Environmental quality of urban areas: a cross-cutting approach to measure smart factors and eco-sustainability

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Outline

- Smart cities: what do we measure?
- Urban Environmental quality: proposal to measure smart and sustainability factors
- Indicators by 6 multi-topic dimensions: a cross-cutting approach
- Performance of cities
- Conclusions

1. The concept of smart city is integrated in the actions and priorities of EC policies:

- Five goals and seven flagship initiatives for the 2020 Europe Strategy for smart, sustainable and inclusive growth: all with a direct connection with the smart city
  - **The core strategy is** related to the **technological components** to support the improvement of public services
  - **On the contrary, less emphasis** is placed on other components of smartness such as **governance's actions**

2. Monitoring process

- The Digital Agenda has implemented a Digital Agenda Scoreboard: for each country it collects **only data aggregated at the national level**
- The biggest problem in monitoring projects and results on Smart Cities and Communities is the territorial level of investigation (the city).
  - For each city there **is a large number of sets of indicators, but very few of these are accepted by the generality of local realities involved in monitoring**
  - Cities tend to use indicators that are best suited to the purposes of their own projects
  - **Difficulty in** presenting an objective **comparison** between cities and, sometimes, even within different areas of cities

3. *Mapping Smart Cities in the EU*, a more comprehensive approach

- Smart cities actions are considered "**not only as guidelines to operate in a technologically innovative approach** to solving problems of urban living, but as an **integrated strategy to reduce poverty, inequality, unemployment** ..."
- Smart cities are described **as the result of a complex, coordinated approach** to:
  - **develop and link capitals** (**human, social, economic and environmental ones**), technology and ICT infrastructure,
  - generate incremental **economic development** and **more sustainable** and **better quality of life**

4. Academic contributions

- A smart City is a city with at least one initiative concerning these **six ends**: 1. Smart Governance, 2. Smart People, 3. Smart Living, 4. Smart Mobility, 5. Smart Economy, 6. Smart Environment
- **3 main components to achieve these ends**:
  1. **Physical infrastructure**: Smart technologies, Mobile technologies, Digital networks
  2. **Human infrastructure**: Social capital
  3. **Institutional factors**: Governance, Policy, Regulations and directives

To wrap it up:

- **From a "basic" position** [ICT networks/intelligent use of digital technologies to ensure the availability of information (early 90's)]
- **To the 6 smart dimensions of Giffinger** (Governance, People, Living, Mobility, Economy, Environment), with specific attention to urban scale of analysis (R. Giffinger *et al.* 2007) (but constraint of available indicators)
- **To necessary and complementary role of human and social capital** (A. Caragliu *et al.* 2009)

The **smart city** is **the result of the integration of the physical and intangible infrastructure of places and social relationships between people, which can combine with each other to ensure a state of overall well-being of people and communities**

Smart Communities: the italian institutional framework

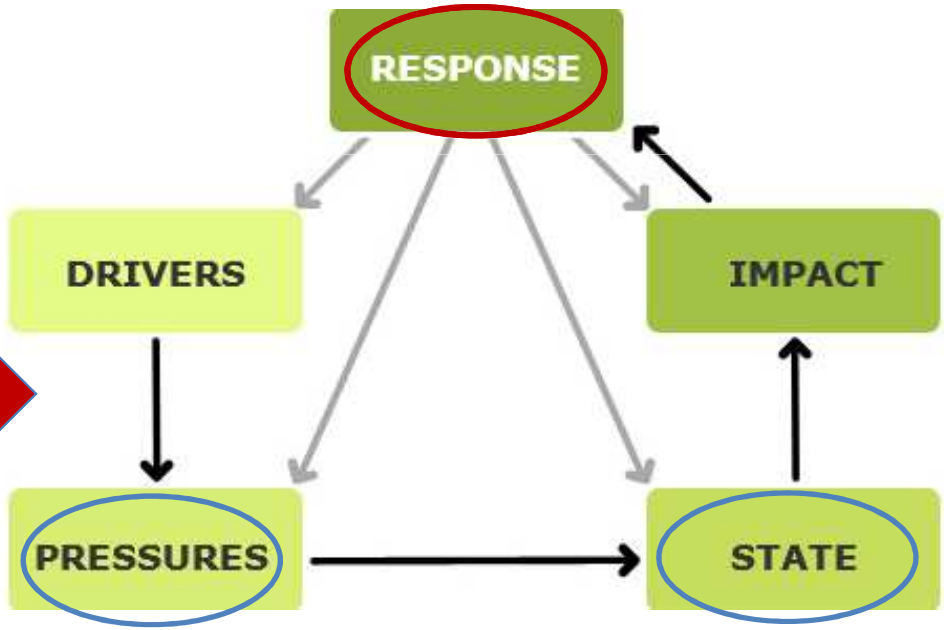
- ✓ **Law n°221/2012**: a coordinated teamwork among different public bodies for a good strategy and for an efficient monitoring process
  - Art.20 comma 12 «Smart communities»:
  - for **monitoring**,[…] the Digital Agency, in contact with the technical Committee of Smart cities, in cooperation with ISTAT draws up, after consulting ANCI (Association of Italian Municipalities),
  - a **system to measure** including a set of statistical indicators **regarding** both the **present status and progress** of **economic**, **social**, **cultural** and **environmental conditions of smart communities** as well as the **quality of life of its citizens**

A proposal for a cross-cutting approach to measure smart factors and eco-sustainability

Urban Environment Quality

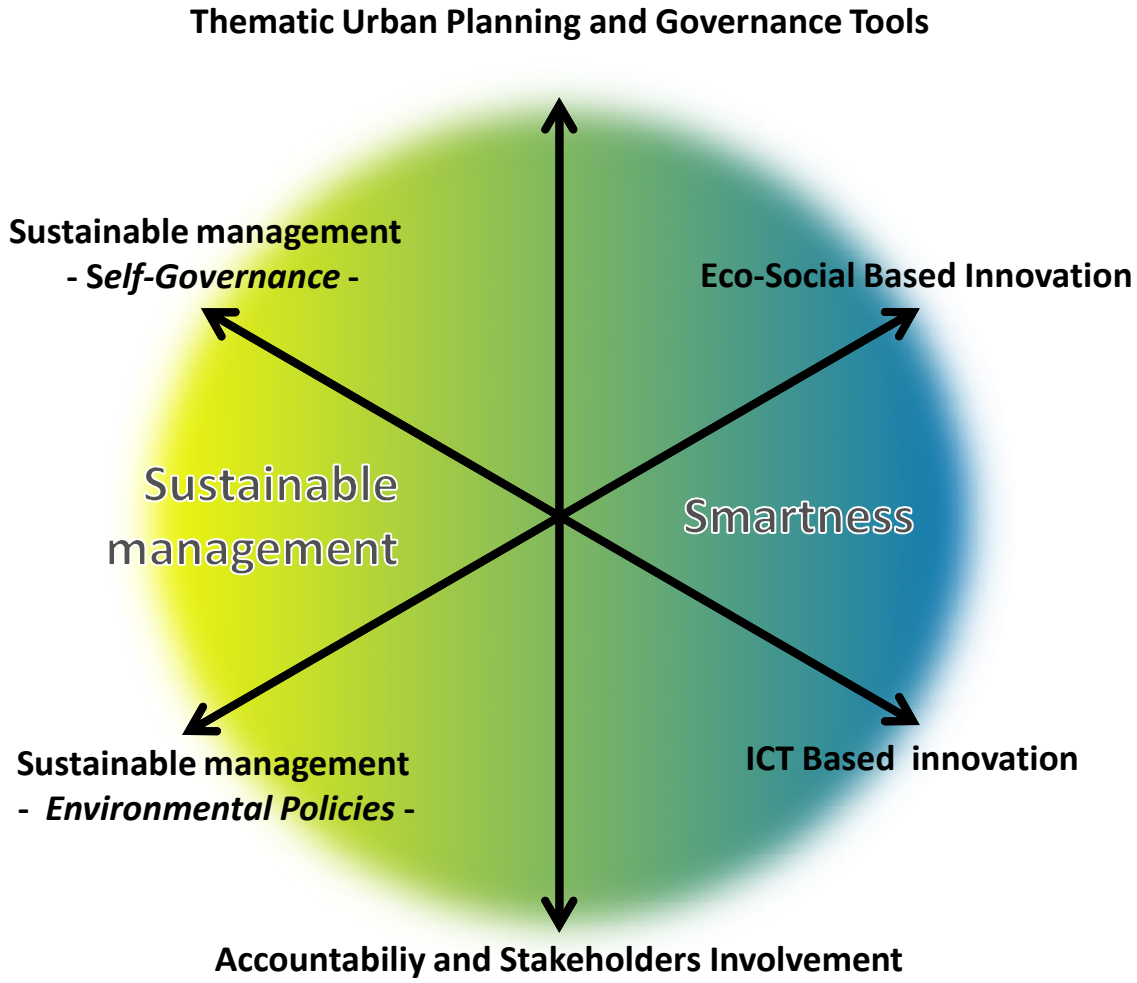
- **Annual Istat survey**
- **116 cities (NUTS3 capitals)**
- **8 Topics:**
  - Eco-management
  - Urban green areas
  - **Pollutants**: Air, Noise
  - **Utilities**: Waste, Energy, Water, Urban mobility

Indicators are classified according to the DPSIR framework (EEA, 1995):



From topics to analytical dimensions

- The Response indicators from 8 survey topics are grouped according to 6 areas
- Each area represents a complex of actions and measures that define the orientation of the city government to the eco-sustainable management and smartness.



City map of smart and eco-sustainability response factors

CROSS CUTTING DIMENSIONS	*GOVERNANCE* and *SELF-GOVERNANCE* Sustainable management	*URBAN SMARTNESS*

A — Cities Thematic Planning and Governance Tools

- ✓ General/Thematic Plans and Actions
- ✓ ...

B — Accountability and Stakeholders Involvement

- ✓ Eco-Social reporting
- ✓ Shared planning
- ✓ On Line Services
- ✓ Home Composting
- ✓ ...

C — Sustainable Governance

- ✓ Waste: actions to promote the proper delivery
- ✓ Air pollution: traffic road restrictions
- ✓ Water services: dispersions and rationing measures
- ✓ Sustainable mobility: parking, Ztl, pedestrian areas
- ✓ Green areas: georeferenced census
- ✓ ...

D — Sustainable Self-Governance

- ✓ Standards of Environmental Management Achieved by Public Offices
- ✓ Green Public Procurement
- ✓ Availability of Green Powered Public Vehicles
- ✓ Correct waste collections in schools and public offices
- ✓ ...

E — Innovative Technologies and Smart Energy

- ✓ Charging Points for Electric Vehicles
- ✓ Smart Public Lighting
- ✓ Energy from Renewable sources
- ✓ Efficient use of energy by district heating
- ✓ Smart Traffic Light
- ✓ Info mobility
- ✓ ..

F — Eco-Social Innovations Incentives to Sustainable Behaviour; Promotion of Environment that Fosters Individual and Collective Social Development

- ✓ City gardens
- ✓ Organic food for school canteens
- ✓ Sustainable Mobility Services (as zone 30, bike paths, bike sharing, car sharing)
- ✓ Light Pollution Prevention
- ✓ ..

Indicators score

- 59 indicators ware selected because of relevance on 6 thematic areas of analysis
- Indicators values were standardized according to this scheme

+1	Municipalities who adopted not mandatory planning actions or positive actions to improve urban environment end utilities quality or included in the best quartile of cities distribution.
0	Municipalities compliant to planning rules or included in central quartiles of cities distribution
-1	Municipalities NOT compliant to mandatory planning rules or with a low level of utilities supply comparing to their demographic size or included in the worst quartile of cities distribution.

- Normalization of each area's total score (from 0 to 1 value)
- **Final output: 6 rankings of 116 cities**

Thematic Urban Planning and Governance Tools

Topic	Indicators		Min	Max
Eco-management	1. General Urban Plan (Y/N)		-1	0
Energy	2. Green Energy Action Plan (Paes) (Y/N)		-1	1
Mobility	3. Urban Mobility Plan (Y/N)	Cities>100.000 ab.	-1	1
		Cities<100.000 ab.	0	1
	4. Urban Traffic Road Plan (Y/N)	Cities>30.000 ab.	-1	0
		Cities<30.000 ab.	0	1
Noise	5. Noise Cluster Map (Y/N)		-1	0
Green Areas	6. Green Areas Plan (Y/N)		0	1
	7. Ecological Network (Corridors and Stepping Zones) (Y/N)		0	1

Sustainable Governance (Environmental Policies)

Topic	Indicators		Min	Max
Water	1. Losses of Drinking Water (%)		-1	1
	2. Restriction in Drinking Water Supply (Y/N)		-1	0
Air	3. Traffic Road Restriction (Emergency or Planned Y/N)	With Air Pollutant (over the threshold)	-1	1
		Without	0	1
Mobility	4. Road Parking Places with Fees (n° x 1000 vehicles)		-1	1
	5. Intermodal Parking Areas (Y/N)		-1	1
	6. Areas with Traffic Road Subjected to Restrictions (Y/N)	Cities>30.000 ab.	-1	0
		Cities<30.000 ab.	0	0
	7. Pedestrian Areas Denity (m^2/km^2)		0	1
Waste	8. Waste Collected Door to Door		0	1
	9. Big and Heavy Home Waste Collection on Demand (Y/N)		0	1
	10. Permanent Areas for Special Waste Collection (Y/N)		0	1
	11. Non Permanent Areas for Special Waste Collection (Y/N)		0	1
	12. 13. 14. 15. Other Waste Collection Services/Information Campaign (Y/N)		0	1
Green Areas	16. Green Areas Georeferred Census		0	1

Sustainable Self-Governance

Topic	Indicators	Min	Max
Eco-management	1. Municipality/Offices Certified ISO 14001 (Y/N)	0	1
	2. Municipality /Offices Certified EMAS (Y/N)	0	1
	3. Green Public Procurement (Y/N)	-1	1
	4. Recycled Paper /FSC Endowment (%)	-1	1
	5. Municipality Ecological Vehicles (%)	-1	1
	6. Proper Waste Collection in Municipality Offices (Y/N)	-1	1

ICT Innovation

Topic	Indicators		Min	Max
Eco-management	1. Public Lighting – Solar (%)		0	1
	2. Public Lighting – LED (%)		0	1
	3. Public Lighting - Pollutant (%)		-1	0
Energy	4. District heating (m^3/ab.)		0	1
	5. Green Energy/Efficient Energy Use (actions)		-1	1
	6. Charging point for electric vehicles		0	1
Mobility	7. Info mobility (n° of services/8)	Metropolitan area	-1	1
		Cities >30.000 ab.	-0,5	1
		Cities<30.000 ab.	0	1
	8. Smart Traffic Light (%)	Cities>100.000 ab.	-1	0
		Cities<100.000 ab.	-0,5	0,5
	9. Car Sharing – Electric vehicles (%)		0	1

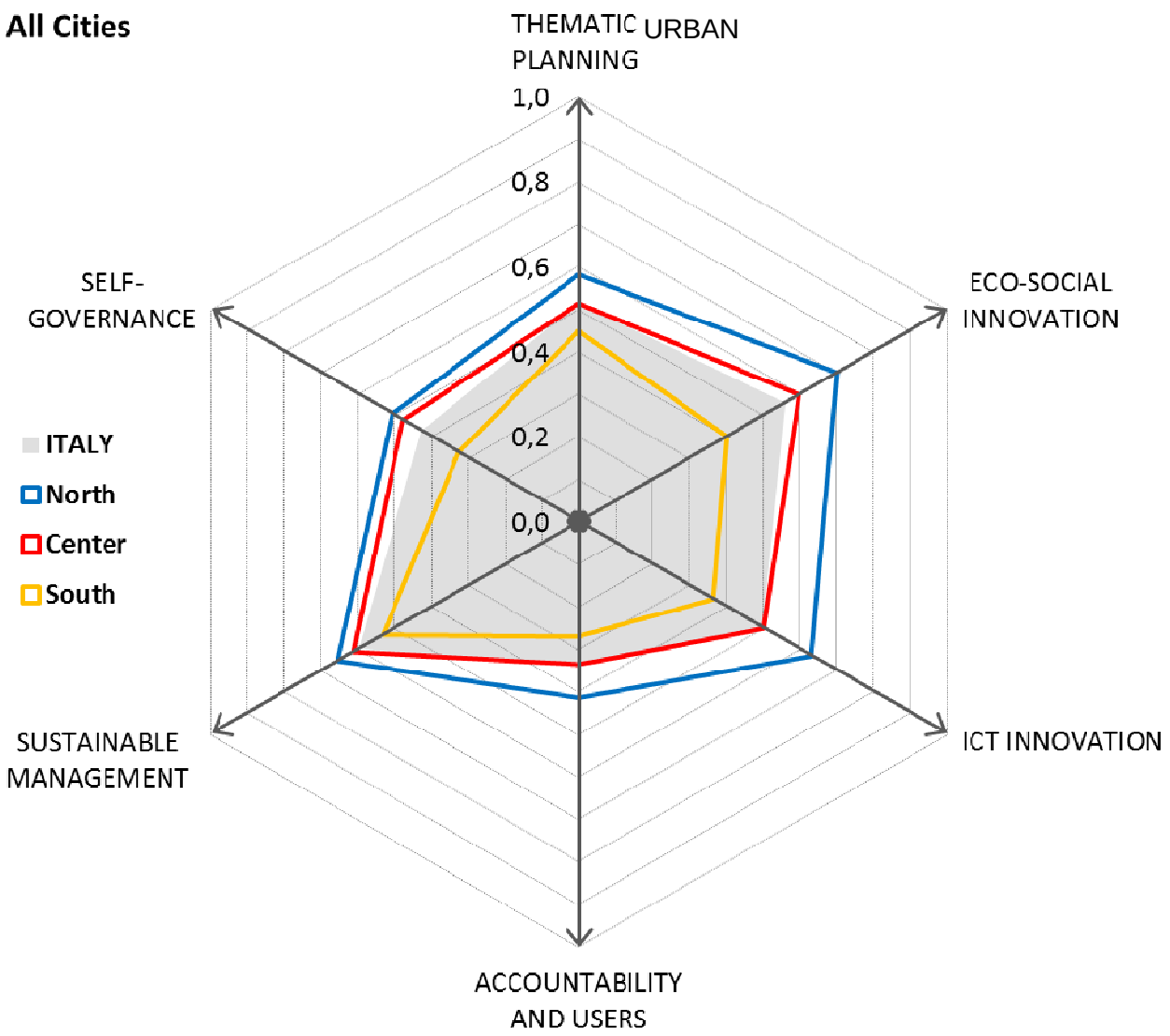
Eco-Social Innovation

Topic	Indicators		Min	Max
Eco-management	1. Organic Food in Canteens of School (Y/N)		0	1
	2. Public Lighting – Prevention of Light Pollution (%)		-1	1
Mobility	3. «Zone 30» (Areas with limitation of vehicles speed) (Y/N)	Cities >100.000 ab.	-1	1
		Cities 30.000-100.000 ab.	-0,5	1
		Cities <30.000 ab.	0	1
	4. Cycle Paths Density (km/km^2)		-1	1
	5. Bike sharing (Y/N)		0	1
	6. Car Sharing (Y/N)	Metropolitan Areas	-1	1
		Other Cities	0	1
Green Areas	7. «Trees Day» Actions (Y/N)		0	1
	8. Urban Farm/Gardens (Y/N)		0	1

Accountability and Stakeholders Involvement

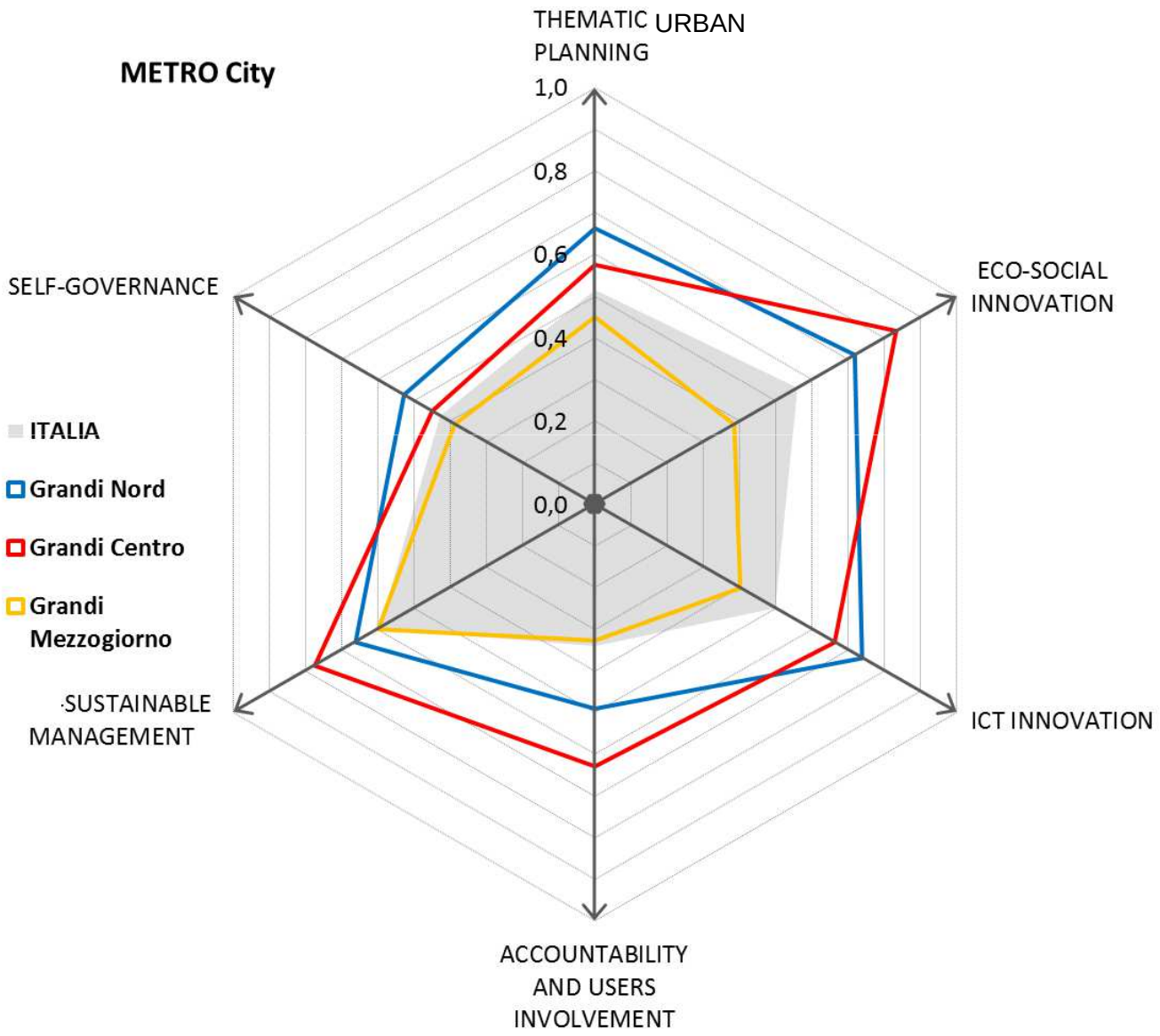
Topic	Indicators	Min	Max
Eco-management	1. Participatory Planning (Y/N)	0	1
	2. Environmental Balance (Y/N)	0	1
	3. Eco-Social Balance (Y/N)	0	1
	4., 5. 6. On-Line Services – Demographic Services (Y/N)	0	0,1
	7. 8. 9.On-Line Services – Payments of School Services (Y/N)	0	0,2
Waste	10. 11. 12.Incentives to Domestic Composting (Y/N)	-1	0

Overall performance: all cities by geographical area

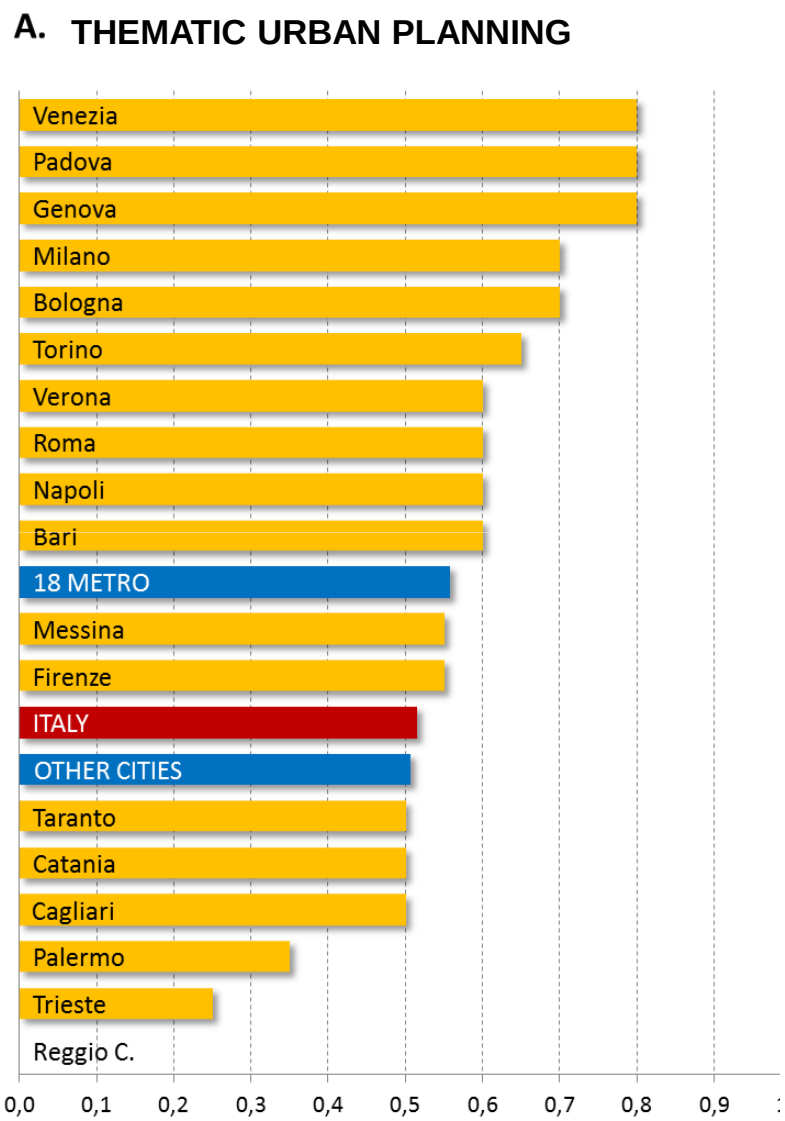


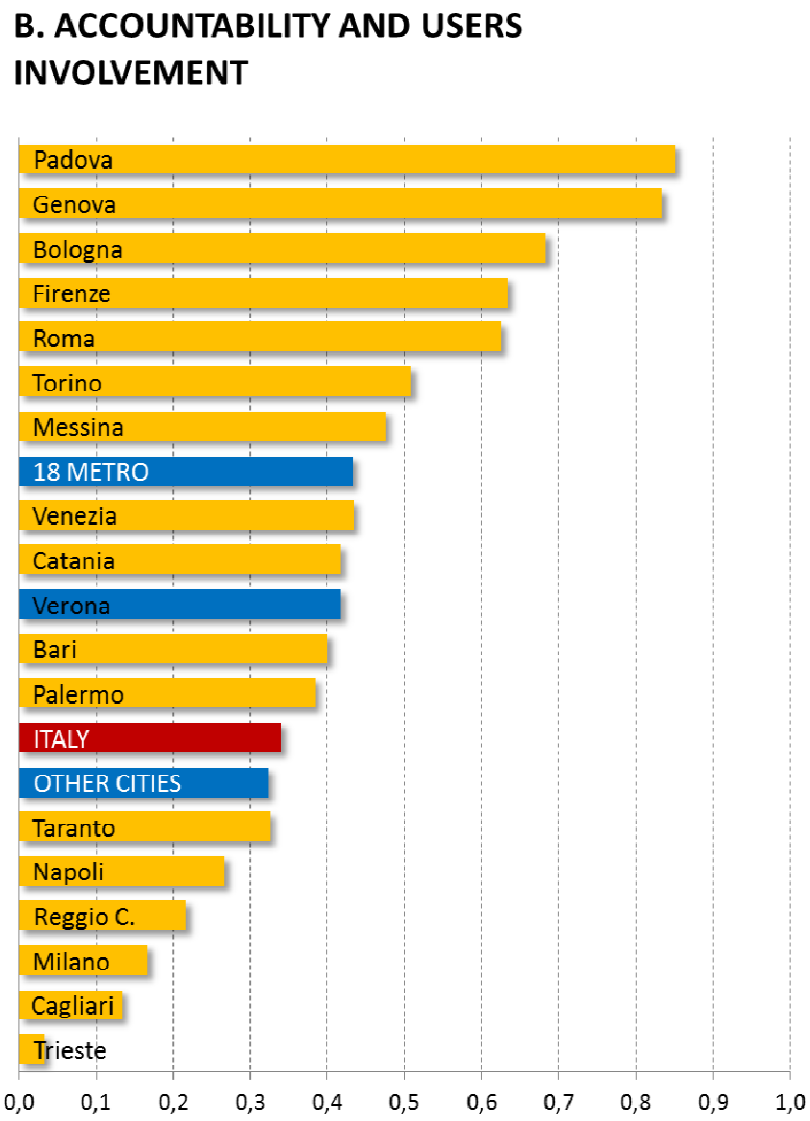
Overall performance: Metro cities by geographical area

Core of Metropolitan Areas or > 200.000 ab



Performance by single dimension: Metro cities





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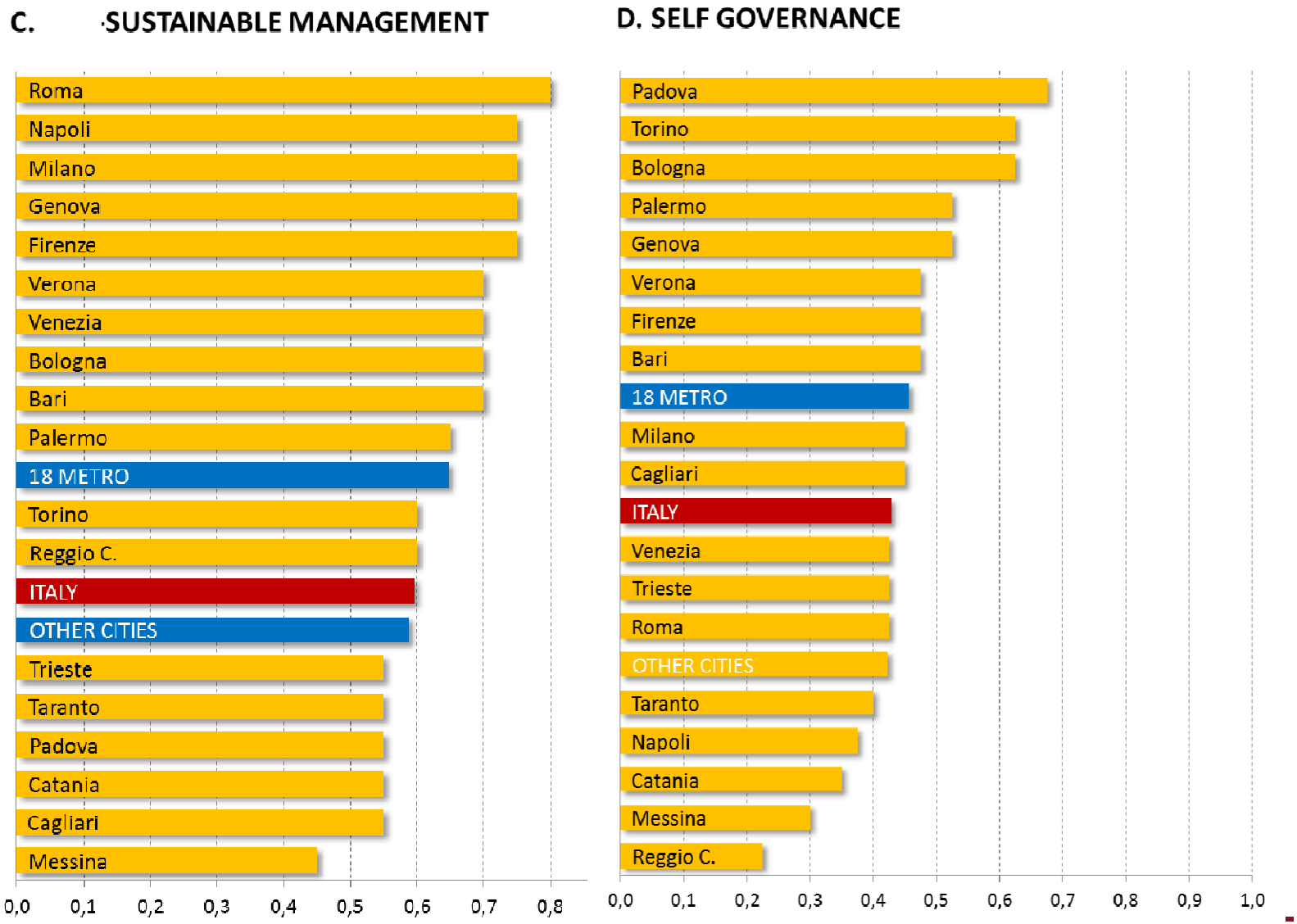

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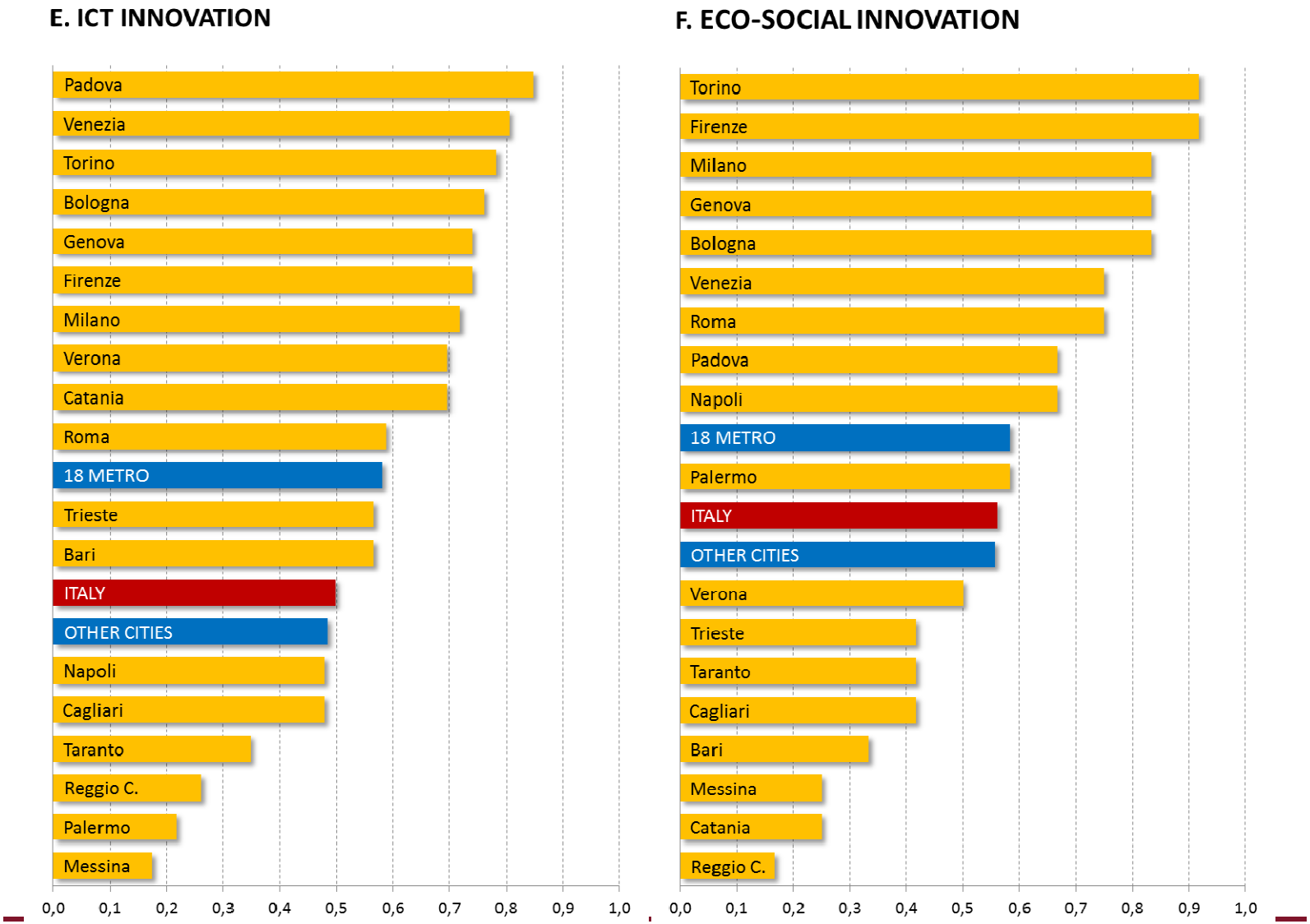
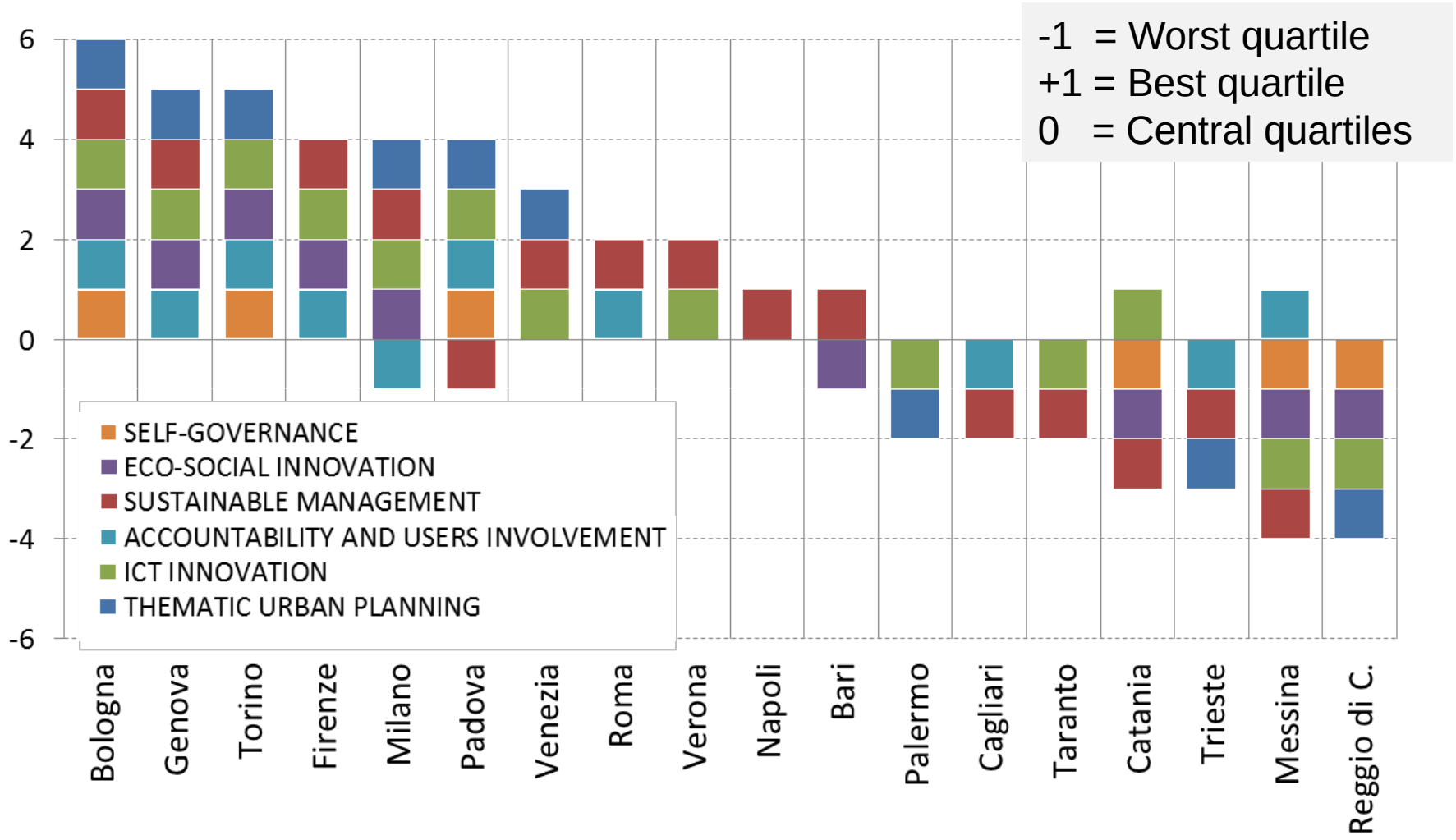


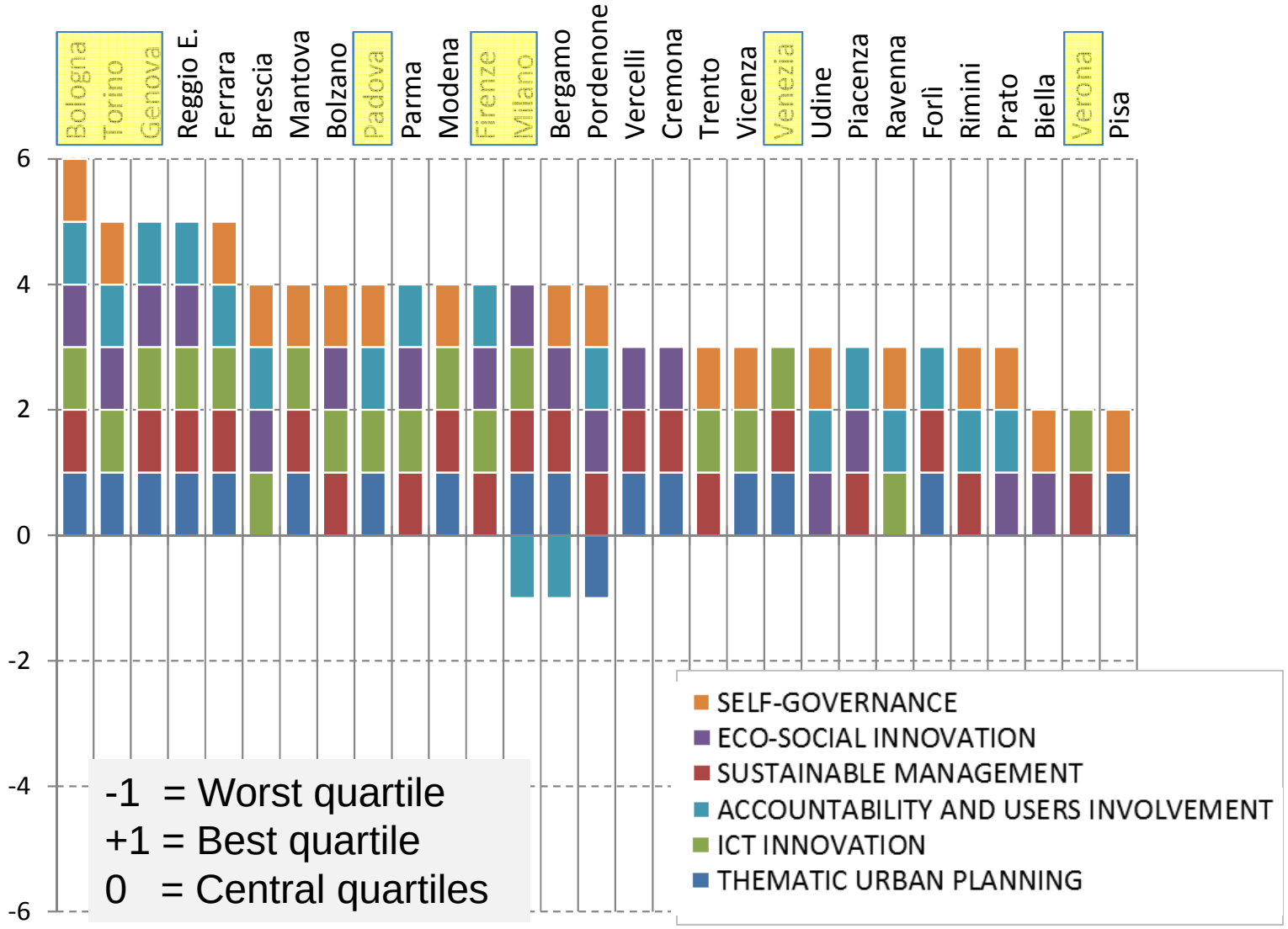
Performance by single dimension: Metro cities

Positioning according to the 6 dimensions



Performance by single dimension: All cities

29 best positioned cities



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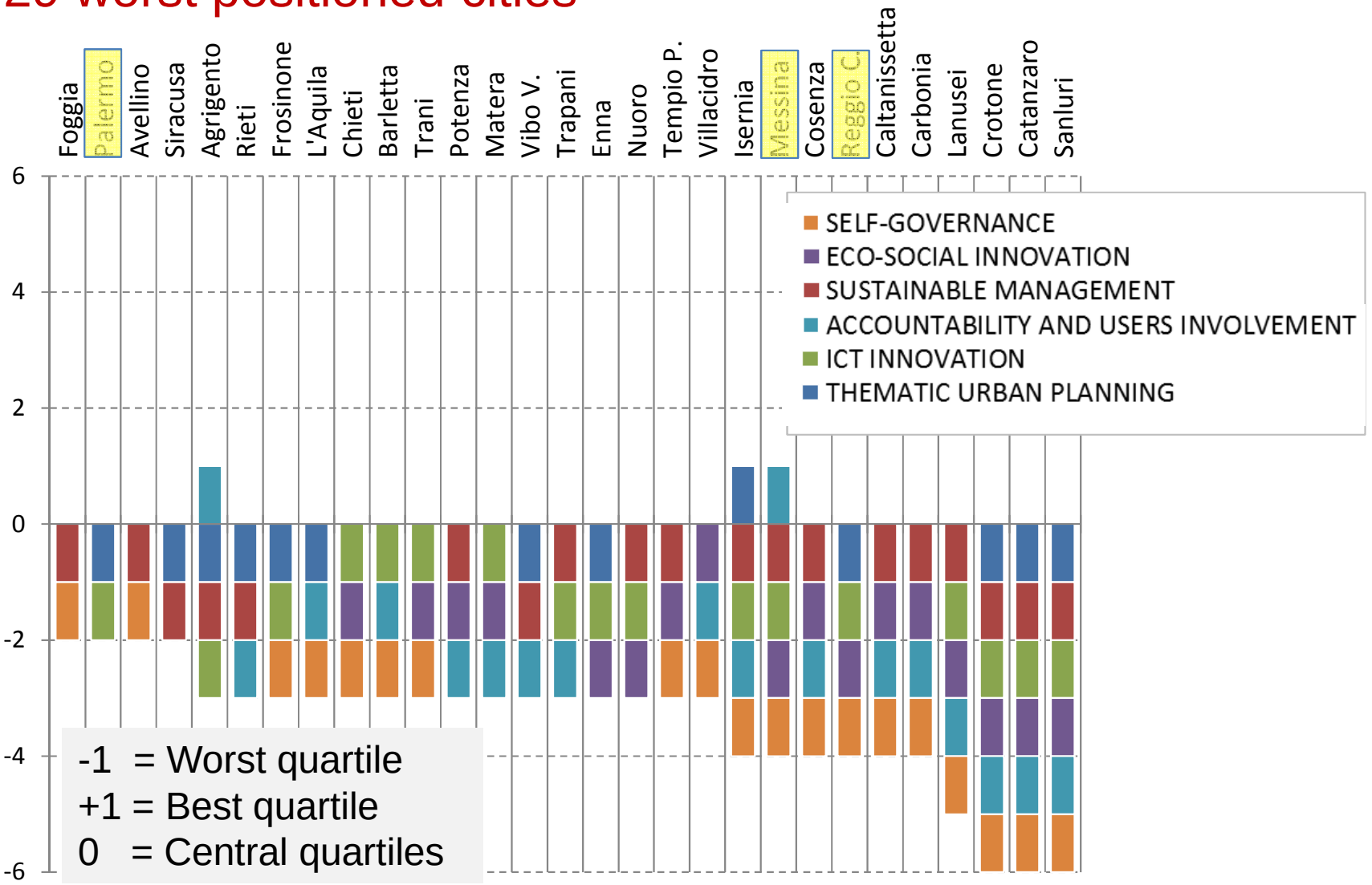

Concluding remarks (1)

- Our analysis aims at representing the ability of Italian cities and towns in capturing the opportunities offered by technological and societal progress for improving the environment, the effectiveness of administrative action and the quality of services
- We are not proposing a paradigm or a definition of «smart city»
- We are measuring – through an original re-evaluation of a time-honoured survey – the ability of municipal governments of orienting their actions towards sustainability and smartness, in a difficult period for public local financesation

Concluding remarks (2)

- The results confirm many known facts:
  - Southern towns and cities are weaker than those in the Centre-North.
- But some results are unexpected:
  - Metropolitan cities are not better positioned than the other cities and towns
  - Especially in the South, the cities are not a driver of social innovation