

SMART CITIES: SELECTION OF INDICATORS FOR VITÓRIA

Carolina Simões Rocon
Cristina Engel de Alvarez

Laboratory of Planning and Projects
Federal University of Espírito Santo | Brazil



Organisers:



International Co-owners:

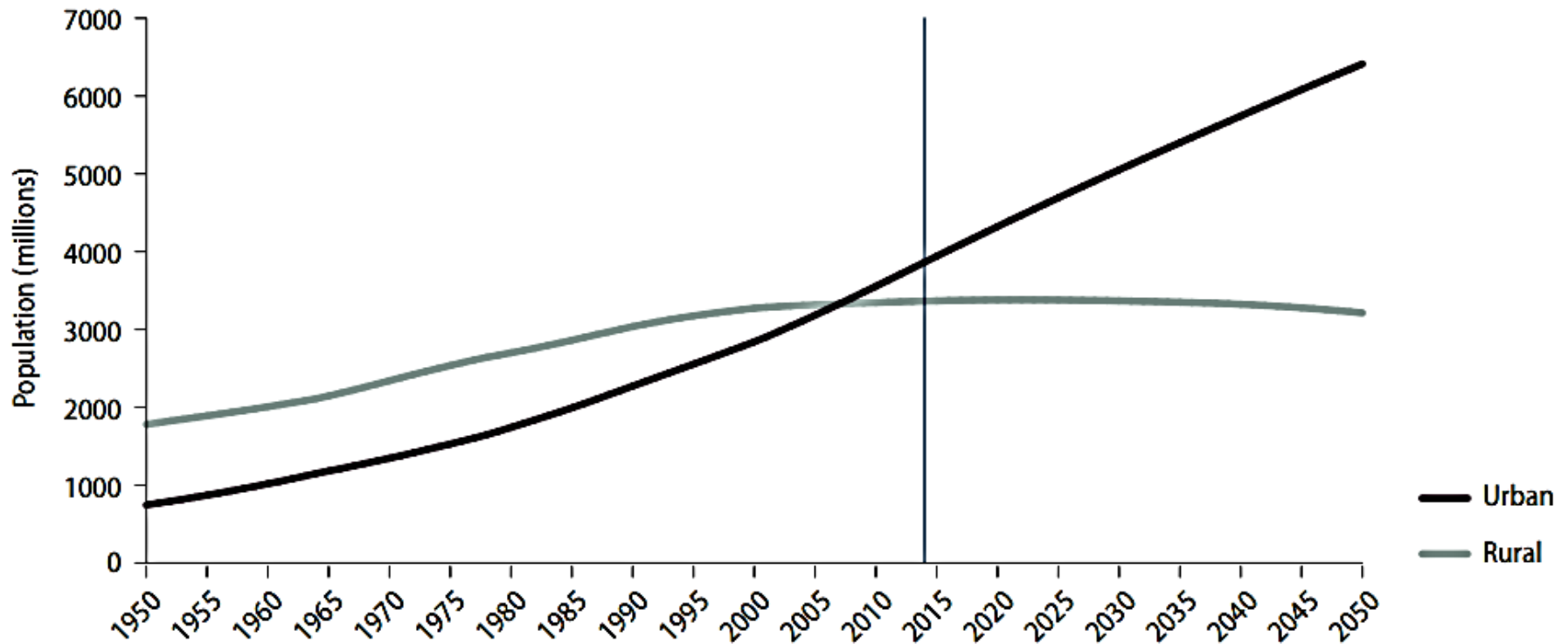


Sustainable Buildings and Climate Initiative
Promoting Policies and Practices for Sustainability



Global Alliance
for Buildings and
Construction

Introduction



Introduction

2014
Urban population



World
54%



Brazil
85%



Introduction



Organisers:



International Co-owners:



Introduction

**VITÓRIA,
BRAZIL**



Organisers:



International Co-owners:



Introduction

100%

Urbanised Territory



Organisers:



International Co-owners:



Introduction

Population Density

+ 3,000

inhabitants /km²



Organisers:



International Co-owners:

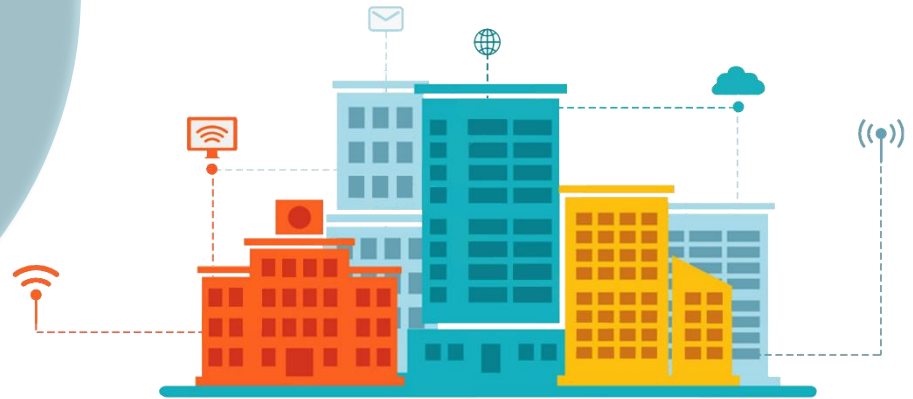


Sustainable Buildings and Climate Initiative
Promoting Policies and Practices for Sustainability

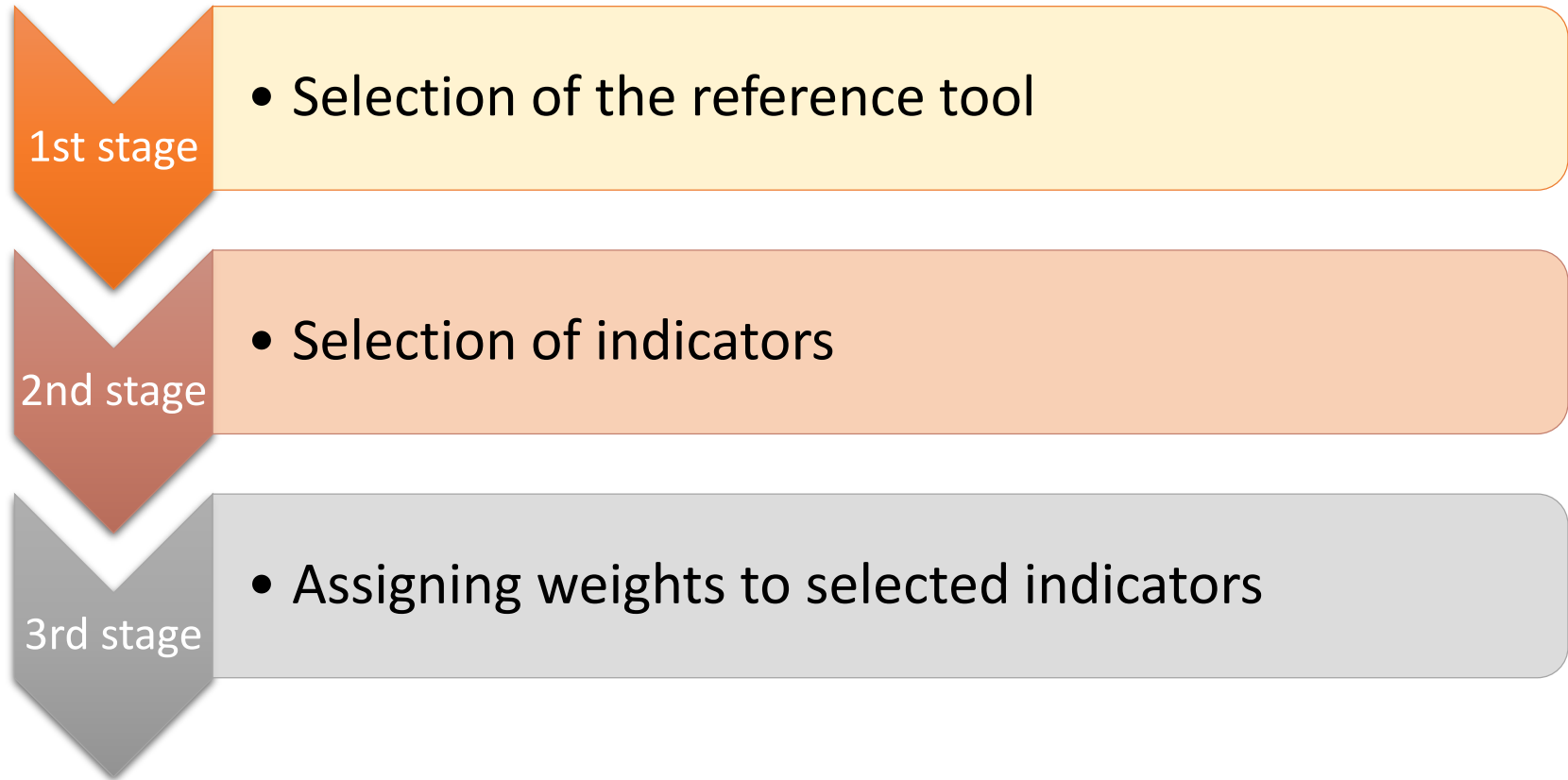


Objective

To select and assign weights to assessment indicators for Vitória, according to the Smart City concept



Methodology



Organisers:



International Co-owners:



Sustainable Buildings and Climate Initiative
Promoting Policies and Practices for Sustainability



Global Alliance
for Buildings and
Construction

Methodology

1st
stage

Selection of the reference tool

Smart Cities tools



Sustainability tools



Organisers:



International Co-owners:



Sustainable Buildings
and Climate Initiative
Promoting Policies and Practices for Sustainability



Global Alliance
for Buildings and
Construction

Methodology

1st
stage

Selection of the reference tool criteria

Developed for assessment of Smart Cities

Free access to assessment methodology

World-wide
recognition

Developed in Brazil

Academic
relevance

Relevance of the criteria
for the research



Suitability of the tool to the
criterion

Methodology

1st
stage

Selection of the reference tool

European Smart Cities Tool

- European medium-sized cities, with populations between 100,000 and 500,000 people;
- 74 indicators;
- Key features: economy, people, governance, mobility, environment and living.



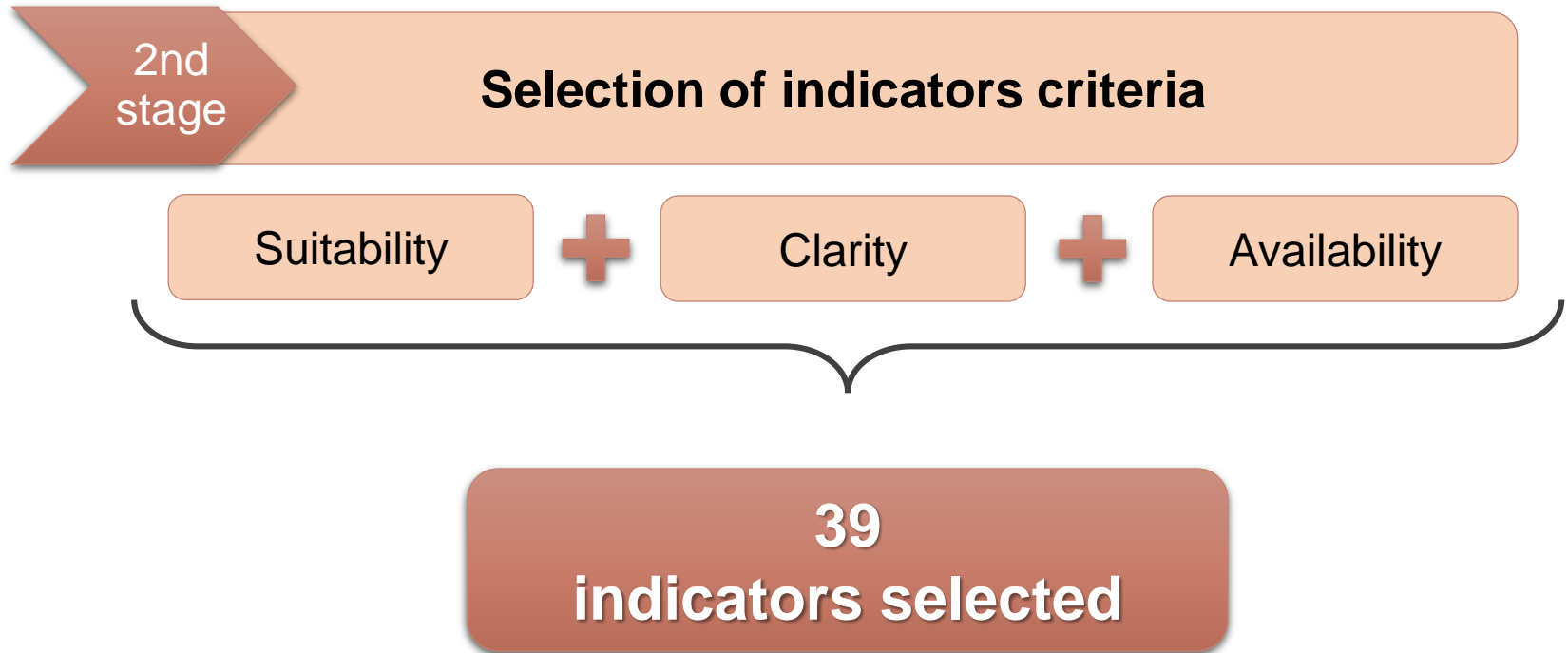
Organisers:



International Co-owners:



Methodology



Methodology

3rd
stage

Assigning weights criteria

Direct or partial relationship with the strategies themes
of Vitória's Agenda

Economy

Urban-
Environmental

Sociocultural



Organisers:



International Co-owners:



Sustainable Buildings
and Climate Initiative
Promoting Policies and Practices for Sustainability



Global Alliance
for Buildings and
Construction

Methodology

3rd
stage

Assigning weights to selected indicators

Evaluate the relationship of each indicator with the Vitória Agenda themes, considering its direct or partial affinity

$$CM_i = ADR_i \times 2 + APR_i \times 1$$

Calculate the weight in contribution percentage for the scoring of each key feature

$$IW_i = \frac{CM_i}{\sum_i CM_i}$$

Results

Keys

| | |
|-----|--------------------------|
| DR | Directly Related |
| PR | Partially Related |
| E | Economical axis |
| S | Sociocultural axis |
| U | Urban-environmental axis |
| ADR | Amount Directly Related |
| APR | Amount Partially Related |
| CM | Calculation Method |
| IW | Indicator Weighting |



Organisers:



International Co-owners:



Sustainable Buildings and Climate Initiative
Promoting Policies and Practices for Sustainability



Global Alliance
for Buildings and
Construction

Results

| Factor | Indicator | Adapted Indicator | DR | ADR | PR | APR | CM | IW | |
|---------|------------------------------|--|---|-----|----|-----|----|----|--------|
| ECONOMY | Innovative spirit | R&D expenditure in % of GDP | State government investment in Science & Techonology/State budget | E | 1 | S | 1 | 3 | 13.64% |
| | | Employment rate in knowledge-intensive sectors | Proportion of workers in STEM occupations (Science, Technology, Engineering, Mathematics) | E | 1 | S | 1 | 3 | 13.64% |
| | | Patent applications per inhabitant | Patents registered in ES year/100,000 Inhabitants | E | 1 | - | 0 | 2 | 9.09% |
| | Entrepreneurship | Self-employment rate | Self-employed workers/Total workers | E | 1 | - | 0 | 2 | 9.09% |
| | | New businesses registered | New companies registered | E | 1 | - | 0 | 2 | 9.09% |
| | Productivity | GDP per employed person | GDP per capita | E | 1 | - | 0 | 2 | 9.09% |
| | Flexibility of labour market | Unemployment rate | Unemployment rate | E+S | 2 | - | 0 | 4 | 18.18% |
| | International embeddedness | Air transport of passengers | Embarked and disembarked passengers/Year | E | 1 | - | 0 | 2 | 9.09% |
| | | Air transport of freight | Participation in national freight handling (t)/Year | E | 1 | - | 0 | 2 | 9.09% |

Results

| Factor | Indicator | Adapted Indicator | DR | A DR | PR | A PR | CM | IW |
|------------------------------------|---|---|----|------|----|------|----|--------|
| Attractivity of natural conditions | Sunshine hours | Annual solar radiation (hours) | - | 0 | U | 1 | 1 | 7.14% |
| | Green spaceshare | Total square meters of green area per capita (annual measure) | U | 1 | - | 0 | 2 | 14.29% |
| Pollution | Particulate matter | Annual daily average of PM10 concentrations ($\mu\text{g}/\text{m}^3$) | U | 1 | - | 0 | 2 | 14.29% |
| | Fatal chronic lower respiratory diseases per inhabitant | Number of deaths from respiratory diseases per 10,000 inhabitants | S | 1 | U | 1 | 3 | 21.43% |
| Sustainable resource management | Efficient use of water (use per GDP) | Average estimated water consumption in $\text{m}^3/\text{inhabitant}$, per month | U | 1 | E | 1 | 3 | 21.43% |
| | Efficient use of electricity (use per GDP) | Average consumed electricity, in $\text{kwh}/\text{inhabitant}$, per month | U | 1 | E | 1 | 3 | 21.43% |

ENVIRONMENT



Organisers:



International Co-owners:



Sustainable Buildings and Climate Initiative
Promoting Policies and Practices for Sustainability



Global Alliance for Buildings and Construction

Results

| Factor | Indicator | Adapted Indicator | DR | A DR | PR | A PR | CM | IW | |
|--------|--------------------------|---|---|---------|----|---------|----|----|--------|
| LIVING | Cultural facilities | Theatre attendance per inhabitant | Audience of the National Theatre Festival of Vitória/1,000 Inhabitants | S | 1 | - | 0 | 2 | 8.70% |
| | | Life expectancy | Life expectancy at birth | S | 1 | - | 0 | 2 | 8.70% |
| | | Hospitals beds per inhabitant | Inpatient beds in public and private health facilities/1,000 Inhabitants | S | 1 | - | 0 | 2 | 8.70% |
| | Health conditions | Doctors per inhabitant | Number of doctors/10,000 Inhabitants | S | 1 | - | 0 | 2 | 8.70% |
| | | Satisfaction with quality of health system | Positive assessment of emergency care at home or hospitalization for 24 hours or more by the public health system (SUS) | S | 1 | - | 0 | 2 | 8.70% |
| | Individual security | Crime rate | Homicides per 100,000 Inhabitants | S | 1 | - | 0 | 2 | 8.70% |
| | | Death rate by assault | Armed robbery per 100,000 Inhabitants | S | 1 | - | 0 | 2 | 8.70% |
| | Housing quality | Share of housing fulfilling minimal standards | Percentage of households served by the sanitation system network | U | 1 | S | 1 | 3 | 13.04% |
| | Touristic attractiveness | Overnights per year per resident | Hotel occupancy rate | E | 1 | S | 1 | 3 | 13.04% |
| | Economic welfare | Poverty rate | Incidence of poverty | E | 1 | S | 1 | 3 | 13.04% |



Organisers:



International Co-owners:



Sustainable Buildings and Climate Initiative
Promoting Policies and Practices for Sustainability



Results

| Factor | Indicator | Adapted Indicator | DR | A DR | PR | A PR | CM | IW | |
|----------|--|---|--|---------|----|---------|----|----|--------|
| MOBILITY | (Inter-) national accessibility | International accessibility | Existing ports and airports | E | 1 | U+S | 2 | 4 | 23.53% |
| | | Computers in households | Households with computers | E+S | 2 | - | 0 | 4 | 23.53% |
| | Availability of ICT-Infrastructure | Broadband internet access in households | Percentage of households with access to broadband internet, compared to total households | E+S | 2 | - | 0 | 4 | 23.53% |
| | Sustainable, innovative and safe transport systems | Green mobility share (non-motorized individual traffic) | Motorization rate (Vehicles/100 Inhabitants) | U | 1 | - | 0 | 2 | 11.76% |
| | | Traffic safety | Total number of traffic accidents (with or without victims) | U | 1 | S | 1 | 3 | 17.65% |

Results

| Factor | Indicator | Adapted Indicator | DR | A DR | PR | A PR | CM | IW | |
|--------|-----------------------------|---|--|---------|----|---------|----|----|--------|
| PEOPLE | Level of qualification | Importance as knowledge centre (top research centres, top universities, etc.) | Ratio of students enrolled in high-quality courses (4 and 5 ENADE scores) | S | 1 | E | 1 | 3 | 27.27% |
| | | Population qualified at levels 5-6 ISCED | Percentage of population with 13 or more years of schooling | S | 1 | E | 1 | 3 | 27.27% |
| | Social and ethnic plurality | Share of foreigners | Foreigners living in the state/10,000 Inhabitants | - | 0 | S | 1 | 1 | 9.09% |
| | | Share of nationals born abroad | Naturalised foreigners living in the state/10,000 Inhabitants | - | 0 | S | 1 | 1 | 9.09% |
| | Creativity | Share of people working in creative industries | Ratio of workers in STEM occupations (Science, Technology, Engineering, Mathematics) | E | 1 | S | 1 | 3 | 27.27% |

Results

| Factor | Indicator | Adapted Indicator | DR | A DR | PR | A PR | CM | IW |
|------------|----------------------------------|--|--|------|-------|------|----|--------|
| GOVERNANCE | Participation in decision-making | City Council representatives per inhabitant | - | 0 | E+S+U | 3 | 3 | 23.08% |
| | | Share of female city representatives | - | 0 | S | 1 | 1 | 7.69% |
| | Public and social services | Expenditure of the municipal per resident in PPS | E+S+U | 3 | - | 0 | 6 | 46.15% |
| | | Share of children in day care | Percentage of enrolment compared to demand | S | 1 | E | 1 | 3 |

Results

Highest relative weight

46.15 %

Social Welfare Return Index
Governance dimension

27.27 %

Ratio of Students Enrolled in High Quality Courses
Percentage of Population with 13 or More Years of Schooling
Ratio of Workers in STEM Occupations
People dimension



Organisers:



International Co-owners:



Sustainable Buildings and Climate Initiative
Promoting Policies and Practices for Sustainability



Final Considerations

- Main challenges of the research:
 - Access to reliable data;
 - Obtain updated data.
- Difference between European medium-sized cities development levels compared to the Brazilian cities;
- The reference tool does not address issues that correspond to recurring problems in Brazil, such as illiteracy and infant mortality;
- Need to continue the research: supplement the list of indicators with new items according to the local reality.



Organisers:



International Co-owners:



Sustainable Buildings and Climate Initiative
Promoting Policies and Practices for Sustainability



Global Alliance
for Buildings and
Construction

Thank you



Organisers:



International Co-owners:

