -

Reference: CESBA MED Project – SNTool assessment system

J. Governance — SCTool

J3 Public buildings operation

J3.1 Public buildings sustainability

Intent: To evaluate the number of buildings with a certification label

Indicator	Unit of Measure
Percentage area of public buildings with recognized sustainability certifications for ongoing operations	%

Assessment Methodology:

1. Calculate the floor area of public buildings with certification to a recognized standard for ongoing building operation (m²)

(A) - numerator

2. Calculate the total floor area of public buildings (m²)

(B) - denominator

3. Calculate the value of the indicator as

A/B (%)

Standard: -

Reference: UNECE - Collection Methodology for Key Performance Indicators for Smart Sustainable Cities

J. Governance — SCTool

J4 Equity

J4.1 Women elected to city level office

Intent: To assess the opportunity in labour for leading positions of women

Indicator	Unit of Measure
Total number of elected city-level positions held by women divided by the total number of elected city-level positions	%

Assessment Methodology:

1. Calculate the total number of elected city-level positions held by women

(A) - numerator

2. Calculate the total number of elected city-level positions

(B) - denominator

3. Calculate the value of the indicator as

A/B (%)

Standard: -

Reference: ISO 37120: Sustainable cities and communities - Indicators for city services and quality of life

4.Key performance indicators

Definition:

KPIs are a set of assessment criteria that during the contextualisation process must be included in the local versions of the SCTool MED.

There are 10 key performance indicators :

A. Use of land and biodiversity: 1
B. Energy: 2
C. Water: 1
D. Solid waste: 1
E. Environmental quality: 1
F. Transportation and mobility: 2
G. Social aspects: 0
H. Economy: 0
I. Climate change: mitigation and adaptation: 2
J. Governance: 0

A. Use of land and biodiversity

SCTool

A2 Green urban areas

★A2.1 Availability of Green Urban Areas

Intent: To facilitate climate change adaptation and mitigation, to improve health and quality of life, favoring biodiversity conservation

Indicator	Unit of Measure
Proportion of all vegetated areas within the city boundaries in relation to the total area	%

Assessment Methodology:

1. Calculate total amount of Green Urban Areas in the city's boundaries

(A) - numerator

2. Calculate the total area of the city

(B) - denominator

3. Calculate the value of the indicator as

A/B (%)

Note: A Green Urban Area is defined as an urban land covered by vegetation of any kind, for instance natural zones, parks, public and private garden.

Standard:

-

Reference:

IEFCA – Calculation Guideline

B. Energy

SCTool

B2 Energy Consumptions

★B2.1 Final energy consumption

Intent: To estimate the final energy consumption for all energy sectors.

Indicator	Unit of Measure
Total final energy consumed by a city divided by the total population of the city	MWh/inhabitant/yr

Assessment Methodology:

1. Calculate the final energy consumption for all energy sectors in MWh

(A) - numerator

2. Calculate the total population of the city

(B) - denominator

3. Calculate the value of the indicator as

A/B

Standard:

-

Reference:

ISO 37120: Sustainable cities and communities - Indicators for city services and quality of life

B. Energy

SCTool

B3 Renewable energy

★B3.1 Final energy derived from renewable sources

Intent: To incentive the consumption and production of renewable energy

Indicator	Unit of Measure
Share of renewable energies in final energy demand	%

Assessment Methodology:

1. Calculate the total consumption of end-use energy generated from renewable sources for all energy sectors MWh

(A) - numerator

2. Calculate the total final energy demand MWh

(B) - denominator

3. Calculate the value of the indicator as

A/B (%)

Standard:

-

Reference:

CESBA MED Project - SNTool Assessment System.

C. Water

SCTool

C2 Water consumption

★C2. 1 Total water consumption

Intent: To evaluate water resources in the city

Indicator	Unit of Measure
Total amount of the city's daily water consumption divided by the total city population	L/day/person

Assessment Methodology:

1. Calculate the total amount of the city's water consumption in litres per day

(A) - numerator

2. Calculate the total city population

(B) - denominator

3. Calculate the value of the indicator as

A/B

Note: the scope of the indicator includes the use of potable water for:

- Drinking
- Bathing
- Washing
- Gardening
- Commercial
- Industrial
- Agricultural

Standard:

-

Reference:

ISO 37120: Sustainable cities and communities - Indicators for city services and quality of life

D. Solid waste

SCTool

D2 Solid waste management

★D2.2 Solid waste recycling

Intent: To improve separate collection disposal, avoiding burning waste

Indicator	Unit of Measure
Total amount of solid waste that is recycled divided by the total amount of solid waste produced in the city	%

Assessment Methodology:

1. Calculate the total amount of the city's solid waste that is recycled in tonnes

(A) - numerator

2. Calculate the total amount of solid waste produced in the city in tonnes in the city

(B) - denominator

3. Calculate the value of the indicator as

A/B (%)

Note: Recycled materials shall refer to those materials diverted from the waste stream, recovered and processed into new products following local government permits and regulations.

Standard:
-

Reference:
UNECE - Collection Methodology for Key Performance Indicators for Smart Sustainable Cities

E. Environmental quality

SCTool

E1 Air quality

★E1. 1 Fine particulate matter (PM2.5) concentration

Intent: To evaluate the quality of the air through the exceeded daily limits of pollutants (PM2.5)

Indicator	Unit of Measure
Annual average fine particulate matter (PM2.5) concentration	$\mu g/m^3$

Assessment Methodology:

1. Collect the annual mean of PM2.5 concentration values measured over one year by each monitoring station installed in the city's boundaries

2. Calculate the average of the values collected in the previous step as the sum of the annual mean PM2.5 concentration values

(A) - numerator

3. Calculate the number of monitoring stations

(B) - denominator

4. The result shall be expressed as the concentration of PM2.5 in micrograms per standard cubic metre ($\mu g/m^3$)

Standard:
-

Reference:
ISO 37120: Sustainable cities and communities - Indicators for city services and quality of life

F1 Performance of mobility services

★F1. 1 Public transport network

Intent: To assess city's transportation network availability

Indicator	Unit of Measure
Length of public transport system per 1000 population	km/1000 inhabitants

Assessment Methodology:

1. Calculate the total length (in kilometres) of the public transport systems operating within the city

(A) - numerator

2. Calculate the one 1.000th of the city's total population

(B) - denominator

3. Calculate the value of the indicator as

A/B

Standard:
-

Reference:
ISO 37120: Sustainable cities and communities - Indicators for city services and quality of life

F2 Green mobility

★F2. 4 Bicycle network

Intent: To emphasise the use of bicycles as method to reduce traffic congestion and pollution

Indicator	Unit of Measure
Total length of bicycle paths and lanes divided by the city's total population	m/inhabitant

Assessment Methodology:

1. Calculate total length of bicycle paths/lanes in the city

(A) - numerator

2. Estimate/Calculate the total city's population

(B) - denominator

3. Calculate the value of the indicator as

A/B

Standard:
-

Reference:
UNECE - Collection Methodology for Key Performance Indicators for Smart Sustainable Cities

I1 Climate change mitigation

★I1.1 Greenhouse gas emissions

Intent: To assess the adverse contribution the city is making to climate change.

Indicator	Unit of Measure
Total amount of greenhouse gases (equivalent carbon dioxide units) generated over a calendar year for all sectors, divided by the current city population	t CO^2 eq. / inhabitant /yr

Assessment Methodology:

1. Calculate the total amount of greenhouse gases in tonnes (equivalent carbon dioxide units) generated over a calendar year by all activities within the city, including indirect emissions outside city boundaries

(A) - numerator

2. Calculate the current population of the city

(B) - denominator

3. Calculate the value of the indicator as

A/B

Standard:

-

Reference:

ISO 37120: Sustainable cities and communities - Indicators for city services and quality of life

I1 Adaptation to the climatic action: pluvial flood

★I3.1 Permeability of land

Intent: To improve the permeability of the area

Indicator	Unit of Measure
Percentage of weighted ground permeability	%

Assessment Methodology:

1. Calculate the size (Sa) of the city area (m^2)

2. Calculate the size of the surfaces with a different paving or occupied by constructions in the city area (i.e. green areas, surfaces paved with asphalt, surfaces occupied by buildings, etc.). Include all the surfaces in the city area so that:

Sa = total surface of the city area
Sa,i = surface i-th in the city area (m^2)

3. Calculate the real permeability of soil considering the permeability coefficient of each surface.

Sa,i = i-th surface in the city area (m^2)
αi= permeability coefficient of the i-th surface

4. Calculate the indicator's value as:

Note:

Reference permeability coefficients:
- Grass = 1
- Gravel = 0,9
- Sand = 0,9
- Plastic gratings filled with land/grass = 0,8
- Concrete gratings leaning on the grass = 0,6
- Concrete gratings leaning on gravel = 0,6
- Interlocking elements leaning on sand = 0,3
- Interlocking elements leaning on gravel = 0,3
- Interlocking elements leaning on concrete pavement = 0
- Continuous pavements leaning on concrete = 0
- Asphalt = 0

Standard:

-

Reference:

CESBA MED Project - SNTool Assessment System.

5.SMC passport

Sustainable MED cities passport

Definition:

The Passport template is a graphical visualisation of the main information concerning the assessment and it includes two different pages.
The first one contains general information as well as maps and significant images, in order to better represent the features of the analysis.
The second page of the Passport contains the list of the Key Performance Indicators, together with their code, criterion, unit of measure and value.

Observation:

The sustainability score produced by SMC rating system is valid only for the specific geographical area, as it reflects the local priorities and construction practice.

In order to be able to compare the sustainability performance between buildings, neighborhoods or cities in the different Mediterranean regions, it is necessary to use indicators expressed in absolute values instead of scores.

Name of the Pilot City

Name: .....

Total area (km2): .....

Country: .....

City: .....

MAP

SMC Passport City

Short Description

.....

.....

.....

.....

IMAGE

Demography

Population	.....Inhab
Urban residential density	.....Inhab/ha
Population working in the area	.....Persons
Other info	.....

Climate

Annual precipitation	.....mm
Solar irradiance on horizontal	.....kWh/m²y
Winter / summer design temperature	.....ºC
Heating degree days (base 18ºC)	.....HDD

Building Stock

Number of buildings in the area	.....number
Gross area of residential Buildings	.....m²
Gross area office buildings	.....m²
Gross area of retail/ Commercial buildings	.....m²
Total gross area of all buildings	.....m²
Total gross area of buildings constructed before 1975	.....m²
Average building density (total m2/ land surface in m2)	.....number

Use of land and morphology

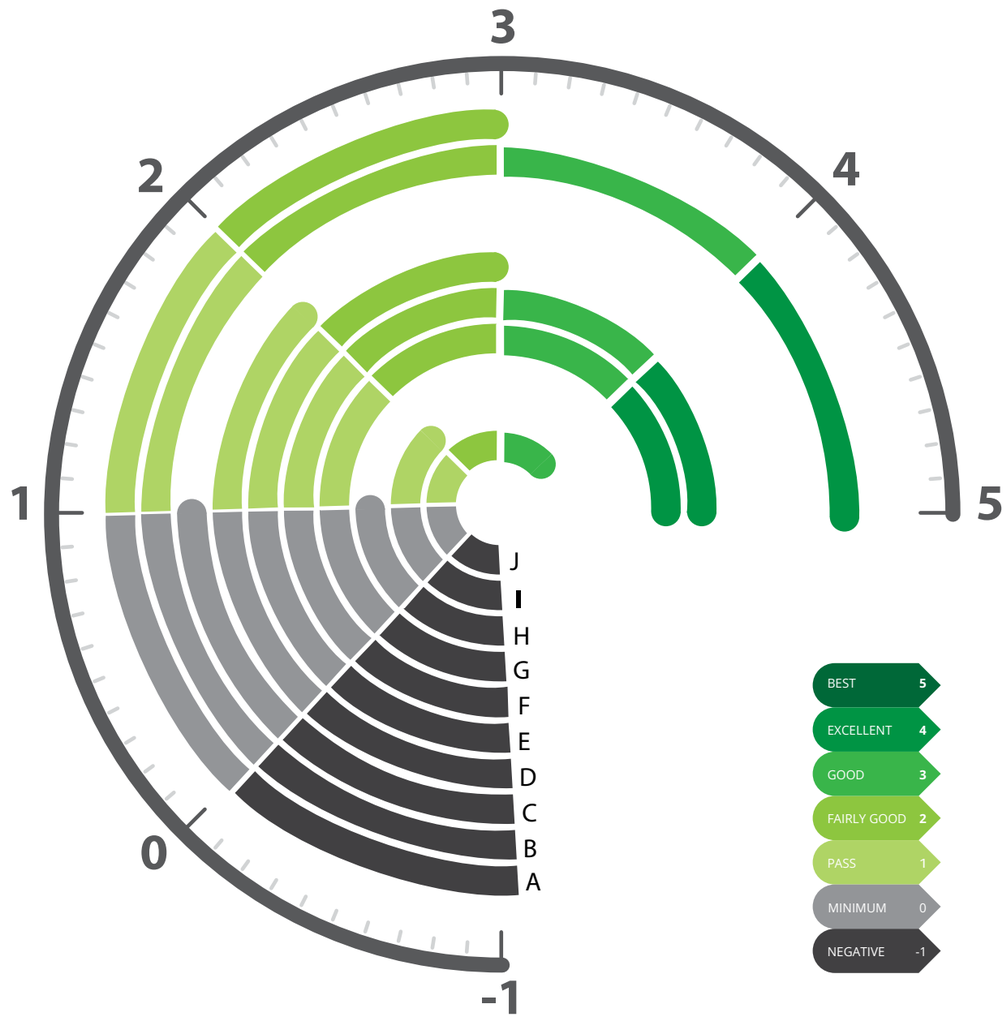
Percentage of consumed land area	.....%
Total lenght of urban streets with sidewalks	.....km
Total lenght of bicycles lanes	.....m
Other relevant info	.....

SMC Key Performance Indicators

Sustainable MED Cities

CODE	CRITERIA	INDICATOR	VALUE	UNIT
A2.1	Availability of green urban areas	Total amount of green urban areas in the city's boundaries divided by the total area of the city	.....	%
B2.1	Final energy consumption	Total final energy consumed by a city divided by the total population of the city	.....	MWh/inhabitant/yr
B3.1	Final energy derived from renewable sources	Share of renewable energies in final energy demand	.....	%
C2.1	Total water consumption	Total amount of the city's daily water consumption divided by the total city population	.....	L/day/person
D2.2	Solid waste recycling	Total amount of solid waste that is recycled divided by the total amount of solid waste produced in the city	.....	%
E1.2	Particulate matter (PM10) concentration	Annual average fine particulate matter (PM10) concentration	.....	µg/m³
F1.1	Public transport network	Length of public transport system per 1000 population	.....	km/1000 inhabitants
F2.4	Bicycle network	Total length of bicycle paths and lanes divided by the city's total population	.....	m/inhabitant
I1.1	Greenhouse gas emissions	Total amount of greenhouse gases (equivalent carbon dioxide units) generated over a calendar year for all sectors, divided by the current city population	.....	t $CO_{2\,eq}$/inhabitant/yr
I3.1	Permeability of land	Percentage of weighted ground permeability.	.....	%

Visualisation of the sustainability assessment results



	Score	Weight	
A Use of land and biodiversity	3,1	11,2%	0,34
B Energy	5	27%	1,35
C Water	1,1	20%	0,22
D Solid Waste	2,2	2,7%	0,05
E Environmental quality	3,2	10,5%	0,33
F Transportation and mobility	5	10%	0,5
G Social Aspects	5	4,4%	0,22
H Economy	1,1	2%	0,02
I Climate Change: mitigation and adaptation	2,4	8,6%	0,2
J Governance	4,2	3,6%	0,15
		100%	3,38

Sustainability Assessmet Results

The document summarises the scores achieved in each issue of the assessment system, giving the final score of the sustainability.

Scores are then illustrated using a tachometer with a graduated scale which goes from the -1 (negative performance) to the 5 points (best performance).

The Certificate template is a graphic label which allows, in a visual way, to understand the sustainability performance obtained by the neighbourhood.

6.References

CESBA MED – Sustainable MED Cities
https://cesba-med.interreg-med.eu/

In-Depth Report: Indicators for Sustainable Cities. Science for Environment Policy. European Commission. https://ec.europa.eu/environment/integration/research/newsalert/index_en.htm.

City sustainability Indicators - World Bank - Urban Development and Local Government

Riccaboni, A., Sachs, J., Cresti, S., Gigliotti, M., Pulselli, R.M. (2020): Sustainable Development in the Mediterranean. Report 2020. Transformations to achieve the Sustainable Development Goals. Siena: Sustainable Development Solutions Network Mediterranean (SDSN Mediterranean).

Istanbul Environment Friendly City Award
https://www.unep.org/unepmap/istanbul-environment-friendly-city-award.

Arnstein, Sherry R. "A Ladder of Citizen Participation," JAIP, Vol. 35, No. 4, July 1969.

SCTool MED

Sustainable Cities Tool

https://www.enicbcmed.eu/projects/sustainable-med-cities