CPI Methodology and Indicators

CONTENTS

01. INTRODUCTION TO THE CPI METHODOLOGY
02. CLARIFICATION ON FEW INDICATORS
03. SPATIAL INDICATORS
A flexible monitoring framework that takes into account the contextual needs and particularities of cities and countries

A framework that promotes integration

An innovative tool based on spatial analysis

A multi-scale decision-making tool

1. The City Prosperity Initiative (CPI) promotes integration in the implementation of a more sustainable urbanization model

2. The CPI supports decision-making from national urban policies to regional to city-wide interventions

3. An innovative tool based on spatial analysis that integrates indicators such as street connectivity, public space, urban expansion

4. As a multi-scale tool, the CPI supports decision-making from national urban policies to regional to city-wide interventions
THE CITY PROSPERITY INITIATIVE
Data, Information and Policy-Making

A POLICY DIALOGUE
MONITORING INSTRUMENT
A DECISION MAKING
BASELINE SETTING

THE WHEEL OF URBAN PROSPERITY AND THE CPI

THE SIX DIMENSIONS OF PROSPERITY

Urban Governance
Productivity
Environment Sustainable
Infrastructure Development
Equality and Social Inclusion
Quality of Life
The City Prosperity Initiative

**MEASURE** by producing critical mass of data and information

**UNDERSTAND** the factors that generate or inhibit prosperity

**CHANGE** by formulating policies, strategies and action plans

**MONITOR** the outcomes of policy implementation

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**THE WHEEL OF URBAN PROSPERITY AND THE CPI**

![Image of the wheel of urban prosperity and the CPI]

- **51.9%**
- **51.9**
## Scale of Prosperity

<table>
<thead>
<tr>
<th>Scale</th>
<th>Prosperity Factors</th>
<th>Policy Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>80-100</td>
<td>Very solid prosperity factors</td>
<td>Consolidate urban policies</td>
</tr>
<tr>
<td>70-79</td>
<td>Solid prosperity factors</td>
<td></td>
</tr>
<tr>
<td>60-69</td>
<td>Moderately solid prosperity factors</td>
<td>Strengthen urban policies</td>
</tr>
<tr>
<td>50-59</td>
<td>Moderately weak prosperity factors</td>
<td></td>
</tr>
<tr>
<td>40-49</td>
<td>Weak prosperity factors</td>
<td>Prioritize urban policies</td>
</tr>
<tr>
<td>10-39</td>
<td>Very weak prosperity factors</td>
<td></td>
</tr>
</tbody>
</table>

**Scale of Prosperity**

**WHAT IS DIFFERENT IN THE CPI FRAMEWORK?**

Transformative solutions
- Evidence-based interventions
- 3 legged approach solutions

Action Plans – National Reports
- National Strategies
- Good practices
- National Reports

Expanded CPI
- More refined diagnostic
- National comparability
- 60 Indicators

Basic CPI
- Initial diagnostic
- Global comparability
- 32 Indicators
3. METADATA

ICONS DESCRIPTION

Scope:
- Basic CPI
- Extended CPI
- Methodology CPI

Index number

Index code

Index logo

Index name

Productivity
Guidelines prepare clear standardization techniques

Types of Standardization

- Not required
- Simple reversal
- Classic direct standardization
- Classic reversal standardization
- Standardization with the minimum target
- Standardization with the ultimate goal
- Standardization with single objective

Each indicator of the CPI has a specific way to be standardized
Guidelines prepare clear standardization techniques

Example:
- The poverty rate, which is measured in percent.
- The variable moves from 0 to 100.
- The relationship with the CPI is reversed (a rise in the poverty rate will generate a decrease in the level of prosperity of the city).

Standardization: Simple Reversal

\[ X^{(S)} = 100 - X \]
**Classic reversal standardization**

Example:

- Higher values are worst
- CO₂ emissions (measured in metric tons of CO2 per capita)
- WB (2008-2010)
  - Minimum 0.01
  - Maximum 44.20

A city with 1.44 metric tons would have a standardized value of:

\[
X^{(S)} = 100 \left( 1 - \frac{X - \text{Min}(X)}{\text{Max}(X) - \text{Min}(X)} \right)
\]

**Standardization with minimum target**

Example:

- Number of intersection per square kilometer
- UN-Habitat (2014) recommends 100 sq. km

A city with 50 intersections would have a standardized value of:

\[
X^{(S)} = 100 \left( 1 - \frac{X - X^*}{X^*} \right)
\]
Standardization with ultimate goal

Example:

- PM10 concentration (measured in micrograms per cubic meter).
- EC (2013) has set a target value recommended maximum = 40.
- To exceed a certain threshold value decreases (40=100)
- A city with = 54.63, its normalized value is:

\[
X^{(S)} = 100 \left[ 1 - \frac{54.63 \mu g/m^3 - 40 \mu g/m^3}{40 \mu g/m^3} \right] = 63.43
\]

Standardization with single objective

Examples:

- Residential densities
- Women in Local Government (measured as a % target value)
- Mossuz-Lavau (2005) = 50%
- In a city with 31.22% of women in government, the standardized value would be:

\[
X^{(S)} = 100 \left[ 1 - \frac{31.32\% - 50\%}{50\%} \right] = 62.64
\]
Once the variables have been standardized, there is a need to define a methodology to add the information on these variables in a new variable. Need to define a weighting scheme for dimensions, sub-dimensions and variables.

Construction of a scheme of WEIGHTS

a) The dimensions have an equal weight in the indicator.

b) The sub-dimensions have equal weight within its dimension.

c) The variables have equal weight within its sub-dimension.
Construction of a scheme of WEIGHTS

- EQUITY AND SOCIAL INCLUSION DIMENSION
  - ECONOMIC EQUITY SUBDIMENSION
    - GINI COEFFICIENT
      - WEIGHT WITHIN THE CPI: 1/36
    - POVERTY RATE
      - WEIGHT WITHIN THE CPI: 1/36
  - SOCIAL INCLUSION SUBDIMENSION
    - SLUM HOUSEHOLD
      - WEIGHT WITHIN THE CPI: 1/36
    - YOUTH UNEMPLOYMENT
      - WEIGHT WITHIN THE CPI: 1/36
  - GENDER INCLUSION SUBDIMENSION
    - EQUITABLE SECONDARY SCHOOL ENROLMENT
      - WEIGHT WITHIN THE CPI: 1/18
CLARIFICATION OF INDICATORS

Structure of the Index

| Productivity               | 1. Economic Growth Sub Index (EG) |
|                           | 2. Economic Agglomeration (EA)    |
|                           | 3. Employment Sub Index (E)       |
| Infrastructure Development | 1. Housing Infrastructure Sub Index (HI) |
|                           | 2. Social Infrastructure (SI)     |
|                           | 3. ICT Sub Index (ICT)            |
|                           | 4. Urban Mobility Sub Index (UM)  |
|                           | 5. Street Connectivity (SC)       |
| Quality of Life           | 1. Health Sub Index (H)           |
|                           | 2. Education Sub Index (E)        |
|                           | 3. Safety and Security Sub Index (SS) |
|                           | 4. Public Space (PS)              |
| Equity and Social Inclusion | 1. Economic Equity Sub Index (EE) |
|                          | 2. Social Inclusion Sub Index (SI) |
|                          | 3. Gender Inclusion Sub Index (GI) |
|                          | 4. Urban Diversity (UD)           |
| Environmental Sustainability | 1. Air Quality Sub Index (AQ)  |
|                          | 2. Waste Management Sub Index (WM) |
|                          | 3. Water and Energy Sub Index (WE) |
| Governance and Legislation | 1. Participation and Accountability (PA) |
|                          | 2. Municipal Finance (MF)         |
|                          | 3. Governance of Urbanization (GU) |
Indicators of Basic CPI

**ECONOMIC STRENGTH**
- City Product per Capita

**ECONOMIC BURDEN**
- Old Age Dependency
- Economic Density

**EMPLOYMENT**
- Unemployment Rate

**HOUSING INFRASTRUCTURE**
- Improved Shelter
- Access to Improved Water

**SPECIAL INFRASTRUCTURE**
- Physicians Density
- Internet Access

**STREET CONNECTIVITY**
- Intersection Density
- Land Allocated to Streets
- Street Density

**URBAN MOBILITY**
- Use of Public Transport
- Traffic Fatalities
- Length of Mass Transport Network

**HEALTH**
- Life Expectancy at Birth
- Under-Five Mortality Rate

**EDUCATION**
- Literacy Rate
- Mean Years of Schooling

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Indicators of Basic CPI

**EQUITY AND SOCIAL INCLUSION**
- Gini Coefficient
- Poverty Rate

**SOCIAL INCLUSION**
- Slum Household
- Youth Unemployment

**GENDER INCLUSION**
- Equitable Secondary School Enrollment

**ENVIRONMENTAL SUSTAINABILITY**
- PM2.5 Concentration
- CO2 emissions

**WASTE MANAGEMENT**
- Solid waste collection
- Waste water treatment

**WATER AND ENERGY**
- Share of renewable energy

**PARTICIPATION**
- Voter turnout

**MUNICIPAL FINANCE**
- Own revenue collection
- Days to start a business

**GOVERNANCE OF URBANIZATION**
- Urban expansion
SPATIAL DELIMITATION
URBAN AGGLOMERATION VS ADMINISTRATIVE BOUNDARY

Cities defined by their municipal boundaries are often inappropriate for monitoring the urban.
CPI incorporates spatial analysis

SPATIAL INDICATORS

Residential Densities
Economic Densities
Land Use Mix
Urban Expansion
Length of Public Transport
Public Space
Street Connectivity

DEFINING AREA OF INTERVENTION
PPP conversion factor, GDP (LCU per international $)

Purchasing power parity conversion factor is the number of units of a country’s currency required to buy the same amounts of goods and services in the domestic market as U.S. dollar would buy in the United States.

This conversion factor is for GDP.
Source of Data: http://data.worldbank.org/indicator/PA.NUS.PPP
AVERAGE BROADBAND SPEED
MAKING USE OF BIG –REAL TIME- DATA

LENGTH OF MASS TRANSIT NETWORK
Measuring the urban extent of a city in different years (Addis Ababa, in 1986 to 2010).
PUBLIC SPACES

1. Green Area per Capita

2. Accessibility to Open Public Space
   - % urban AREA within 400m from open public space
   - % urban AREA within 1000m from major open public space

Lima, Peru
WHAT IS A PUBLIC SPACE?

“Public spaces are all places publicly owned or of public use, accessible and enjoyable by all for free and without a profit motive”

Charter on Public Spaces

PUBLIC / PRIVATE

Both publicly-and privately-owned public spaces are considered, although public ownership often guarantees more stable access and enjoyment over time.
WHY IS PUBLIC SPACE IMPORTANT?

- Reduce the impact of climate change and heat island effect
- Encourage people to walk and cycle
- Contribute to develop a sense of civic cohesion and citizenship
- Improve safety and reduces fear of crime
- Increases prosperity
A ratio of 50% of public space is common in successful cities. Manhattan, Barcelona, and Brussels have up to 35% of city area allocated to street space and an additional 15% for other public uses.
Water and sanitation provision is related to land allocated to street and street density.

Required conditions for Public Transport.
Land allocated to street (LAS) in cities, Europe, North America & Oceania

Disconnected, fragmented suburbs adjacent to well-connected city cores

A WELL PLANNED URBANIZATION:
A KEY COMPONENT OF SUSTAINABLE DEVELOPMENT
**SAMPLING METHOD**

**Saudi Arabia CPI – Jeddah**
*(Patterns at intra-city level)*

<table>
<thead>
<tr>
<th>Atomistic areas</th>
<th>Residential areas</th>
<th>Informal areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land allocated to streets</td>
<td>25.99</td>
<td>Land allocated to streets</td>
</tr>
<tr>
<td>Street density</td>
<td>46.4</td>
<td>Street density</td>
</tr>
<tr>
<td>Intersection Density</td>
<td>925</td>
<td>Intersection Density</td>
</tr>
<tr>
<td>Land allocated to streets</td>
<td>33</td>
<td>Street density</td>
</tr>
<tr>
<td>Street density</td>
<td>151</td>
<td>Intersection Density</td>
</tr>
</tbody>
</table>
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STREET CONNECTIVITY AND SPATIAL INDICATORS

Un-Habitat recommendation:
- Land Allocated to Streets: 30%
- Street Density: 20 km/km²
- Intersection Density: 100 / km²

Averages:
- Average street width: 15 m
- Street-to-street distance: 100 m
- Distance between intersection: 85 m

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STREET CONNECTIVITY AND SPATIAL INDICATORS

Neiva, Colombia:
- Land Allocated to Streets: 22.5%
- Street Density: 25.75 km/km²
- Intersection Density: 243 / km²

Averages:
- Average street width: 9.1 m
- Street-to-street distance: 80.8 m
- Distance between intersection: 71.7 m
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STREET CONNECTIVITY AND SPATIAL INDICATORS

Dammam, Saudi Arabia:

Land Allocated to Streets: 23 %
Street Density: 17 km /km²
Intersection Density: 72 / km²

Average street width: 17.9 m
Street-to-street distance: 149.5 m
Average block size: 131.6 m

Correlation between street density and intersection density
**LAS:SD ratio**

Measures the **scale** of the urban grain

**SD:ID ratio**

Measures the **skewness** of the urban pattern
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CLASIFICATION OF CITIES:
URBAN BOUNDARIES

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CLASIFICATION OF CITIES:
URBAN TOPOGRAPHY
Street Connectivity – The Form of the City - SA

<table>
<thead>
<tr>
<th>City</th>
<th>Land / streets</th>
<th>Street density</th>
<th>Intersection D</th>
</tr>
</thead>
<tbody>
<tr>
<td>Riyadh</td>
<td>27.87</td>
<td>15.21</td>
<td>109.6</td>
</tr>
<tr>
<td>Makkah</td>
<td>23.12</td>
<td>14.98</td>
<td>111.11</td>
</tr>
<tr>
<td>Jeddah</td>
<td>22.83</td>
<td>14.08</td>
<td>125.71</td>
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<tr>
<td>Taif</td>
<td>22.65</td>
<td>16.7</td>
<td>146.13</td>
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<tr>
<td>Medina</td>
<td>27.19</td>
<td>15.85</td>
<td>153.83</td>
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<td>Tabuk</td>
<td>26.65</td>
<td>14.21</td>
<td>86.67</td>
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<td>Khamis Mushait</td>
<td>20.98</td>
<td>15.45</td>
<td>123.04</td>
</tr>
<tr>
<td>Najran</td>
<td>15</td>
<td>10.06</td>
<td>53.21</td>
</tr>
<tr>
<td>Jizan (Jazan)</td>
<td>22.72</td>
<td>13.71</td>
<td>105.45</td>
</tr>
<tr>
<td>Ha'il (Haiel)</td>
<td>24.49</td>
<td>14.75</td>
<td>110.91</td>
</tr>
<tr>
<td>Arar (Araar)</td>
<td>29.27</td>
<td>16.03</td>
<td>115.42</td>
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<tr>
<td>Al Bahah</td>
<td>13.98</td>
<td>10.34</td>
<td>59.35</td>
</tr>
<tr>
<td>Sakaka</td>
<td>21.43</td>
<td>12.57</td>
<td>90.67</td>
</tr>
</tbody>
</table>

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STREET CONNECTIVITY AND SPATIAL INDICATORS

City prosperity is made possible by its spatial capital - the density, streets and public open space.
IDENTIFYING THRESHOLDS

Poverty Rate

Intersection Density

\[ y = 132.97x^{0.1243} \]

\[ R^2 = 0.3411 \]

IDENTIFYING FACTORS WITH LARGER INFLUENCE

Lead Allocated to Street

Intersection Density

\[ \text{Land Coefficient} = 0.728 \]

\[ \text{Intersection Coefficient} = 0.465 \]
### Deviation from City Core values in Colombian cities

<table>
<thead>
<tr>
<th>Mass Housing Projects</th>
<th>Land Allocated to Streets</th>
<th>Street Density</th>
<th>Intersection Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>-16 %</td>
<td>15 %</td>
<td>82 %</td>
<td></td>
</tr>
<tr>
<td>Informal Areas</td>
<td>-34 %</td>
<td>34 %</td>
<td>130 %</td>
</tr>
<tr>
<td>Industrial Areas</td>
<td>-31 %</td>
<td>-40 %</td>
<td>-38 %</td>
</tr>
</tbody>
</table>

### SD:ID ratio

**Urban Pattern Quadrants**

- **Atomistic pattern**
- **Industrial pattern**
- **Theoretical grid pattern**

**Typologies in Colombian cities:**

- Average All Regions
- Colombian Average
- Historic Center
- Consolidated Areas
- Mass Housing
- Informal Areas
- Industrial
- UN-Habitat
From urban form – to urban planning

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