

# DEVELOPING RESEARCH TOWARDS SUSTAINABLE & SMART TERRITORIES

THE CASE OF THE SMART CITY INSTITUTE @ HEC LIEGE

Prof Nathalie Crutzen

November 2022



INTRODUCTION

THE SMART CITY INSTITUTE

PUBLICATIONS

APPLIED RESEARCH PROJECTS



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THE SMART CITY INSTITUTE

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## INTRODUCTION

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- ▶ PhD thesis in the field of Strategy & Performance Management (2005-2009)
- ▶ Strong interest for research on sustainability management for the last 20 years
- ▶ Academic Lead of the Accenture Chair in Sustainable Strategy at HEC Liege (2010-2015)

# INTRODUCTION

## ACCENTURE CHAIR (2010-2015)

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- ▶ Publications on sustainability, strategy and management controls
- ▶ Applied research projects- eg. the international corporate sustainability barometer
- ▶ Postdoctoral research stay (9 months in 2012)
  - ▶ Schulich School of Business, Toronto, Canada (Dirk Matten & Andy Crane)
  - ▶ International Centre for Corporate Social Responsibility, Nottingham University Business School, UK (Jeremy Moon, JP Gond & Christian Herzig)
  - ▶ Center for Sustainability Management, Leuphana University, Luneburg, Germany (Stefan Schaltegger, Roger Burritt)
- ▶ Specific courses (HEC Liege, ESC Rennes, EDHEC)
- ▶ Participation to many practice-oriented workshops (Febelfin, Business and Society Belgium)

# INTRODUCTION

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- ▶ Progressively ....

How to ensure the sustainability management of territorial ecosystems ?

- ▶ Contribution to a « new » research agenda in management science dedicated to the **management of the transition of territories/cities towards smart and sustainable territories/cities, using a multi-stakeholders' perspective**

**via the** Smart City Institute (2015 - ...)



## CONTEXT

### THE ULTIME GOAL

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Ensure the performance of these territories/ecosystems and their sustainability.

The « Smart City » movement can be seen as a possible answer to these challenges...





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# THE SMART CITY INSTITUTE

## MISSIONS

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**S**SMART  
**C**CITY  
**I**INSTITUTE

TOWARDS SUSTAINABILITY



# SMART CITY

## OUR DEFINITION

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A “Smart City” is a **multi-stakeholders’ ecosystem** (composed with local governments, citizens’ associations, multinational and local businesses, universities, international institutions...)

Engaged in a **sustainability strategy/transition**

Using technologies (such as digital) as potential **enabler**

In order to become **more sustainable** (economic prosperity, social well-being & conservation of our natural resources)

# THE SMART CITY INSTITUTE

## MISSIONS

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RESEARCH



TEACHING



INNOVATION



AWARENESS

# THE SMART CITY INSTITUTE

## RESEARCH FOCUS

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- Original focus on the management of the transition towards smarter and more sustainable territories/cities with research on:
  - ▶ Strategy & policy
  - ▶ Governance & stakeholders' dynamics
  - ▶ New public management
  - ▶ (Sustainability) Accounting/Management Control/Monitoring
  - ▶ Impact assessment
  - ▶ Entrepreneurship & new business models (eg. Circular economy, urban agriculture)
- ▶ **Multidisciplinary** team of scientific and applied researchers (quali and quanti methodologies)
- ▶ European funding (FEDER, Horizon Europe, Interreg) + Wallonia + companies (Schröder)



# THE SMART CITY INSTITUTE

## RESEARCH TEAM

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Dr. JESSICA  
CLEMENT

Sustainability  
Transition/Smart City  
Policies



Dr. GIOVANNI  
ESPOSITO

Change Management  
Public Management



Dr. MICHEL  
MANJÒN-ANTOLÌN

Impact of  
Smart Cities



Dr. LUCA MORA

Urban innovation



Dr. RAMA  
KUMMITHA

Entrepreneurship/  
Smart City Strategies

# THE SMART CITY INSTITUTE

## RESEARCH TEAM



HÉLÈNE  
BLEUS

Circular Economy  
Business Models



CHARLOTTE  
FERRARA

Consumer Behavior  
Circular Economy



BENOIT  
RUYSSCHAERT

Sustainability  
Management Control  
Local government  
Circular Economy

# THE SMART CITY INSTITUTE

## RESEARCH TEAM



NICOLAS  
ANCION

GROOF  
Urban Agriculture



AUDREY  
LEBAS

Governance &  
Management of  
Smart Mobility /  
Monitoring &  
Evaluation



CATHERINE  
NGUYEN

Entrepreneurship  
Spin-off



MAXIMILIEN  
SERVAIS

Diagnosis &  
Evaluation  
Smart City Maturity



FLORENT  
SCATTAREGGIA

GROOF  
Urban Agriculture

# THE SMART CITY INSTITUTE

## MANAGEMENT



NATHALIE CRUTZEN

Academic Director



# THE SMART CITY INSTITUTE

## COLLABORATIONS

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- **Multidisciplinary** research projects (Gembloux, Lepur, UNamur, UMons)
- International research network
  - Leuphana University Luneburg
  - Erasmus Rotterdam
  - Newcastle Business School
  - Edinburgh Napier University,
  - Nova Business School, Portugal
  - Universidad Nacional de Chile
  - University of Laval (Quebec)
  - Texas A&M University (TTI)
  - University of South Australia/Griffith University



INTRODUCTION

THE SMART CITY INSTITUTE

**PUBLICATIONS**

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## OUR LATEST PEER-REVIEWED PUBLICATIONS

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- ▶ **Kummitha, R., & Crutzen, N. (2017). How do we understand smart cities? An evolutionary perspective. *Cities*, 67, 43-52.**
- ▶ **Crutzen, N., Bounazef, D., & Qian, W. (2018). Developing Sustainability Mobility Controls: The Case of Four Belgian Local Governments. *Social and Environmental Accountability Journal*, 38, 2156-2245.**
- ▶ Kummitha, R., & Crutzen, N. (2019). Smart cities and the citizen-driven internet of things: A qualitative inquiry into an emerging smart city. *Technological Forecasting and Social Change*, 140, 44-53.

## OUR LATEST PEER-REVIEWED PUBLICATIONS

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- ▶ Desdemoustier, J., Crutzen, N., & Giffinger, R. (2019). Municipalities' understanding of the Smart City concept: An exploratory analysis in Belgium. *Technological Forecasting and Social Change*, 142, 129-141.
- ▶ Desdemoustier, J., Crutzen, N., Cools, M., & Teller, J. (2019). Smart City appropriation by local actors: An instrument in the making. *Cities*, 92, 175-186.
- ▶ **Crutzen, N., Van Bockhaven, J., Schaltegger, S., & Giffinger, R. (2019). Guest Editorial - Sustainability Accounting and Control for Smart Cities. *Sustainability Accounting, Management and Policy Journal*, 10(4), 646-653.**

## OUR LATEST PEER-REVIEWED PUBLICATIONS

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- ▶ Esposito, G., Clement, J., Mora, L., & Crutzen, N. (2021). One size does not fit all: Framing smart city policy narratives within regional socio-economic contexts in Brussels and Wallonia. *Cities*, 118
- ▶ Clement, J., & Crutzen, N. (2021). How Local Policy Priorities Set the Smart City Agenda. *Technological Forecasting and Social Change*, 171.
- ▶ Esposito, G., Clement, J., Mora, L., & Crutzen, N. (November 2021). One size does not fit all: Framing smart city policy narratives within regional socio-economic contexts in Brussels and Wallonia. *Cities*, 118

## OUR LATEST PEER-REVIEWED PUBLICATIONS

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- ▶ Esposito, G., Terlizzi, A., & Crutzen, N. (2022). Policy narratives and megaprojects: the case of the Lyon-Turin high-speed railway. *Public Management Review*, 24
- ▶ Gerli, P., Clement, J., Esposito, G., Mora, L., & Crutzen, N. (July 2022). The hidden power of emotions: How psychological factors influence skill development in smart technology adoption. *Technological Forecasting and Social Change*, 180, 121721
- ▶ **Clement, J., Manjon, M., & Crutzen, N. (12 July 2022). Factors for collaboration amongst smart city stakeholders: A local government perspective. *Government Information Quarterly*, 39 (4)**

## OUR LATEST PEER-REVIEWED PUBLICATIONS

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- ▶ **Manjon, M., Aouni, Z., & Crutzen, N. (2022). Green and digital entrepreneurship in smart cities. *Annals of Regional Science*, 68 (2), 429–462**
- ▶ **Manjon, M., & Crutzen, N. (2022). Air quality in smart sustainable cities: target and/ or trigger? *Annals of Regional Science*, 68 (2), 359–386**
- ▶ **Clement, J., Esposito, G., & Crutzen, N. (2023). Municipal Pathways in Response to Covid-19: A strategic management perspective on local public administration resilience. *Administration and Society*, 55(1), 3–29**

## ONGOING RESEARCH PROJECTS

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- ▶ **Governance and stakeholders' dynamics in sustainable, smart and/or just transitions**
- ▶ **Sustainability management control designed by local governments (Focus: Circular Economy)\***
- ▶ **Configuration of sustainability strategies by local governments**
- ▶ **Link between UN SDGs & Smart Cities\***
- ▶ Citizens' engagement in Smart Cities
- ▶ Impact of Smart Cities on health





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# SOME APPLIED RESEARCH PROJECTS

## INTERNATIONAL CORPORATE SUSTAINABILITY BAROMETER – BELGIAN CASE

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### RESEARCH OBJECTIVE

- ▶ First International Corporate Sustainability Barometer 2012
- ▶ Compare sustainability/CSR management practices over the world



### METHODOLOGY

- ▶ Comparative analysis of practices in 11 countries worldwide
- ▶ The largest companies in those countries have been surveyed (response rate: 22.2%)



# SOME APPLIED RESEARCH PROJECTS

## PRACTICAL GUIDES

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5. MONITORING & EVALUATION

4. SMART MOBILITY

3. DATA GOVERNANCE

2. CITIZEN PARTICIPATION

1. STRATEGY

5 volumes

DOWNLOADED MORE THAN 20,000 TIMES

# SOME APPLIED RESEARCH PROJECTS

SMART CITY BAROMETERS

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# 7

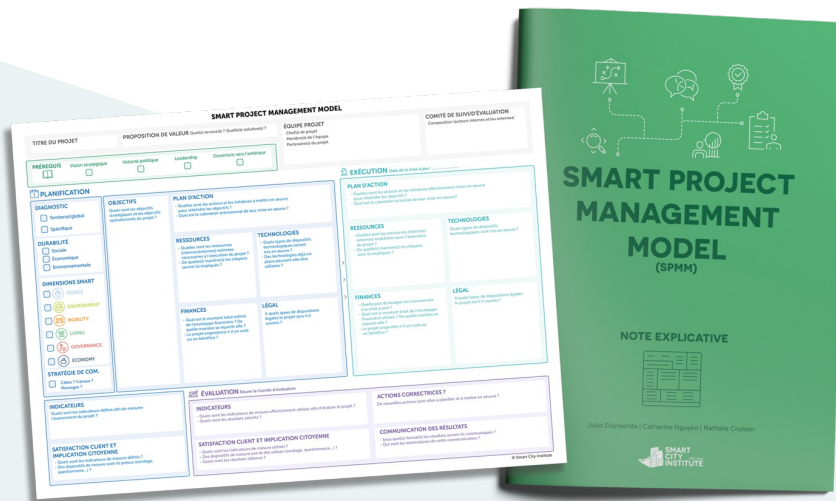
3 Belgian

4 Walloon

- HIGH RESPONSE RATES (53% IN 2020)
- DOWNLOADED MORE THAN 10,000 TIMES

# SOME APPLIED RESEARCH PROJECTS

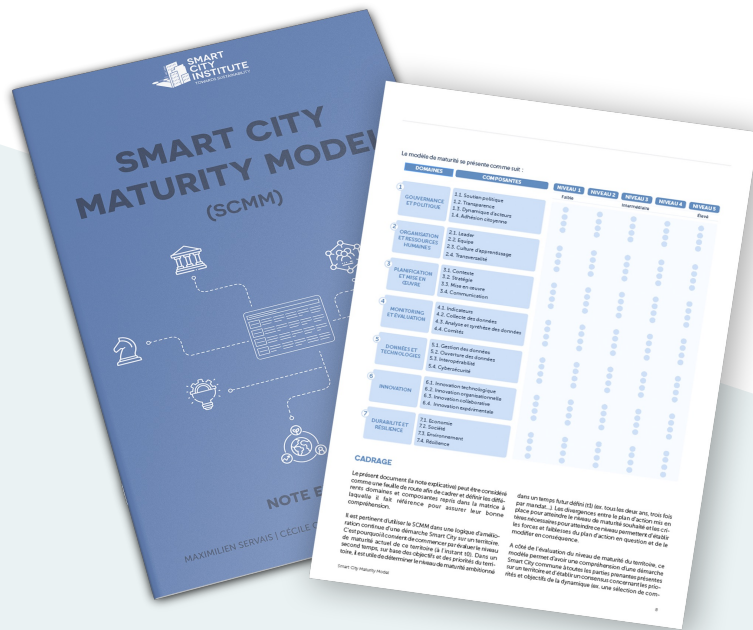
## SMART PROJECT MANAGEMENT MODEL (SPMM)



- Context: Aligned with the collection of practical guides
- Format: Generic model (open source) + explicative note
- Objective: structure & manage SC projects
- Purpose: reflection, collaboration, communication & monitoring tool

# SOME APPLIED RESEARCH PROJECTS

## SMART CITY MATURITY MODEL (SCMM) (IN FRENCH)



- Context: Aligned with the collection of practical guides
- Format: Generic model (open source) + explicative note
- Objective: assess the SC maturity level (7 domains/28 components)
- Purpose: diagnosis, strategic development tools, assessment

# MY SABBATICAL YEAR

OCT 22 – OCT 23

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- ▶ Take an “helicopter view” on the past 10-15 years of research → research strategy for the next 10 years 😊
- ▶ Exploit existing Belgian database (SC barometers, CC survey) and finalize ongoing papers
- ▶ Share ideas and expertise on sustainability strategies, accounting and controls with international researchers (such as UniSA, RMIT, NOVA) + initiate new collaborations
- ▶ Collect new data in Portugal (the case of Cascais/Lisbon)
- ▶ Prepare EMAN 2024 in Liege on Sustainability Accounting and Controls



# RESEARCH



*Sustainability Management Control in Belgian Local Governments: Speeding up the European Green Deal towards a Circular Economy*

**PhD Candidate:** Benoit Ruyschaert

**Promotors:** Prof. Nathalie Crutzen, Prof. Tom Kuppens

**Committee:** Prof. Didier Van Caillie

# CONFERENCES

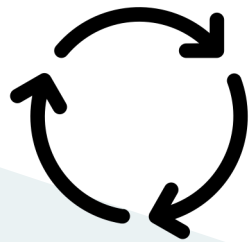
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## *EMAN Conference 2022*

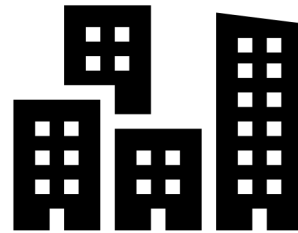


# TOPIC

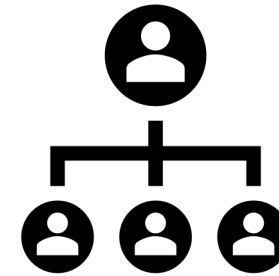
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**Circular  
Economy**



**City**



**Management  
Control**

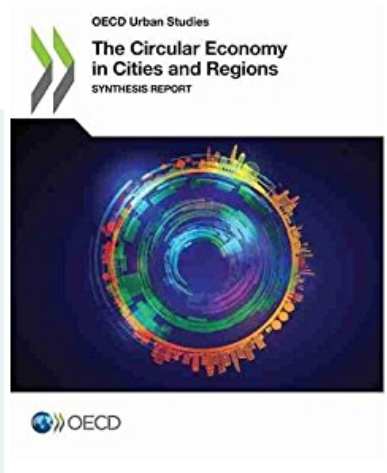
## INTRO

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# Circular Economy

“A **circular economy** describes an **economic system** that replaces the ‘end-of-life’ concept with reducing, alternatively reusing, recycling and recovering materials in production/distribution and consumption processes. It operates at the micro level (products, companies, consumers), meso level (eco-industrial parks) and macro level (city, region, national and beyond), with the **aim to accomplish sustainable development**, this simultaneously creating environmental quality, economic prosperity and social equity, to the benefit of current and future generations. It is enabled by novel business models and responsible consumers.” (Kirchherr et al., 2017, p.224)

# RELEVANCE



247 document results

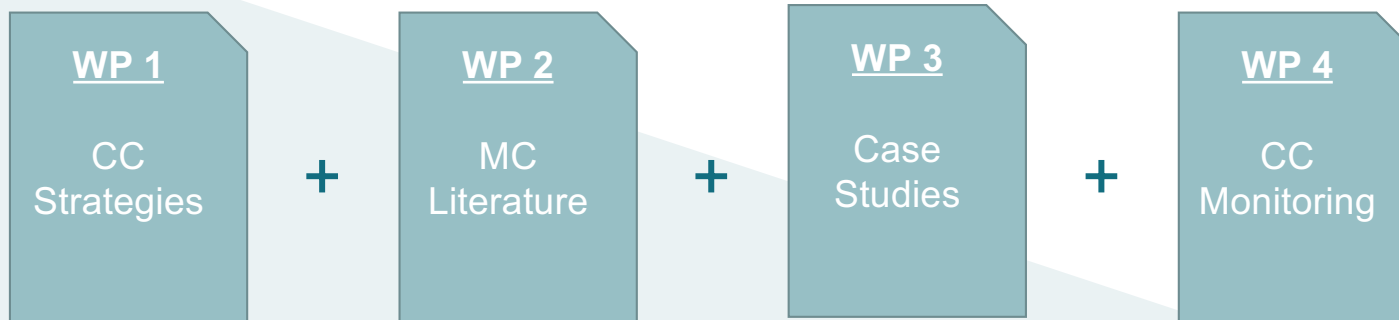
TITLE-ABS-KEY ("circular cit\*")



# THESIS RESEARCH

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**Aim:** How do the (sustainability) management controls designed by local governments support the successful implementation of a circular city strategy ?



## WORK PACKAGES

### WP 1: Circular City Strategies



**Aim:** Study the different types of CC strategies.



**RQ:** What are the different types of strategies that cities use to become circular?



**Method:** A quantitative survey among Belgian municipalities regarding their approach to the circular economy.



**Status:** Working on implementation method and survey questions, literature explored and framework selected.



# INTRO

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## Belgian context

- **581** municipalities
  - Antwerp only large city (>500.000 inhabitants)
  - Brussels split up in 19 municipalities
  - 9 medium sized cities (>100.000 cities)
- Federal government: Action plan (2021-2024) → insufficient (OECD, 2021)
- **3** regions:
  - **Wallonia:** Circular Wallonia strategy (2021)
  - **Flanders:** Fully circular by 2050 (2017) (Circular Flanders > Lokaal Circulair)
  - **Brussels:** Be Circular program (2016)
- **3** languages (communities) (French, Flemish, German (9))
- **10** provinces

# AIM

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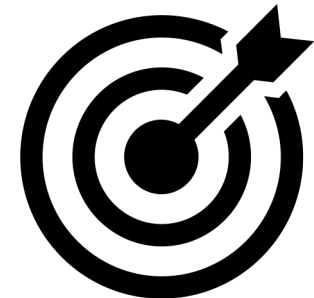
**RQ1:** To what extent have local governments adopted the circular economy in their agenda?

**RQ2:** What are the different strategies that local governments adopt for the circular economy?

**RQ3:** What local characteristics are related to the circular economy strategy that local governments adopt?

## **Originality**

- First empirical results from large set
- Strategy types
- Including small municipalities

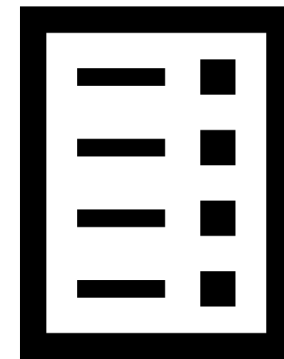


# METHODOLOGY

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## Survey

- Online, made in Qualtrics
- To all 581 Belgian municipalities
- 1 response/municipality
  - Politician/municipal officer
  - Working on circular/sustainability policy
- 3-step implementation
  1. Email to mayor, alderperson, and general director (beginning October)
  2. Reminder by email (after 2 weeks)
  3. Call municipality (after 2 more weeks)



## INTERMEDIATE RESULTS

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- 276 useful responses (**47,5% response rate**)
  - 61% indicated to be working on the circular economy
- Representative for the country, regions

→ **Next step:** analyze results

## WP 2: OVERVIEW

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### WP 2: MC Literature



**Aim:** Identify useful insights from previous research on MC and define a future research agenda based on literature gaps.



**RQ:** What is already known about using MC for implementing a CC strategy?



**Method:** Integrative literature review on related topics in the MC literature, coded using the framework by Malmi & Brown (2008).



**Status:** First draft of paper is written, feedback received and partly implemented.

## WP 2: RESEARCH QUESTION

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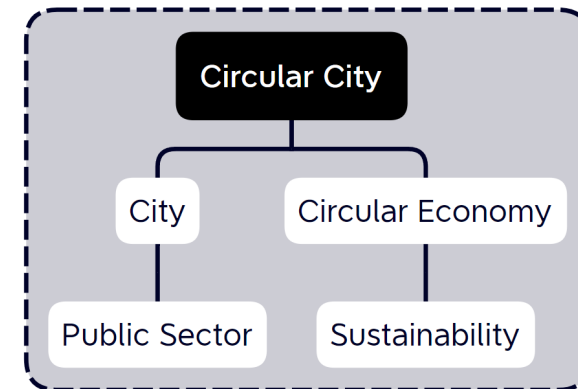
*‘What is already known about using MC for implementing a CC strategy?’*

### Gaps:

- MC adapted for the **circular economy**
  - To avoid becoming a ‘buzzword’
- MC adapted for **local governments**

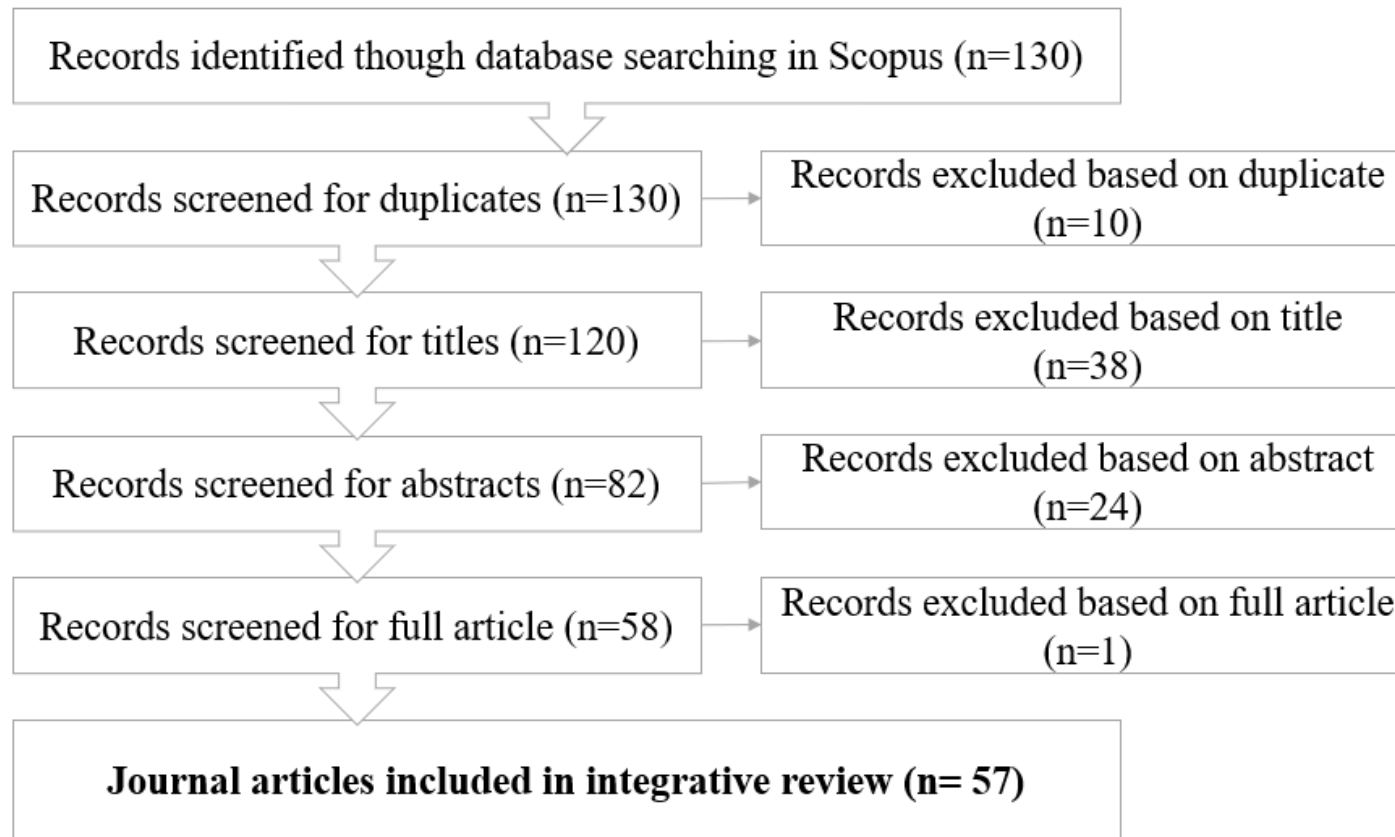
## WP 2: METHODOLOGY

→ Integrative literature review



Used search term (B)	To cover the words	Results
<b>Cit*</b>	City, cities, citizen, citizens	7
<b>local</b>	=	10
<b>Public*</b>	Public, publicly	43
<b>Sustainab*</b>	Sustainable, sustainability	24
<b>Environment*</b>	Environment, environmental	40
<b>Green</b>	=	3
<b>Eco</b>	=	1
<b>Circular*</b>	Circular, circularity	2

## WP 2: METHODOLOGY





# **SUSTAINABLE SMART CITY STRATEGIES – A DRIVER FOR THE LOCALIZATION OF THE SUSTAINABLE DEVELOPMENT GOALS?**

Jessica Clement, Benoit Ruyschaert, and Nathalie Crutzen

# Introduction

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- Cities seen as a key part of achieving Sustainable Development Goals (SDGs)
- Especially through “localizing” SDGs
  - localizing the SDGs: the process of adapting strategies and monitoring and evaluation tools to sub-national territories to promote ‘bottom-up’ advancement of the SDGs
- Role of Sustainable Smart Cities (SSCs) and strategies seen as relevant for achieving SDGs, but no literature found about how strategies play a role in localization
- **Research question:** How do current sustainable smart city strategies contribute to the localization of the SDGs?

# Methods

- Code (using content analysis) SSC strategies published by local governments using the SDG framework
  - First: collect SSC strategies across diverse contexts
    - Ensure there is an explicit 'sustainability' element in strategy
    - Substituting Digital Strategy if no SSC Strategy
    - But only if SSC is cited as key objective, e.g. for Los Angeles:  
"ITA is an integral part of making L.A. a "Smart City" that uses data, tech, and resources to improve the lives of residents, businesses, and visitors."
  - + "Contributions to UN Sustainability (SDG) & LA Green New Deal"
  - Second: using 17 Goals and 169 associated Targets of SDGs, code strategies
- **Background: methodology taken from previous literature**
  - Other studies (e.g., Nerini et al. 2018\*) have used this method, but with a literature review
  - First paper found using content analysis from strategy documents

\* Nerini et al. (2018) "Mapping synergies and trade-offs between energy and the Sustainable Development Goals", *Nature Energy*, 3(1).

# Example of Coding

	GOAL OR TARGET IN THE 2030 AGENDA FOR SUSTAINABLE DEVELOPMENT	A: Does the target require action relevant to smart city transitions	B: Is there evidence in the strategy of synergies between the Target and pursuing a smart city?	Reasoning (in my own words)	Evidence (quote or logic from (e.g. figure) in the strategy. Add page numbers and section titles.
	<b>Goal 1: End poverty in all its forms everywhere</b>				
1.1	By 2030, eradicate extreme poverty for all people everywhere, currently measured as people living on less than \$1.25 a day				
1.2	By 2030, reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions				
1.3	Implement nationally appropriate social protection systems and measures for all, including floors, and by 2030 achieve substantial coverage of the poor and the vulnerable				
1.4	By 2030, ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services, ownership and control over land and other forms of property, inheritance, natural resources, appropriate new technology and financial services, including microfinance			1 Using data to improve access to services	"This data could also be shared with other service providers to improve delivery to the community and develop better, more inclusive services." (40)
1.5	By 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters			1 aiming to better understand how to protect vulnerable areas against climate related events	"such as extreme weather events ... understanding of the vulnerabilities and risks experienced by different parts of the city and the likelihood and impacts of various disruptions upon people, infrastructure and systems." (30)
1.a	Ensure significant mobilization of resources from a variety of sources, including through enhanced development cooperation, in order to provide adequate and predictable means for developing countries, in particular least developed countries, to implement programmes and policies to end poverty in all its dimensions				
1.b	Create sound policy frameworks at the national, regional and international levels, based on pro-poor and gender-sensitive development strategies, to support accelerated investment in poverty eradication actions				
2.1	By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food				

This excel is completed for all 17 Goals, inclusive of their 169 Targets

# Sample of Strategies

Sample of 57 cities:

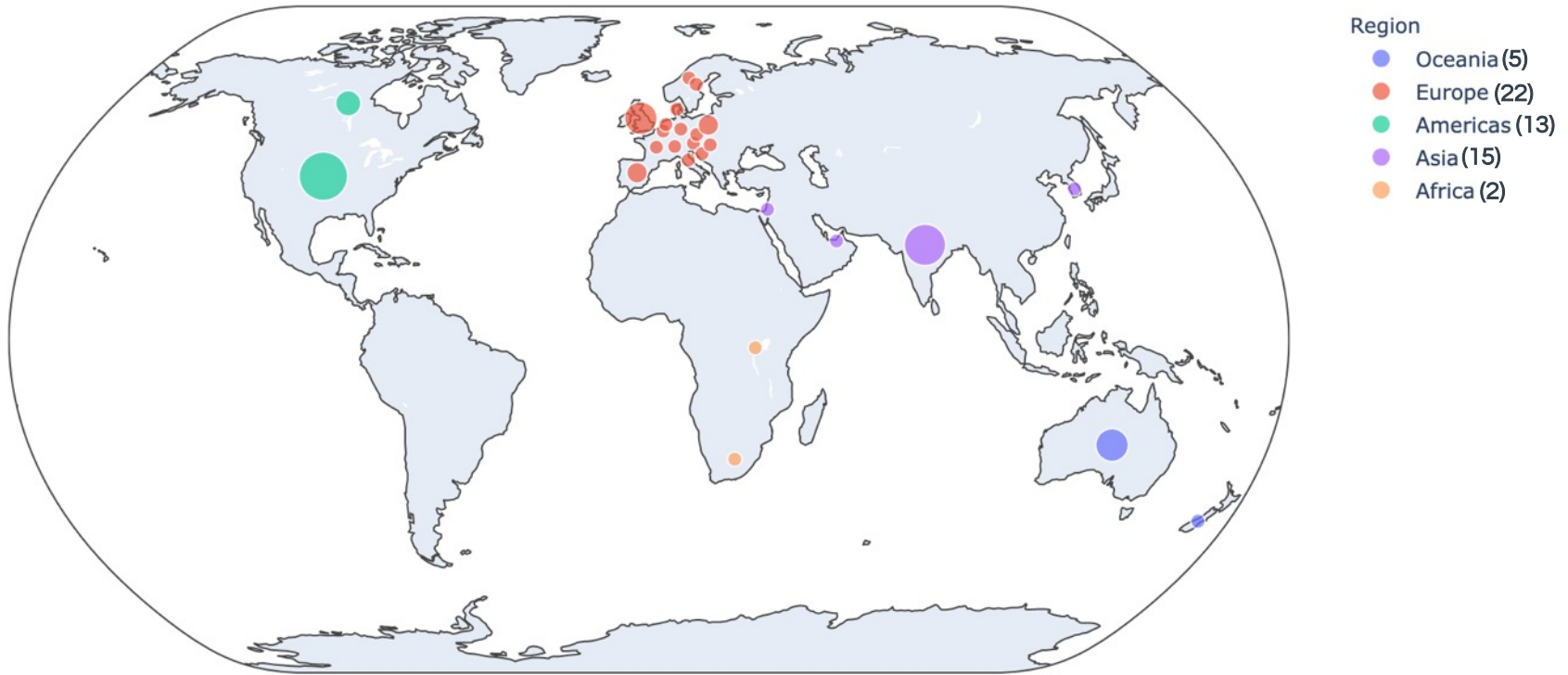


Figure: The bubble size indicates the number of cities per country, with a bigger bubble indicating a higher number of cities, and where the colour indicates the region of each country. Regions are defined using United Nations classification.

# Findings (1)

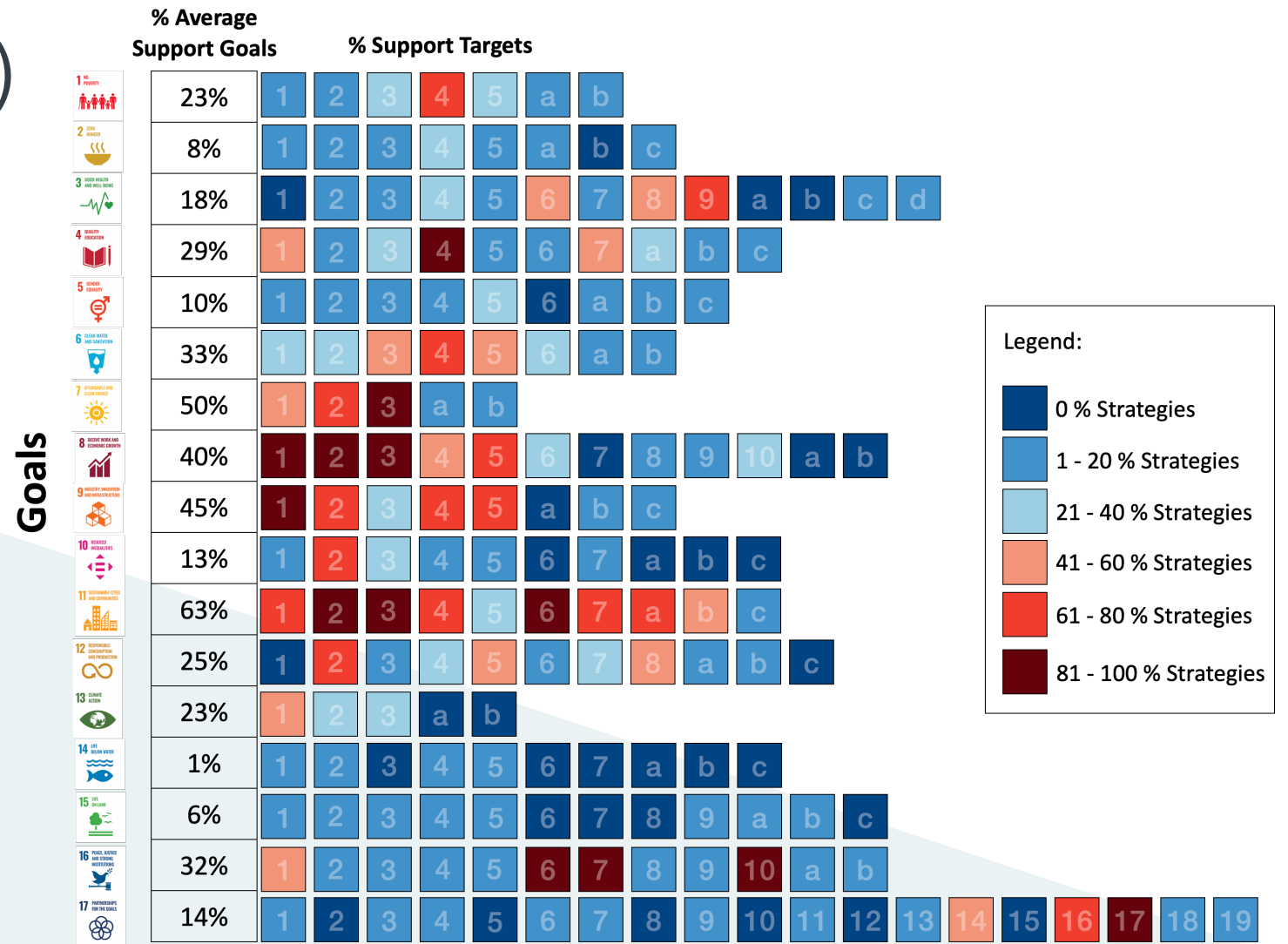


Figure: First showing the average percentage of strategies that support a SDG (left). Calculated by adding the percentage for each Target, and then dividing by the number of Targets for a given Goal. Then showing the percentage of strategies that address a given Target of a SDG (right).

# Findings (1)

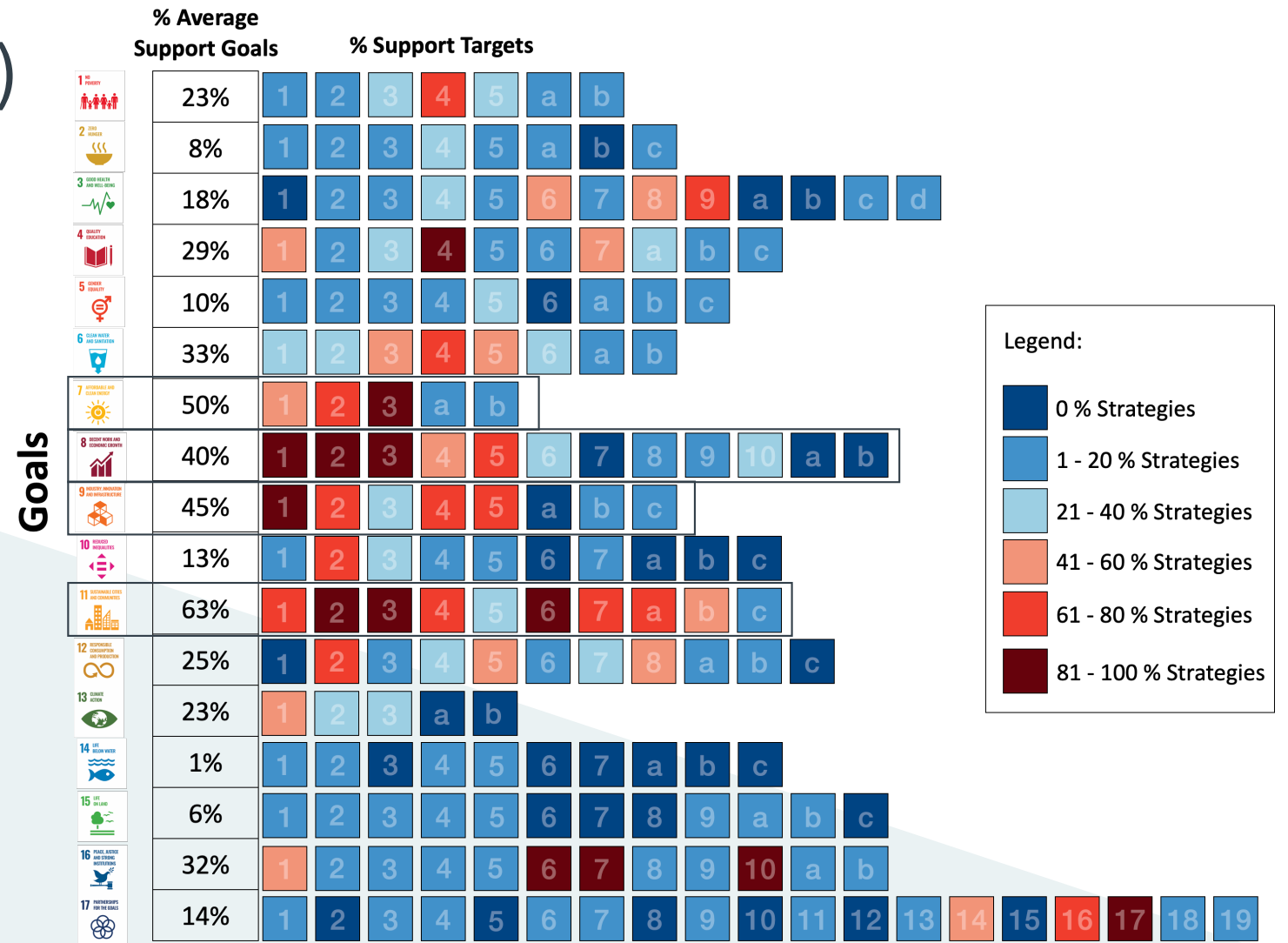


Figure: First showing the average percentage of strategies that support a SDG (left). Calculated by adding the percentage for each Target, and then dividing by the number of Targets for a given Goal. Then showing the percentage of strategies that address a given Target of a SDG (right).

SDGs	Targets		
 <p>7 AFFORDABLE AND CLEAN ENERGY</p>	<ul style="list-style-type: none"> <li>2 Increased share of renewable energy in the global energy mix</li> <li>3 Double the global rate of improvement in energy efficiency</li> </ul>		
	 <p>8 DECENT WORK AND ECONOMIC GROWTH</p>	<ul style="list-style-type: none"> <li>1 Sustain per capita economic growth in accordance with national circumstances</li> <li>2 Achieve higher levels of economic productivity through diversification, technological upgrading, and innovation</li> <li>3 Promote development-oriented policies that support decent job creation, entrepreneurship, creativity and innovation</li> <li>5 Achieve full and productive employment and decent work for all women and men</li> </ul>	
		 <p>9 INDUSTRY, INNOVATION AND INFRASTRUCTURE</p>	<ul style="list-style-type: none"> <li>1 Develop quality, reliable, sustainable, and resilient infrastructure</li> <li>2 Promote inclusive and sustainable industrialization and raise industry's share of employment</li> <li>4 Upgrade infrastructure and industries to make them sustainable, with increased resource-use efficiency and clean technologies</li> <li>5 Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries</li> </ul>
 <p>11 SUSTAINABLE CITIES AND COMMUNITIES</p>			<ul style="list-style-type: none"> <li>1 Access for all to adequate, safe, and affordable housing and basic services and upgrade slums</li> <li>2 Access to safe, affordable, accessible, and sustainable transport systems for all</li> <li>3 Enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning</li> <li>4 Strengthen efforts to protect and safeguard the world's cultural and natural heritage</li> <li>6 Reduce the adverse per capita environmental impact of cities</li> <li>7 Provide universal access to safe, inclusive and accessible, green and public spaces</li> <li>a Support positive economic, social and environmental links between urban, per-urban and rural areas</li> </ul>

Figure: Primary SDGs and their key Targets supported through SSC strategies. Primary SDGs are those that found an average support of 40% or more and the Targets are those that were supported by 61% or more of the strategies. Targets are paraphrased for brevity. Source: <https://sdgs.un.org/goals>



# Findings (2): SDG Nexus

- Factor analysis to understand what SDGs are simultaneously included in strategies: **Nexus of SDGs**
- Aims to reduce observed variables to identify patterns in data, and ultimately groups of inter-related variables based on similar profile values
- Factors found:
  - Factor 1: comprised of **SDGs 3, 6, 7, 11, 16, and 17** → wellbeing and access to basic resources (water, energy, as well as access to social and political participation) in cities.
  - Factor 2: **SDGs 1, 8, 9, and 10** → economic, infrastructure, and innovation development for reducing poverty and inequalities
  - Factor 3: **SDGs 1 and 5** → representing link between poverty and gender inequalities
  - Factor 4: **SDGs 2, 12, and 13** → sustainable (urban, peri-urban) agriculture and production for an improved climate
  - Factor 5: **SDGs 14 and 15** → biodiversity and conservation on both the land and in the water

# Implications...

Knowing that Smart Sustainable Cities are not “supposed to” cover all Targets, what is missing?

- Zero Hunger (SDG 2)
- Gender dimension (SDG 5)
- Biodiversity (SDG 15, especially 15.9 on local biodiversity)
- City-sharing best practices (e.g., international partnerships for knowledge & technical sharing between developed cities and developing cities) (SDG 17)

# Conclusion

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- While SDG localization priorities will depend on the context of each city, developing such documents may support several different objectives (economic, social, and environmental)
- With the caveat:
  - if local administrations wish to use SSC strategies as a means for a fundamental shift toward a more sustainable urban model, careful attention must be paid to include initiatives on often untreated topics in such strategies, such as food access and sustainable urban agriculture, gender equality, and biodiversity conservation
- Therefore can develop SSC strategy with the participation of a vast set of stakeholders and in concert with other local strategy documents