Sustainability Assessment of Urban Systems

(ENV-461) – MA B1 11

10: Deriving policy recommendations

Lecturers:

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Laboratory on Human-Environment Relations in Urban Systems

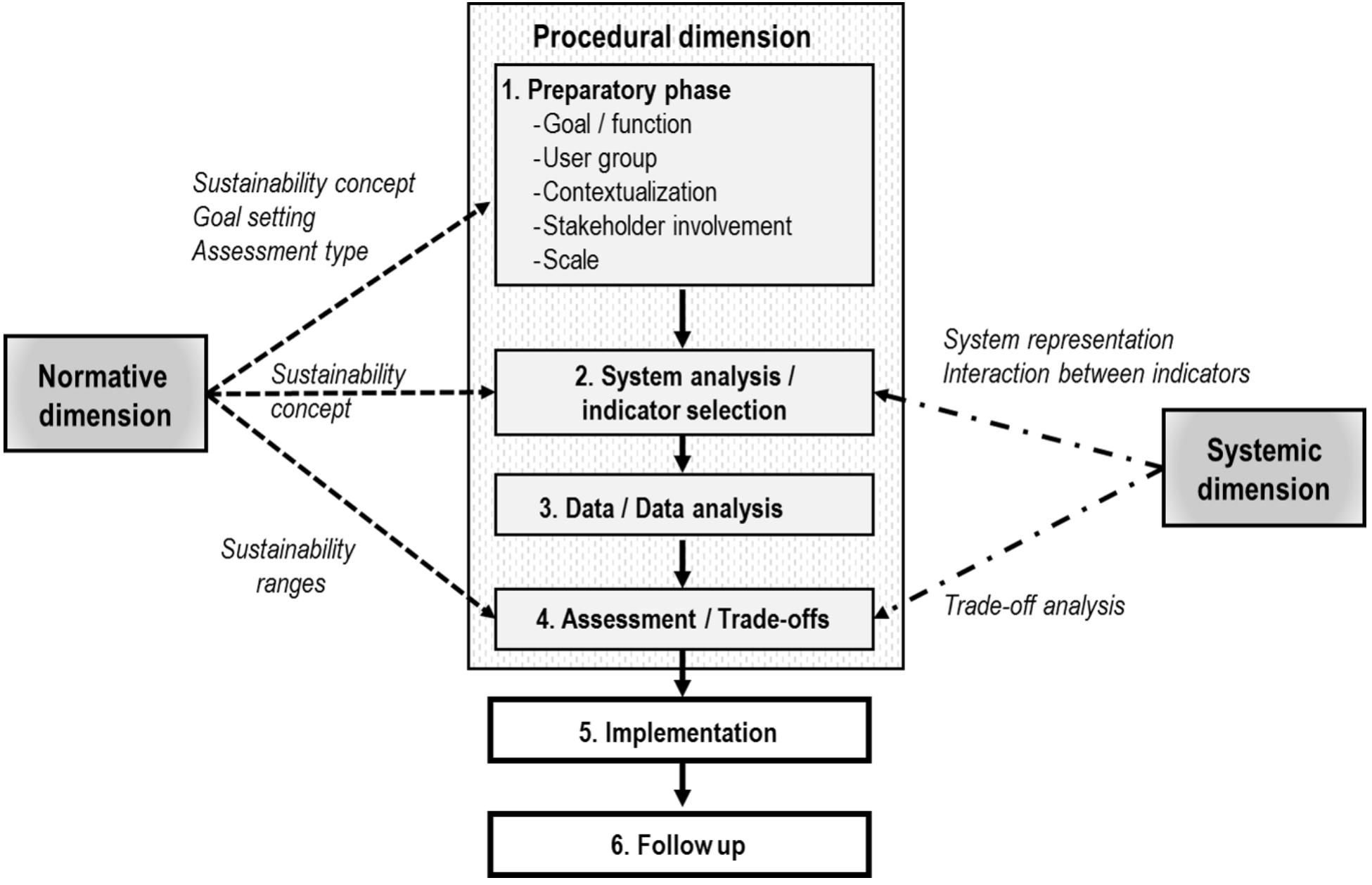
Program of the course

Lectures : BS 170 on Wednesdays, 13:15 – 16:00 (Lecture + Exercise)

n°	Date	Session	Milestones Project
1	19/02/2025	**Introduction** into sustainability and SA	
2	26/02/2025	**Sustainability issues** in **urban systems**	
3	05/03/2025	**Key steps in SA #1**: SSP, normative dimension, frameworks	**Groups formed**
4	12/03/2025	**Key steps in SA #2**: Systemic dimension	
5	19/03/2025	**Key steps in SA #3**: Participatory dimension	**Submission - Outline 19.03**
6	26/03/2025	**Deriving indicators (1/2)**	
7	02/04/2025	**Deriving indicators (2/2)**	
8	09/04/2025	**Influence matrix**	
9	16/04/2025	**Multi-Criteria Analysis**	
	23/04/2025	**Easter break**	
10	30/04/2025	**Deriving policy recommendations**	
11	07/05/2025	**Policy implications**	
12	14/05/2025	**Sustainability Assessment in practice**	
13	21/05/2025	**Exam**	
14	28/05/2025	**Presentation of semester work_2**	

* May be updated depending on the number of students enrolled

Sustainability Solutions Space



Goals of the Lecture

- Understand the policy cycle
- Analyze where indicators and sustainability assessment can support the policy cycle
- Use the tools developed in the last courses for designing policies

The policy cycle

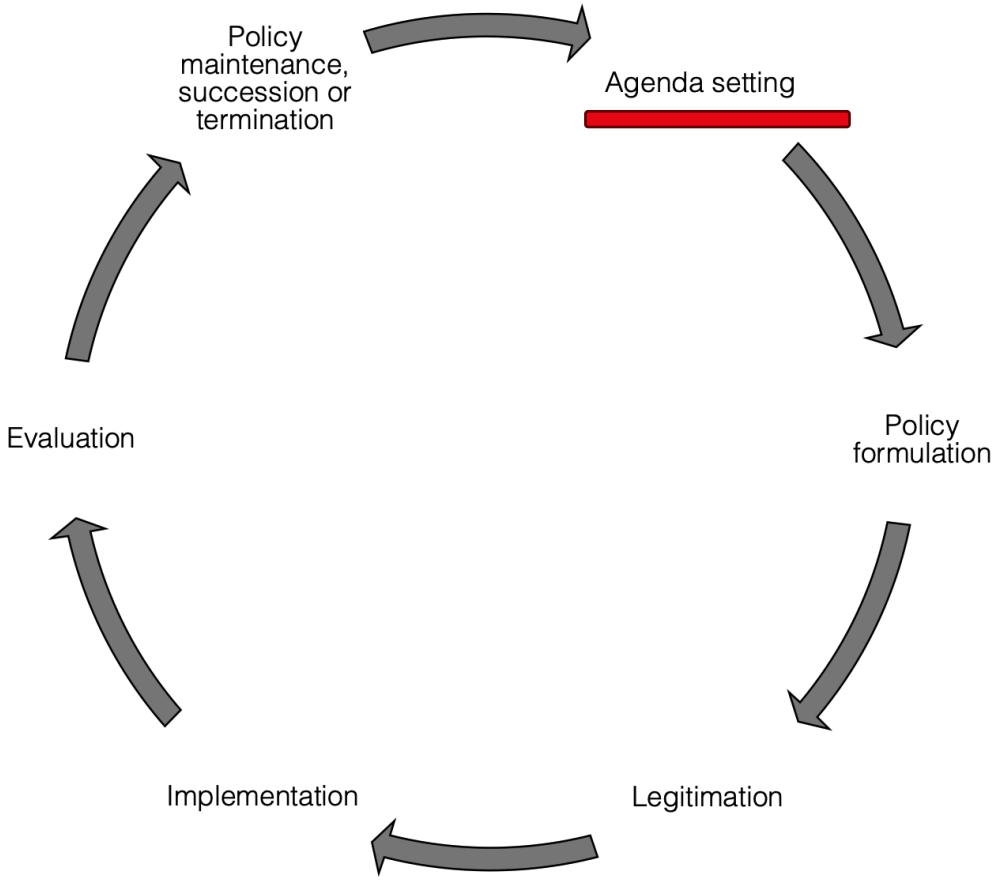
The Policy Cycle

- The policy cycle is one of the most fundamental theories explaining why and how public policies change
- The Policy Cycle is a conceptual framework used to describe the stages that policies typically go through from inception to evaluation.
- It represents a dynamic, iterative process where policy development is continuously refined based on new information, changing circumstances, and feedback.

The Policy Cycle

- It emphasizes the idea that policies are not static but evolve over time as they are monitored and reassessed. The cycle also allows for feedback loops, where evaluations can lead to adjustments or even the reversal of previous policy decisions.
- The cycle involves several key stages, including agenda-setting, policy formulation, decision-making, implementation, and evaluation.

The Policy Cycle

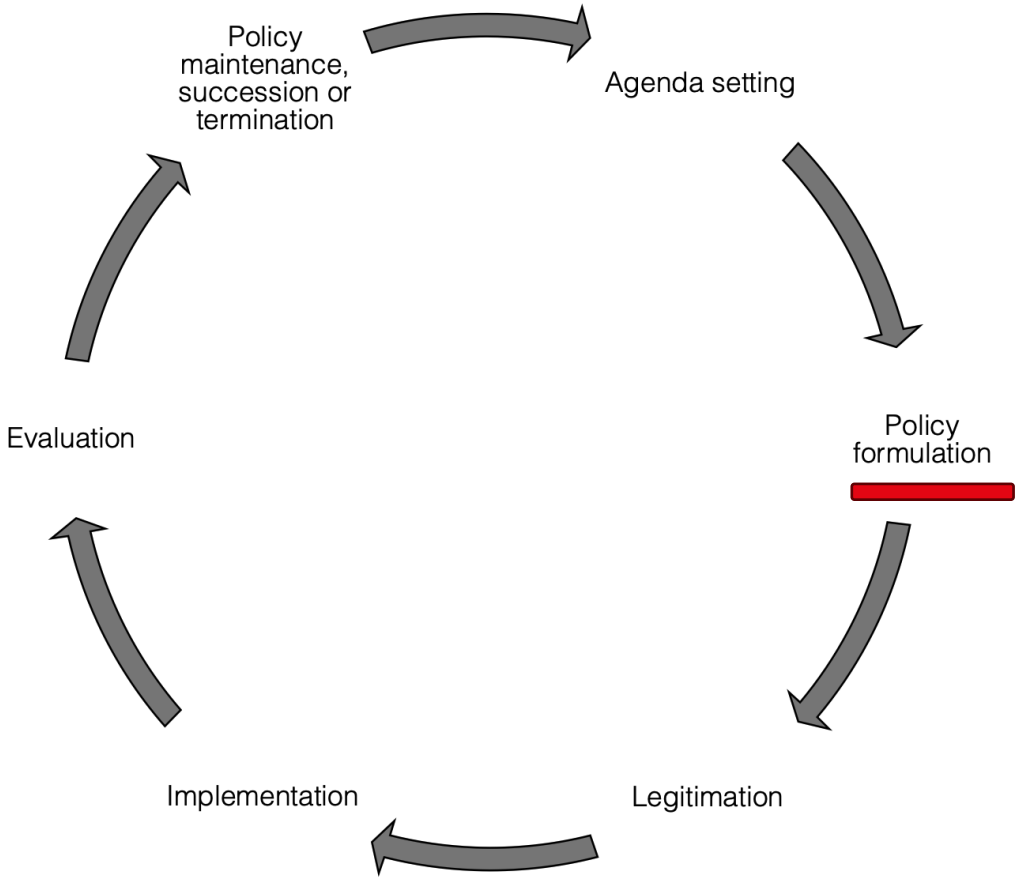


p. 32, Cairney, Paul. *Understanding public policy: theories and issues*. Vol. 2. Bloomsbury Publishing, 2019.

Agenda-Setting:

- Identifying and prioritizing issues that require governmental attention.
- Often influenced by public opinion, crises, and media coverage.

The Policy Cycle

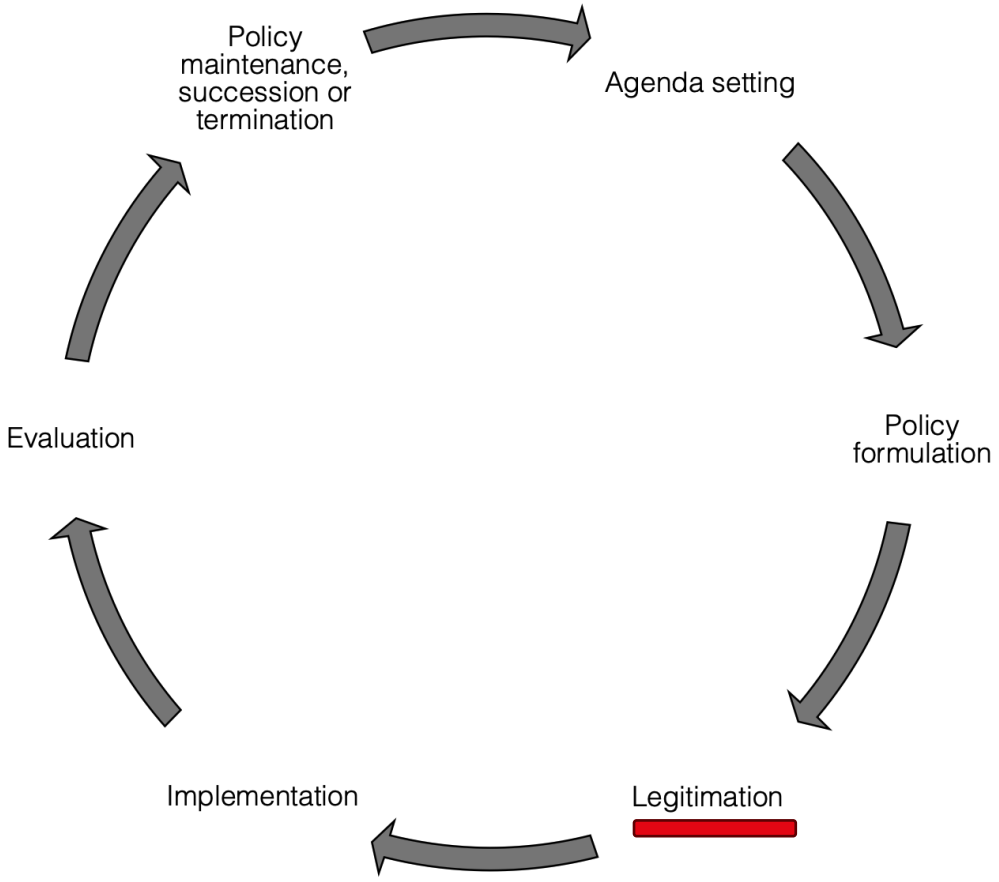


p. 32, Cairney, Paul. *Understanding public policy: theories and issues*. Vol. 2. Bloomsbury Publishing, 2019.

Policy formulation:

- Developing possible solutions or policy options for the identified problems.
- Often involves consultation of scientists, expert input, and stakeholder consultation, e.g. in Switzerland (ger.: "Vernehmlassungsverfahren", fr.: "la procédure de consultation")

The Policy Cycle



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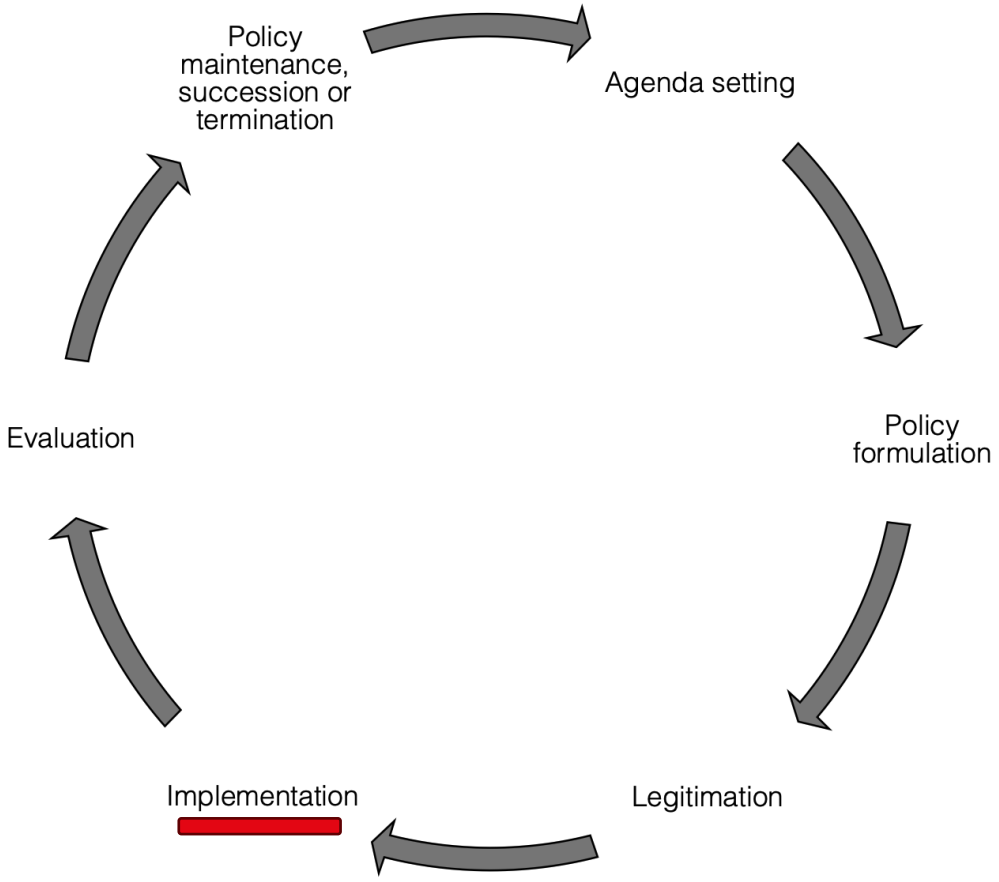
Legitimation/decision-making

- Choosing a specific policy option based on political, economic, and social considerations.
- Actors like policymakers, interest groups, and lobbyists play significant roles.
- The legitimation, for instance, unfolds through parliamentary debates that precede the decision of policies being adopted

The Policy Cycle



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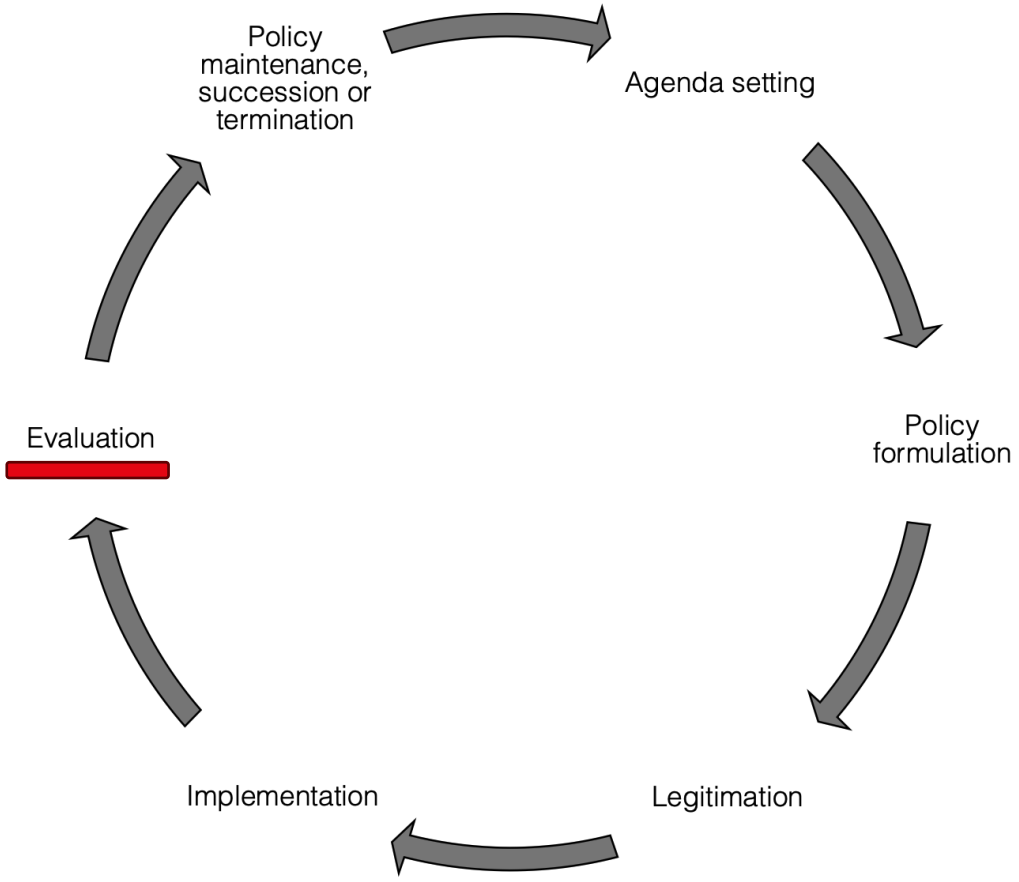
Implementation

- Putting the chosen policy into action through the creation of programs, laws, and regulations.
- Involves agencies, departments, and local governments to carry out the policy.

The Policy Cycle



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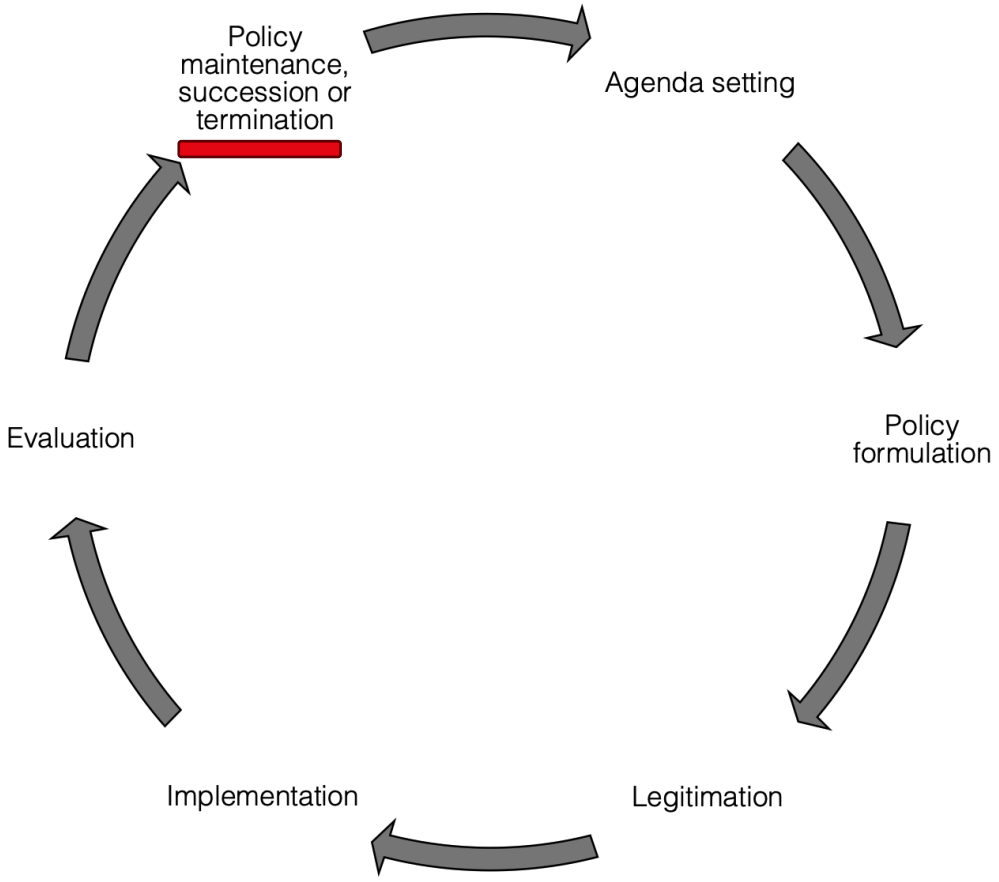
Evaluation

- Assessing the policy's effectiveness by measuring outcomes and impact.
- Feedback from evaluation can lead to adjustments in the policy or even a return to the agenda-setting phase.

The Policy Cycle



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Succession or termination

- Based on the evaluation, policies may be revised or abandoned if they are found to be ineffective or no longer needed.

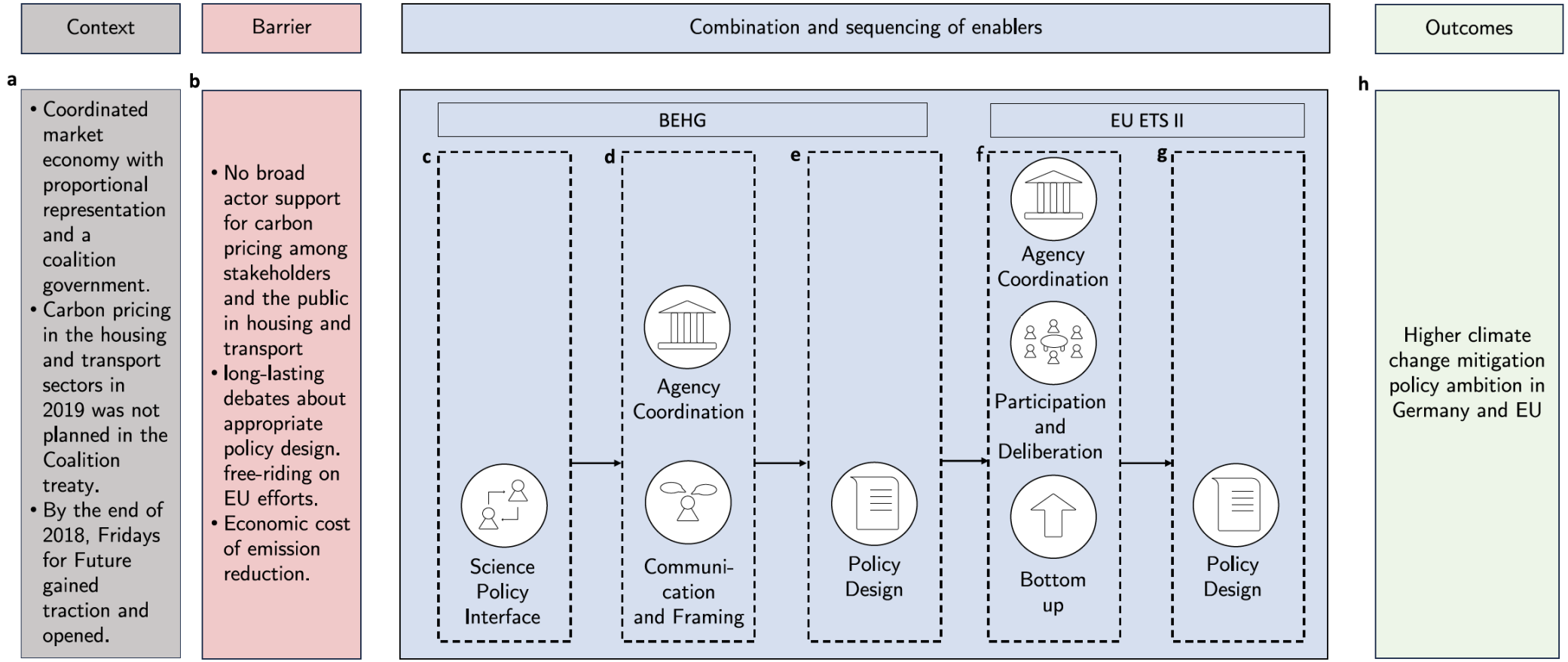
The Policy Cycle: Which indicators could be used to inform at each stage of the policy cycle?

- There is no one objectively selectable set of indicators most appropriate in any case.
- Depends on the issue, the political system, the level of government, and the availability of data.

The Policy Cycle: indicators at each stage

Stage	Key Theoretical Concepts	Role of Indicators	Where and How Indicators are Used
Agenda-Setting	Issue Salience, Problem Recognition, Attention Cycles	**Moderate** (supporting but not dominant)	In media, scientific reports, advocacy campaigns: indicators are used to dramatize problems and justify urgency for action.
Policy Formulation	Risks versus benefits, Technical feasibility	**High** (strong guidance for design)	In expert commissions, advisory bodies, government departments: indicators structure problem definitions and quantify policy targets.
Decision-Making	Political Bargaining, Actor Coalitions, Interest Mediation	**Low to Moderate** (background role)	In parliaments, cabinets, negotiations: indicators are selectively mobilized to legitimize decisions, but strategic and political factors are stronger.
Implementation	Administrative Capacity, Compliance and Monitoring	**Moderate to High** (important for operational control)	Within implementing agencies, bureaucracies, and regulatory bodies: indicators track progress, guide adaptive management, and trigger corrective actions.
Evaluation	Performance Assessment, Accountability, Policy Feedback	**High** (central to outcome assessment)	In audit offices, independent evaluations, NGOs, and academia: indicators systematically assess effectiveness and provide feedback for reforms or policy termination.

Indicator use for agenda setting



Use of indicators:

In reports:
-efficiency
-equity
-technical feasibility

Montfort, S., Fesenfeld, L., Ingold, K., Lamb, W. F., & Andrijevic, M. (2025). Political enablers of ambitious climate policies: a framework and thematic review. npj Climate Action, 4(1), 14.

Motivated reasoning (particularly important during decision-making and political debates)

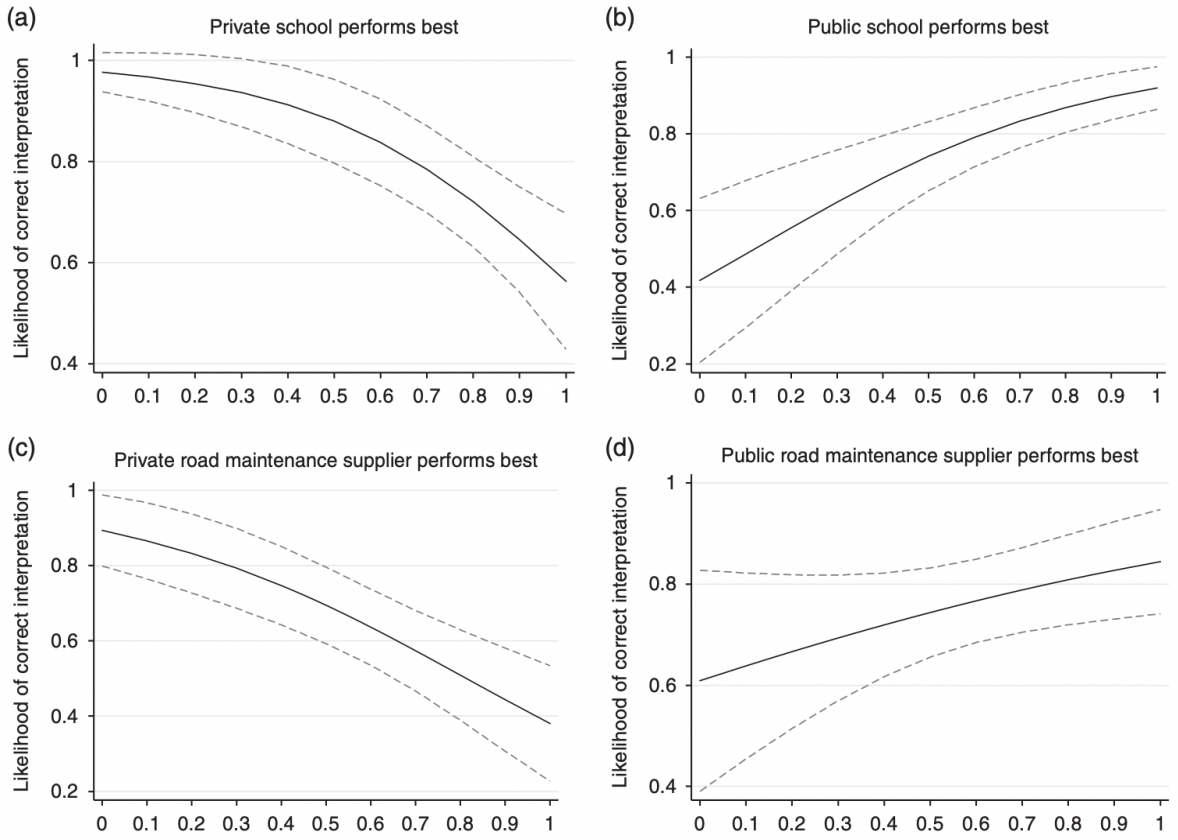
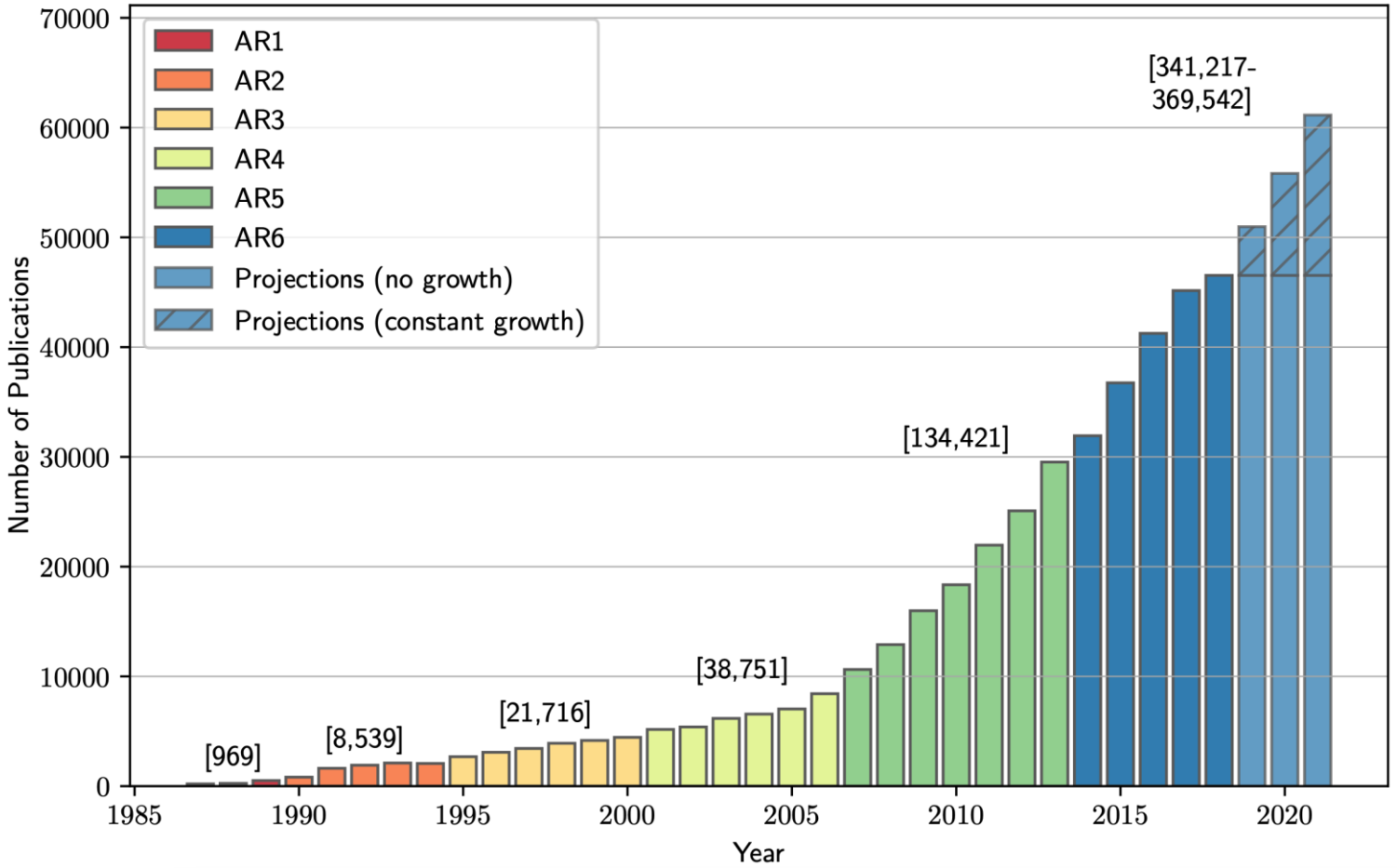
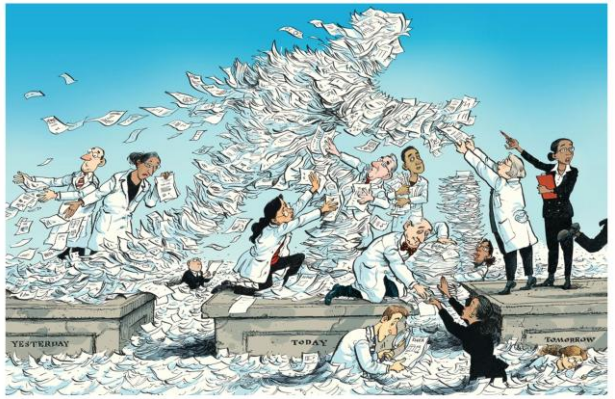


Fig. 3. Relationship between prior attitudes and correct interpretations in treatment groups (politician sample)
Note: estimated relationships with 95 per cent confidence intervals. The x-axis runs from 0 to 1, with 1 denoting the maximum support for public service provision.

Policy Evaluation: Challenges



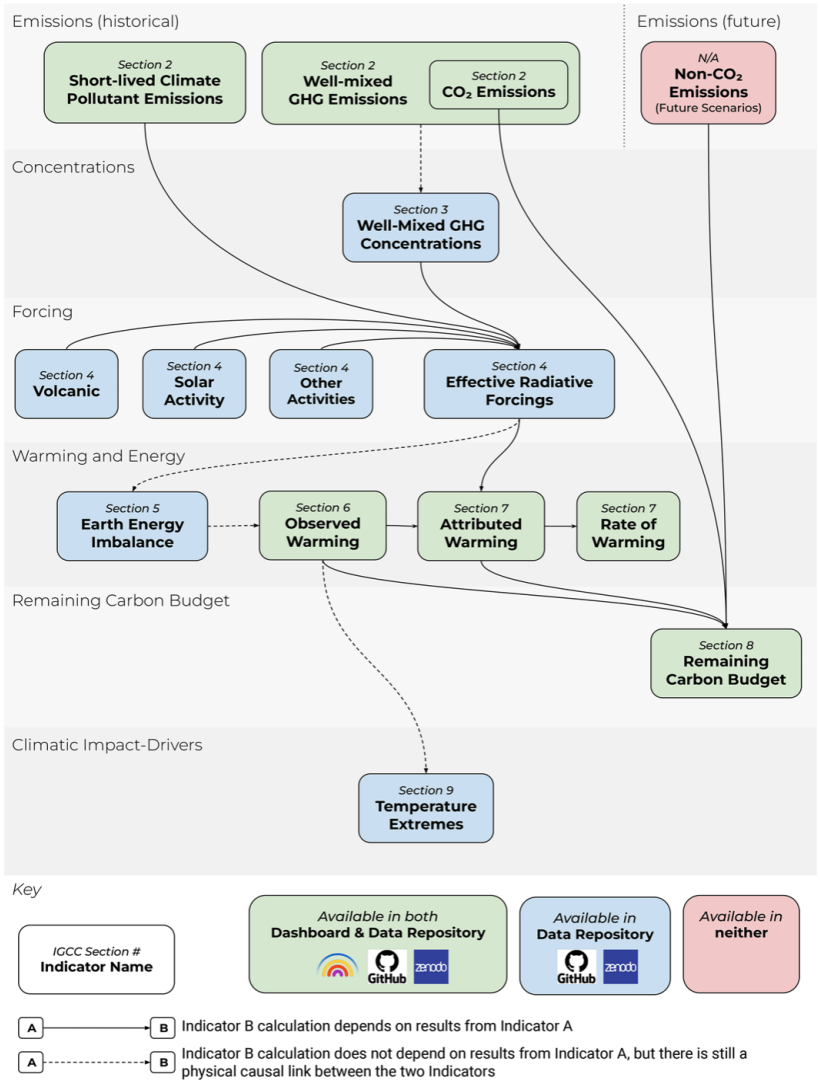
Callaghan, M. W., Minx, J. C., & Forster, P. M. (2020). A topography of climate change research. *Nature Climate Change*, *10*(2), 118-123.



Elliott, Julian, Rebecca Lawrence, Jan C. Minx, Olufemi T. Oladapo, Philippe Ravaud, Britta Tendal Jeppesen, James Thomas, Tari Turner, Per Olav Vandvik, and Jeremy M. Grimshaw. "Decision makers need constantly updated evidence synthesis." *Nature* 600, no. 7889 (2021): 383-385.

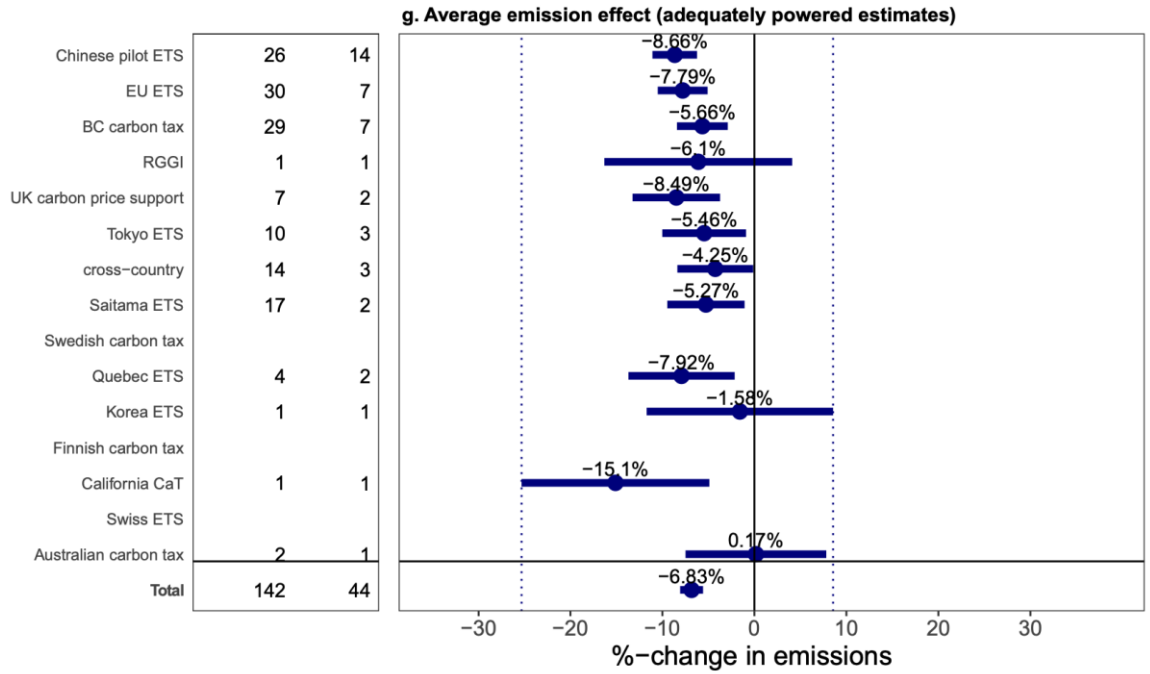
Policy Evaluation: opportunities

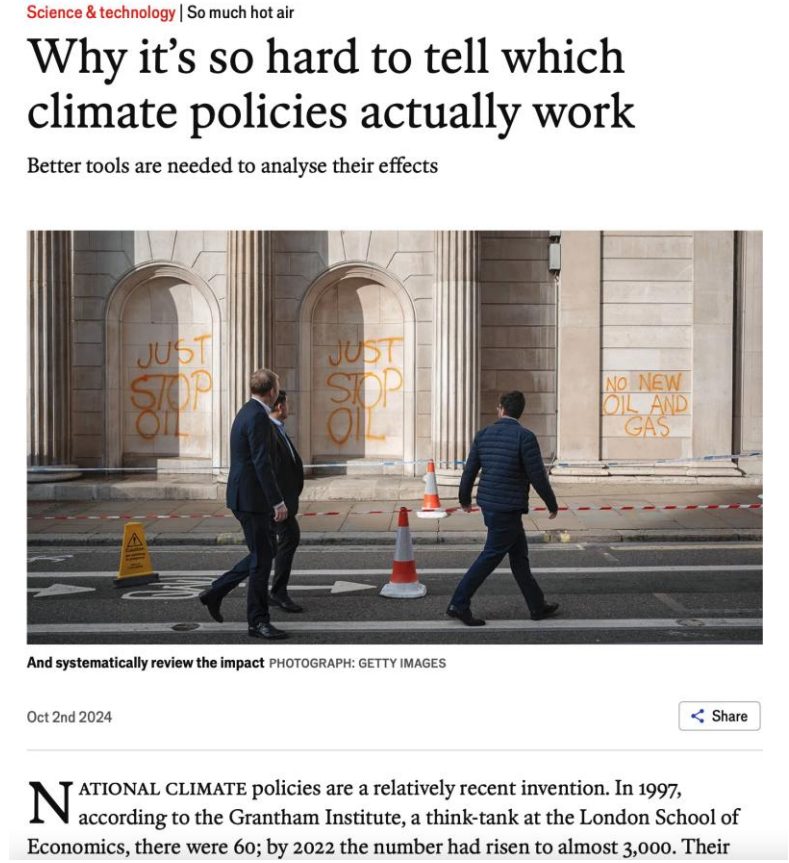
- Living evidence synthesis
  - Constantly updated evidence bases, e.g. example on the right of yearly report updating information on key climate change indicators
  - Living evidence synthesis
- Use of Artificial Intelligence and machine learning to scale up the evidence synthesis



Forster et al. (2024). Indicators of Global Climate Change 2023: annual update of key indicators of the state of the climate system and human influence. *Earth System Science Data*, *16*(6), 2625-2658.

Scientific Policy Evaluation through relevant indicators can lead to media uptake





Science & technology | So much hot air

Why it's so hard to tell which climate policies actually work

Better tools are needed to analyse their effects

And systematically review the impact PHOTOGRAPH: GETTY IMAGES

Oct 2nd 2024 Share

NATIONAL CLIMATE policies are a relatively recent invention. In 1997, according to the Grantham Institute, a think-tank at the London School of Economics, there were 60; by 2022 the number had risen to almost 3,000. Their

Döbbeling-Hildebrandt, N., Miersch, K., Khanna, T. M., Bachelet, M., Bruns, S. B., Callaghan, M., ... & Minx, J. C. (2024). Systematic review and meta-analysis of ex-post evaluations on the effectiveness of carbon pricing. *Nature communications*, *15*(1), 4147.

Usability in policy processes and characteristics of indicators

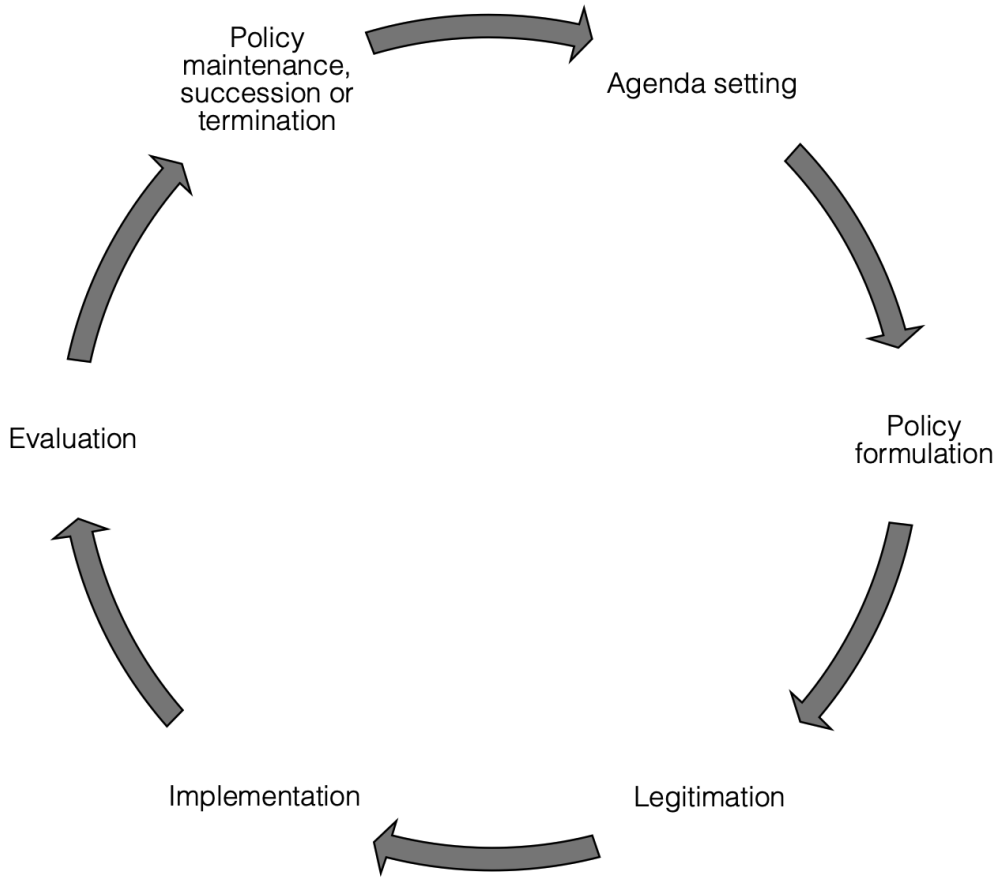
Type / Feature of Indicator	Usability	Why
Simple & Communicable	+	Indicators that are easy to understand and explain (e.g., CO_2 levels) are more likely to gain traction. (Hezri & Dovers 2006)
Timely	+	Closely aligned with political priorities or recent events; must be timely to influence decisions. (Turnhout et al. 2007; Meadow et al. 2005)
Standardized / Institutionalized	+	Indicators from trusted bodies (e.g., UN SDGs, OECD) carry legitimacy and comparability. (Cash et al. 2003)
Co-Produced with Stakeholders	+	Developed collaboratively with users (e.g., governments, civil society), increasing legitimacy and buy-in. (Turnhout et al. 2007; Meadow et al. 2005)
Composite but Intuitive	+/-	Indices (e.g., Ecological Footprint, HDI) are accepted if transparent and easy to interpret. (Böhringer & Jochem 2007)
Highly Technical or Disputed	-	Complex or controversial indicators are often ignored or strategically used only when convenient. (Radaelli 1995; Hezri 2006)

References: Usability in policy processes and characteristics of indicators

- Böhringer, C., & Jochem, P. E. P. (2007). Measuring the immeasurable — A survey of sustainability indices. *Ecological Economics, 63*(1), 1–8.
- Cash, D. W., Clark, W. C., Alcock, F., Dickson, N. M., Eckley, N., & Jäger, J. (2003). Knowledge systems for sustainable development. *Proceedings of the National Academy of Sciences, 100*(14), 8086–8091.
- Hezri, A. A. (2006). Sustainability indicator systems and policy processes in Malaysia: a framework for utilisation and learning. *Journal of Environmental Management, 78*(4), 357–373.
- Hezri, A. A., & Dovers, S. R. (2006). Sustainability indicators, policy and governance: Issues for ecological economics. *Ecological Economics, 60*(1), 86–99.
- Meadow, A. M., Ferguson, D. B., Guido, Z., Horangic, A., Owen, G., & Wall, T. (2005). Moving toward the deliberate coproduction of climate science knowledge. *Weather, Climate, and Society, 7*(2), 179–191.
- Radaelli, C. M. (1995). The role of knowledge in the policy process. *Journal of European Public Policy, 2*(2), 159–183.
- Turnhout, E., Hisschemöller, M., & Eijsackers, H. (2007). Ecological indicators: Between the two fires of science and policy. *Ecological Indicators, 7*(2), 215–228.

Where can sustainability assessment inform policy?

The policy cycle



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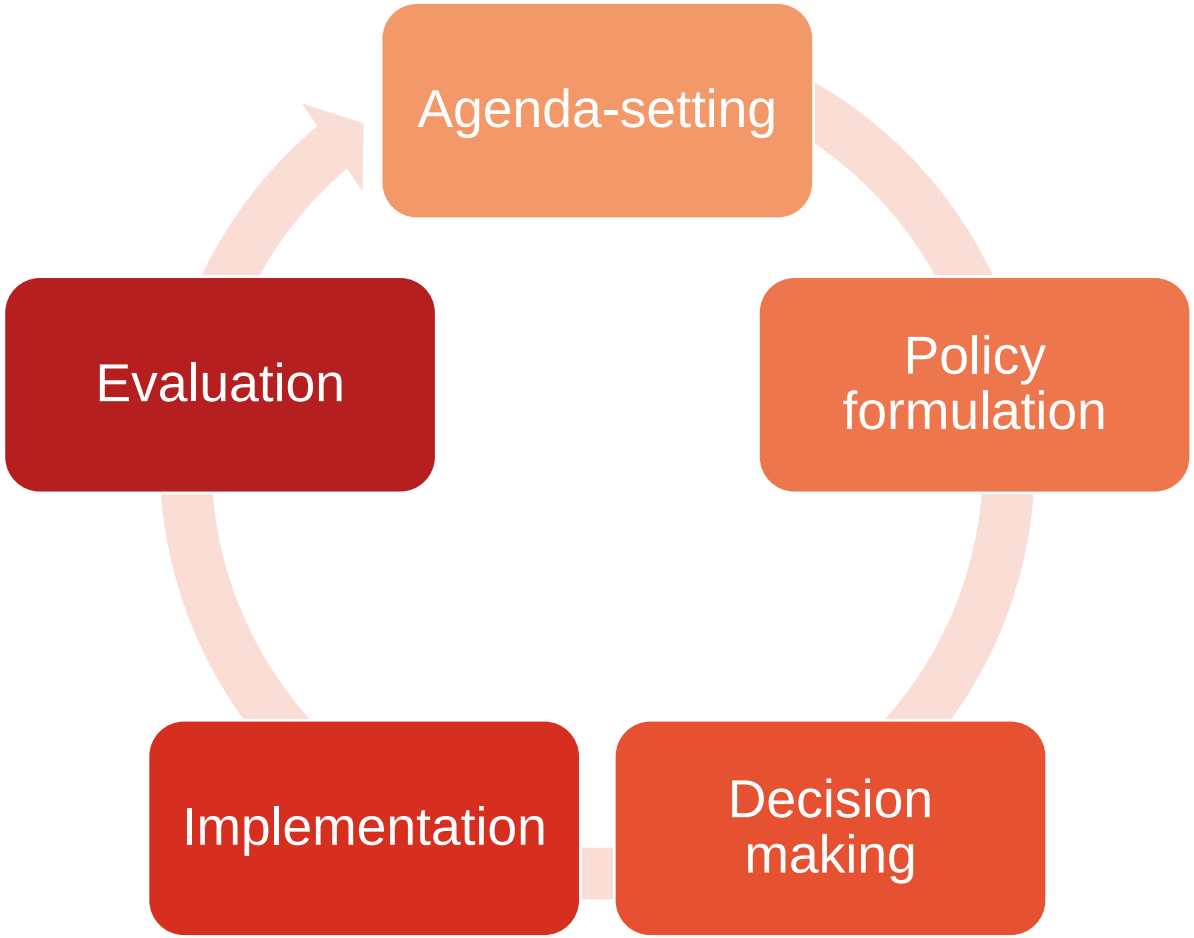
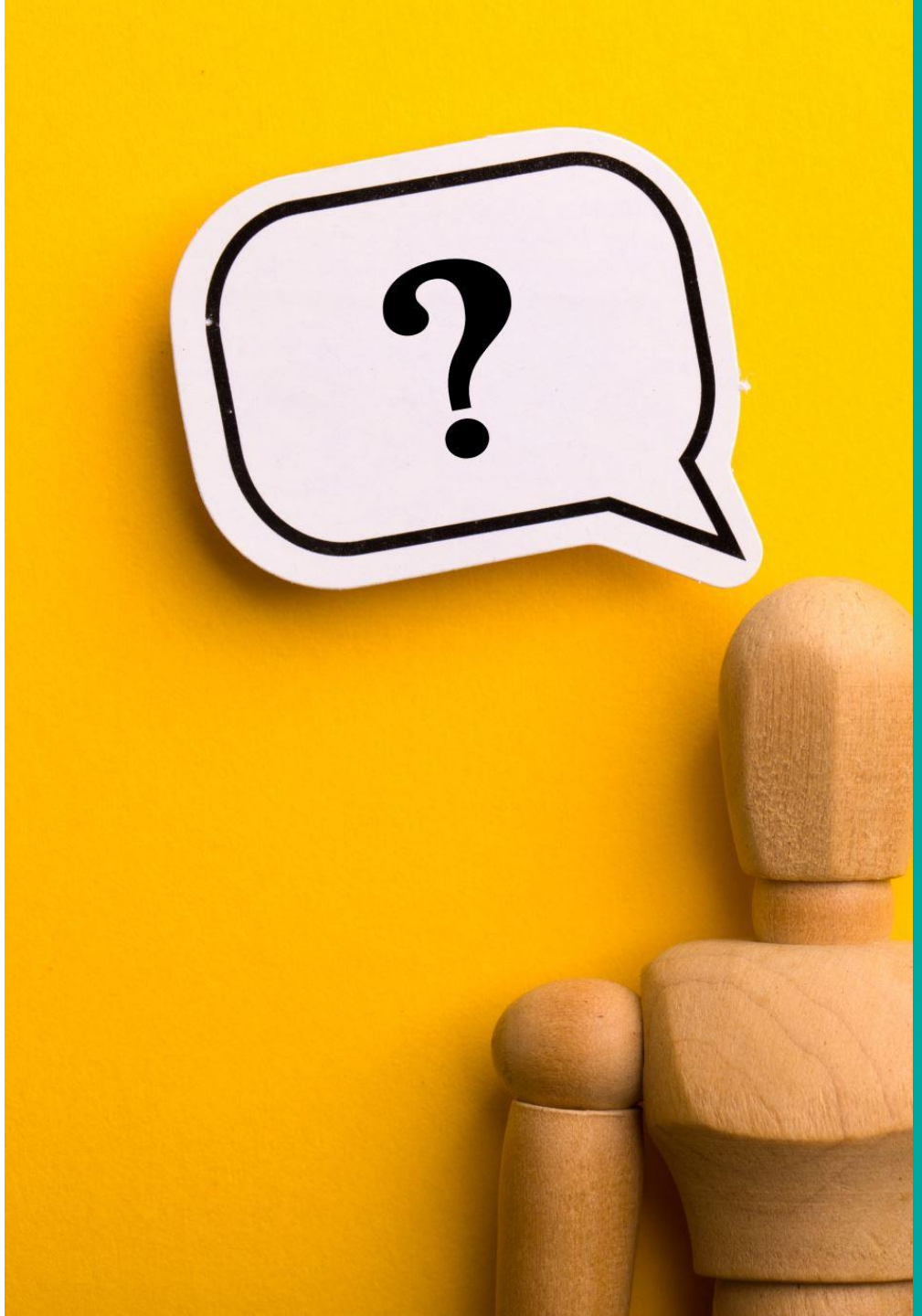
Influence of Sustainability Assessment results





How can we derive policies from a SA?

What do you need to derive policies?

What do we have to support derivation of policies?

		Environmental aspects			Economic aspects			Social aspects		
		Indicator Env.1	Indicator Env. 2	Indicator Env. 3	Indicator Econ.1	Indicator Econ. 2	Indicator Econ. 3	Indicator Soc. 1	Indicator Soc. 2	Indicator Soc. 3
Environmental aspects	Indicator Env. 1		0	1	0	1	0	-2	1	0
	Indicator Env. 2	0		1	0	1	0	2	1	0
	Indicator Env. 3	1	1		0	1	0	-1	1	0
Economic aspects	Indi. Econ. 1	1	1	1		1	0	1	1	-1
	Ind. Econ. 2	-1	1	1	2		0	1	1	0
	Ind. Econ. 3	1	-1	1	2	0		1	0	0
Social aspects	Indicator Soc. 1	1	1	-2	0	0	0		1	0
	Indicator Soc. 2	2	2	2	1	0	0	2		1
	Indicator Soc. 3	1	1	1	1	1	0	2	1	

Influence Matrix

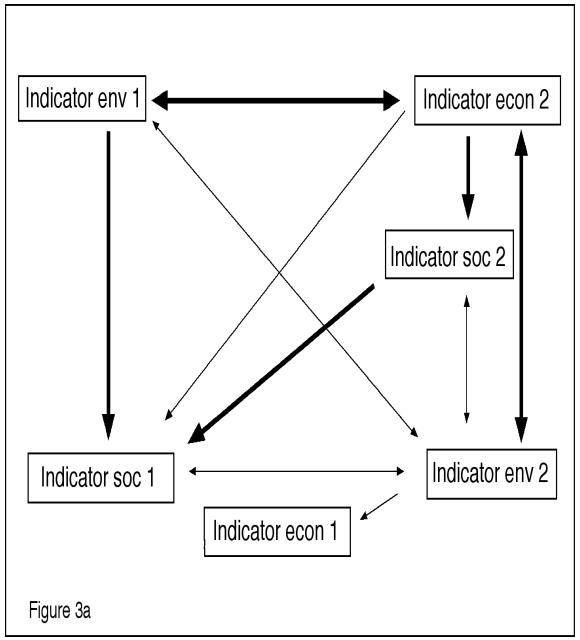


Figure 3a

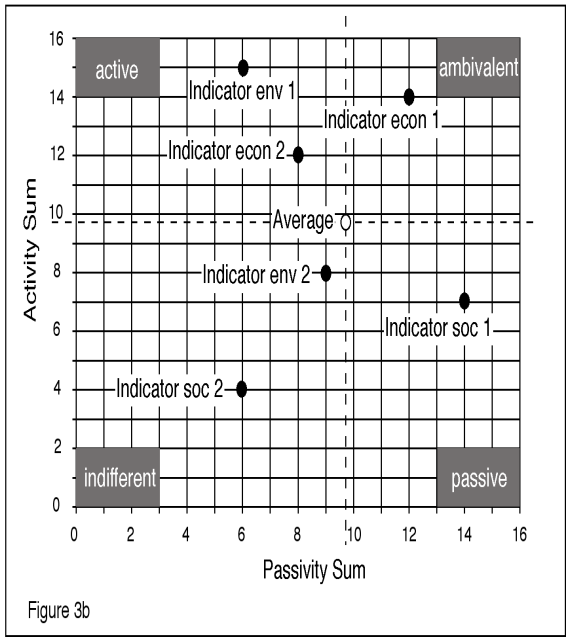


Figure 3b

Activity – Passivity Plot

		Options			
Criteria	Units	$a_{j=1}$	$a_{j=2}$	(...)	$a_{j=n}$
$g_{i=1}$		$g_1(a_1)$	$g_1(a_2)$	...	$g_1(a_n)$
$g_{i=2}$		...	...	...	...
(...)		...	...	...	...
$g_{i=m}$		$g_m(a_1)$	$g_m(a_2)$	...	$g_m(a_n)$

Impact Matric and MCDA

Sustainability Assessment of Urban Systems

Laboratory on Human-Environment Relations in Urban Systems

MCDA – Results?

Table 19
Multi-criteria impact matrix

Criteria	Units	Dir.	CB-Pre	CB	ST	CBST	L	R	NP
Owners' income	€/year	5	48,000	33,000	99,000	132,000	78,000	72,000	—
Economic activity tax	€/year	5	~12,750	~15,470	~46,410	~61,880	~36,570	~33,750	—
Construction tax	€	5	~61,990	~55,730	~96,520	~152,250	~81,890	~67,650	—
Number of jobs		5	2	1	4	5	3	3	—
Visual impact	km^2	6	76.570	71.465	276.550	348.015	220.400	163.290	—
Forest lost	ha	6	8.4	8.1	6.6	14.7	3.9	2.6	—
Avoided CO_2 emissions	ton CO_2/year	5	4680	6010	19,740	25,750	14,740	13,760	—
Noise	dB(A)	6	14.64	23.86	18.6	23.84	20.88	14.66	—
Installed capacity	MW	5	13.6	16.5	49.5	66	39	36	—

Influence Matrix?

		Environmental aspects			Economic aspects			Social aspects		
	→	Indicator Env.1	Indicator Env. 2	Indicator Env. 3	Indicator Econ.1	Indicator Econ. 2	Indicator Econ. 3	Indicator Soc. 1	Indicator Soc. 2	Indicator Soc. 3
Environmental aspects	Indicator Env. 1		0	1	0	1	0	-2	1	0
	Indicator Env. 2	0		1	0	1	0	2	1	0
	Indicator Env. 3	1	1		0	1	0	-1	1	0
Economic aspects	Indi. Econ. 1	1	1	1		1	0	1	1	-1
	Ind. Econ. 2	-1	1	1	2		0	1	1	0
	Ind. Econ. 3	1	-1	1	2	0		1	0	0
Social aspects	Indicator Soc. 1	1	1	-2	0	0	0		1	0
	Indicator Soc. 2	2	2	2	1	0	0	2		1
	Indicator Soc. 3	1	1	1	1	1	0	2	1	

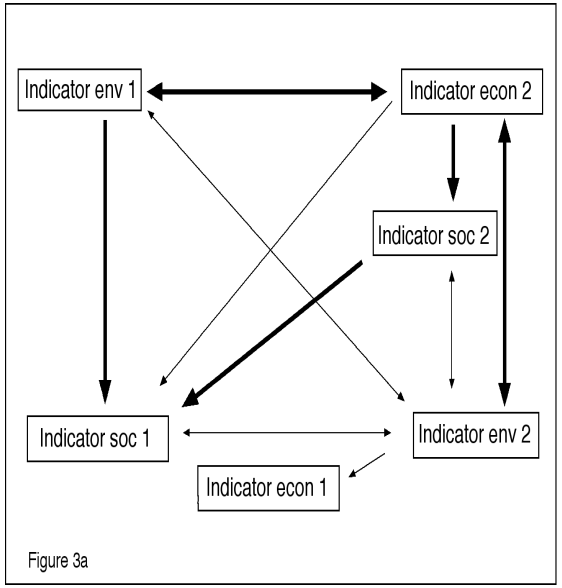


Figure 3a

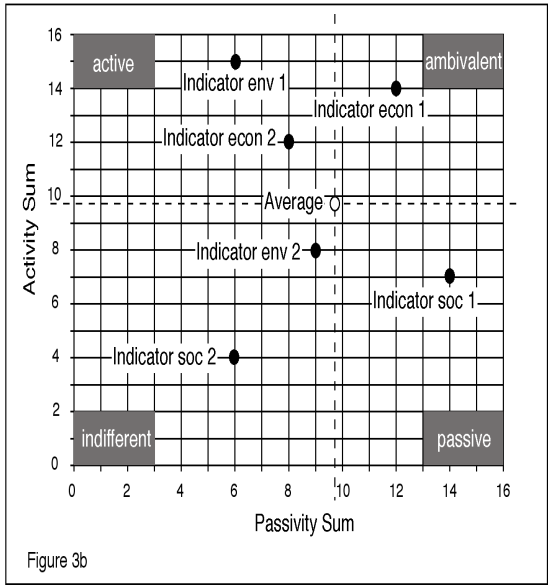


Figure 3b

Laboratory on Human-Environment Relations in Urban Systems

EPFL

Sustainability assessment of the four most densely populated cities in Switzerland

Mohamed Amine Ajnui
Saria Sfeir
Yasmine Sefraoui
Gabriel O'gbonna

École polytechnique fédérale de Lausanne

Examples

Laboratory on Human-Environment Relations in Urban Systems

EPFL

Sustainability assessment of the four most densely populated cities in Switzerland

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École polytechnique fédérale de Lausanne

Results : MCDA (Multi-Criteria Decision analysis)

Weighted Sum Method - Equal Weights

Amine Anjui et al., 2024

Standard Deviation from the Mean

City	Basel	Geneva	Lausanne	Zürich	Best Options
Environmental	0.032	-0.060	0.000	0.028	Basel
Social	-0.159	0.010	0.022	0.128	Zürich
Economic	-0.204	-0.077	-0.183	0.463	Zürich
Sum	**-0.3**	**-0.1**	**-0.2**	**0.6**	**Zürich**

Distance from the Group Leader

City	Basel	Geneva	Lausanne	Zürich	Best Options
Environmental	10.6	8.0	10.1	10.5	Basel - Zürich
Social	12.9	18.5	17.8	21.5	Zürich
Economic	22.1	23.6	22.2	33.0	Zürich
Sum	**45.5**	**50.1**	**50.2**	**64.9**	**Zürich**

Distance from the Mean

City	Basel	Geneva	Lausanne	Zürich	Best Options
Environmental	16.1	11.3	15.0	17.5	Zürich
Social	19.8	30.0	28.2	35.2	Zürich
Economic	29.8	31.6	29.6	42.2	Zürich
Sum	**65.7**	**72.9**	**72.9**	**94.9**	**Zürich**

Distance from the Best and Worst Performers

City	Basel	Geneva	Lausanne	Zürich	Best Options
Environmental	8.8	4.9	7.6	8.9	Zürich - Basel
Social	3.3	11.3	11.8	16.7	Zürich
Economic	2.6	8.6	3.5	33.0	Zürich
Sum	**14.7**	**24.9**	**22.9**	**58.6**	**Zürich**

Standardized scores by Indicator - **Weighting scheme :** Equal weights

Benchmarking indicators among similar cities

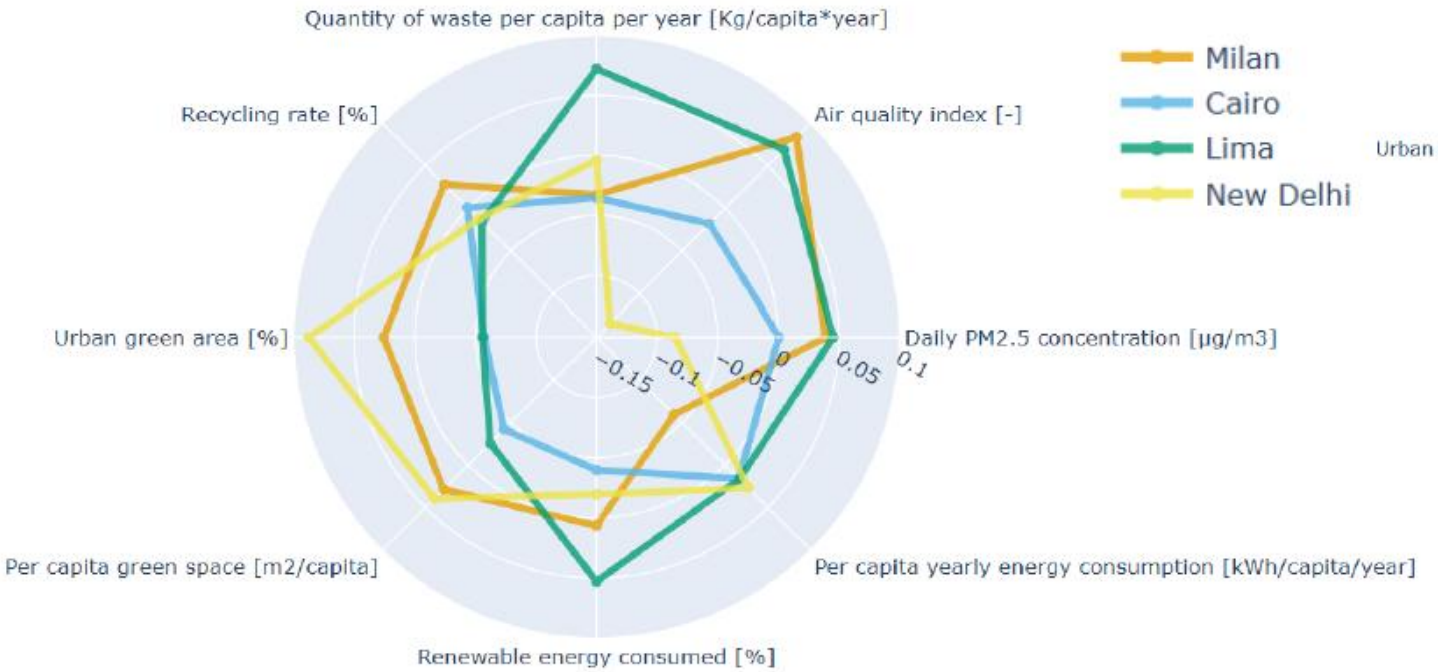
Kamoun Ines Baretje, Aurèle Raviglione, Luca Coretti Giulia

Lima

- Congestion level
- Green areas

Social

Environment



New Dehli

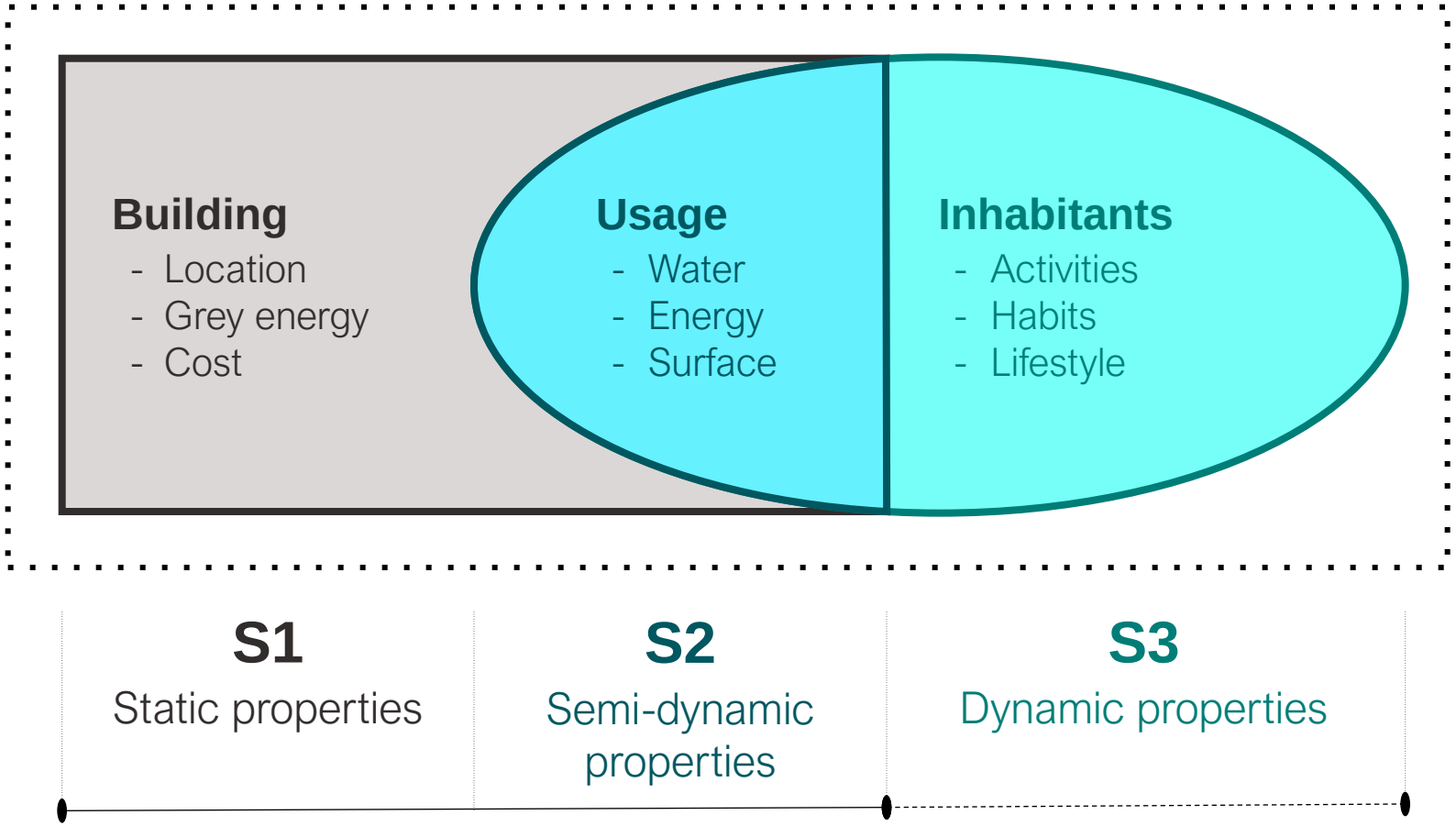
- Air quality
- Public transport
- Bike roads

Example Geneva

To what extent is cooperative housing in Geneva more sustainable than non-cooperative housing?

Binder | Heinrich

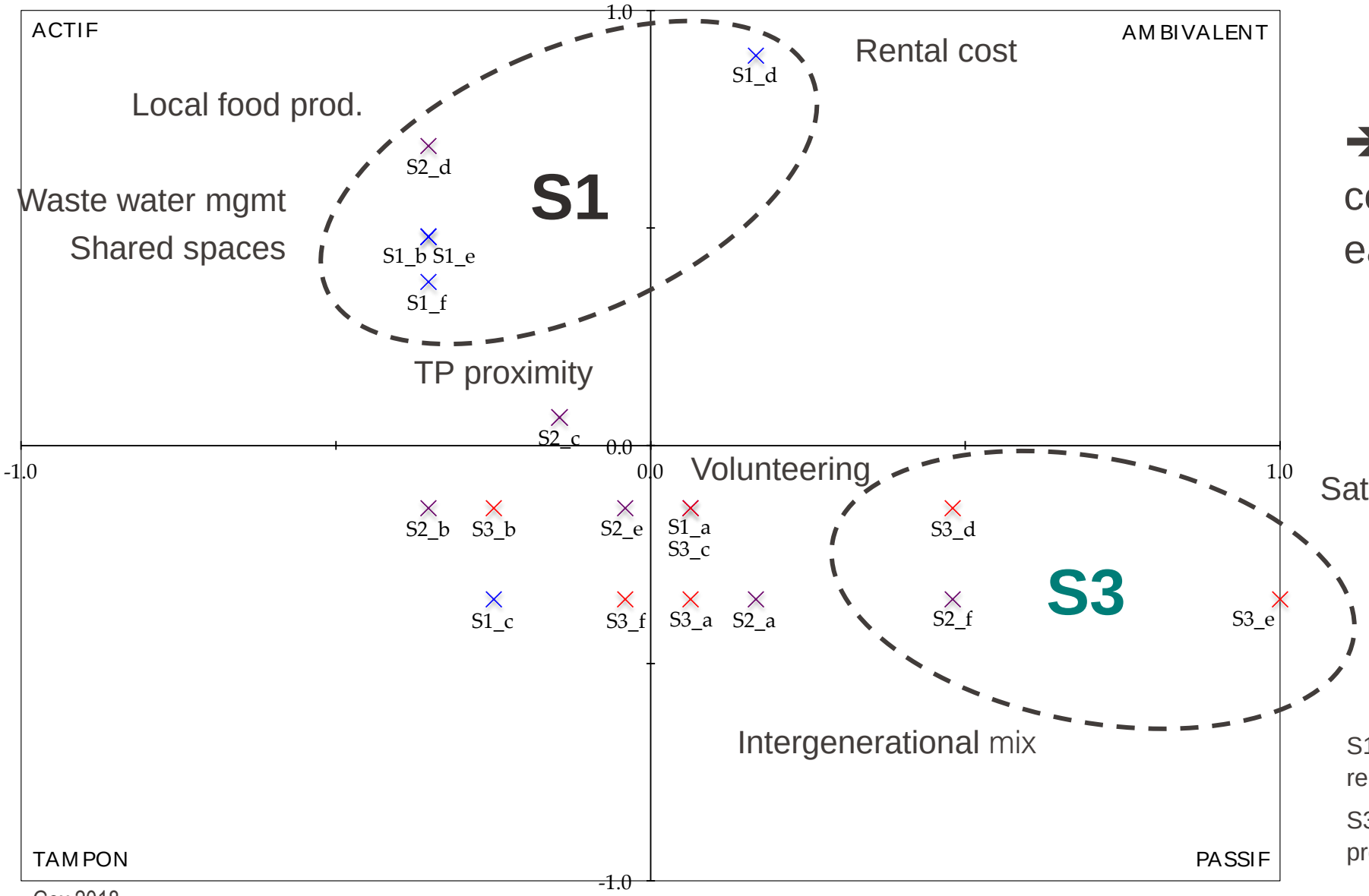
Indicators



Cost effectiveness, Minergie P, on-site WT, meeting spaces, etc.

Mobility, volunteering, more to come ?

Activity-Passivity Plot



➔ Need to consider S1 early!

S1 static properties related to the building

S3 dynamic properties

Influence Matrix

		S1						S2						S3						
		Permeable surface	Waste water management	Grey energy	Rental costs	Shared spaces	Proximity to public transportation	Water consumption	Energy consumption	Renewable electricity production	Local food production	Surface per person	Intergenerational mix	Incinerated waste	Recycled waste	Share of home-work	Voluntary work	Life satisfaction	Slow mobility	**Activity**
S1	Permeable surface		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	**2**
	Waste water management	2		1	2	0	0	-3	0	0	0	0	0	0	0	0	0	0	0	**8**
	Grey energy	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0**
	Rental costs	0	0	0		0	0	0	0	0	0	-3	-3	0	0	2	-2	-2	0	**12**
	Shared spaces	0	0	0	0		0	0	0	0	0	0	3	0	0	0	3	2	0	**8**
	Proximity to public transportation	0	0	0	1	0		0	0	0	0	0	2	0	0	0	0	1	3	**7**
S2	Water consumption	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	**0**
	Energy consumption	0	0	0	0	0	0	0		-2	0	0	0	0	0	0	0	0	0	**2**
	Renewable electricity production	0	0	0	2	0	0	0	0		0	0	0	0	0	0	0	2	0	**4**
	Local food production	2	0	0	0	0	0	2	0	0		0	0	-2	1	0	1	2	0	**10**
	Surface per person	0	0	0	0	0	0	0	0	0	0		0	0	0	2	0	0	0	**2**
	Intergenerational mix	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	**0**
S3	Incinerated waste	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	**0**
	Recycled waste	0	0	0	0	0	0	0	0	0	0	0	0	-2		0	0	0	0	**2**
	Share of home-work	0	0	0	0	0	0	0	0	0	0	0	0	0	0		-2	0	0	**2**
	Voluntary work	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		2	0	**2**
	Life satisfaction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	**0**
	Slow mobility	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		**0**
	Passivity	**4**	**0**	**1**	**5**	**0**	**0**	**5**	**0**	**2**	**0**	**3**	**8**	**4**	**1**	**4**	**8**	**13**	**3**	

Activity- passivity plot

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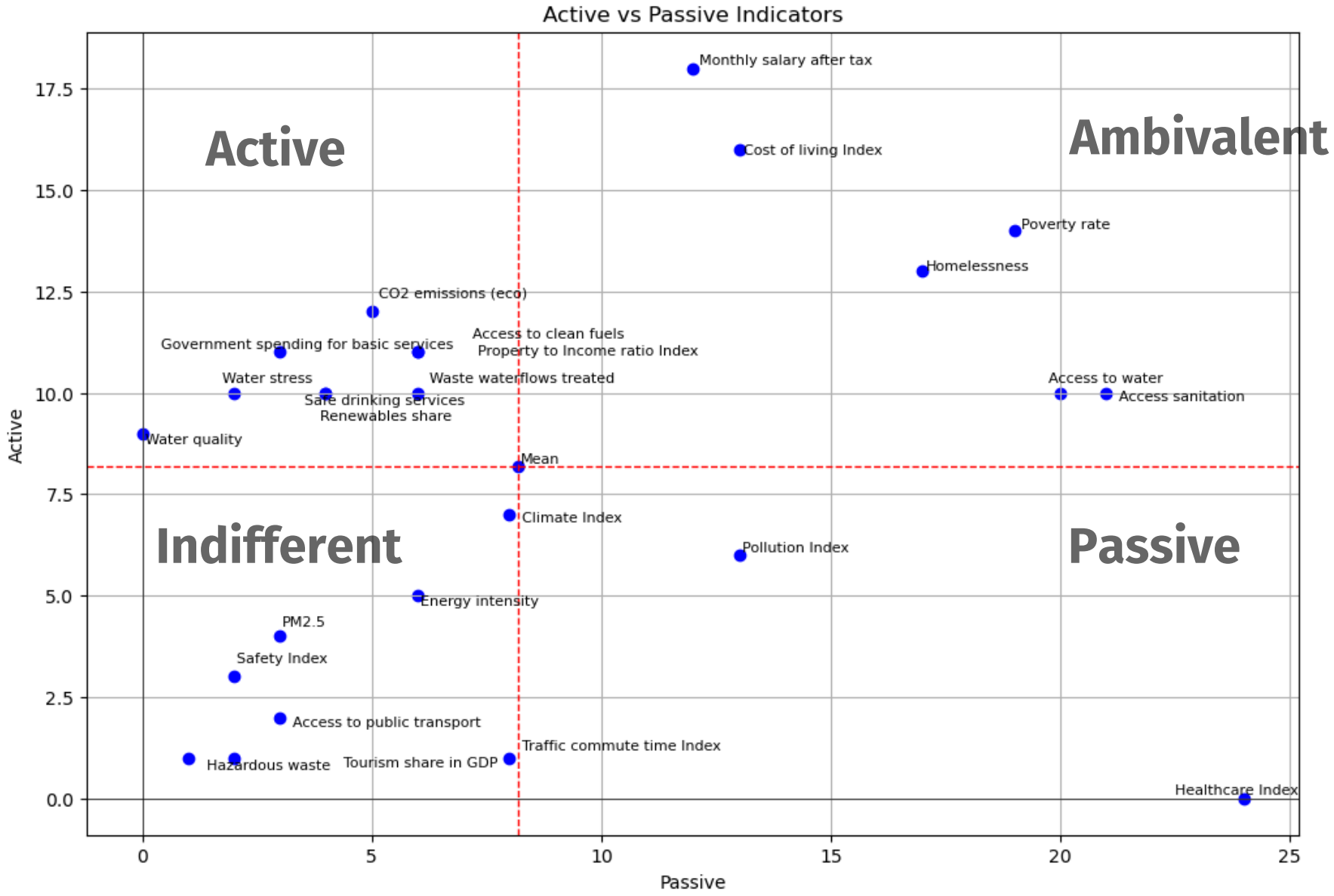

Sustainability Assessment of Urban Systems

Laboratory on Human-Environment Relations in Urban Systems

Influence matrix

		1	2	3	4	5	6	7	8	9	10	
1	Poverty rate		2	2	0	2	1	-2	0	2	-1	14
2	Acces to water	2		2	0	2	0	-2	0	0	0	10
3	Access sanitation	2	2		0	2	0	-2	0	0	0	10
4	Government spending for basic s	-2	-2	-2		-2	1	0	0	0	0	11
5	Homelessness	2	2	2	0		-1	-2	-1	1	-1	13
6	Cost of living Index	-2	-2	-2	2	1		2	0	-1	0	16
7	Monthly salary after tax	-2	-2	-2	0	-2	2		1	2	0	18
8	Safety Index	0	0	0	0	0	0	-2		0	0	3
9	Property to Income ratio Index	-2	-2	-2	0	-2	2	0	0		1	11
10	Acces to public transport	0	0	0	0	0	1	0	0	0		2
	Traffic commute time Index	0	0	0	0	0	0	0	0	0	0	1
	Water stress	0	1	1	0	1	0	0	0	0	0	10
	Water quality	0	1	1	0	1	0	0	0	0	0	9
	Pollution Index	0	0	0	0	0	0	0	0	0	0	6
	Climate Index	0	0	0	0	0	0	0	0	0	0	7
	Access to clean fuels	-1	0	-1	0	0	0	0	0	0	0	11
	Renewables share	0	0	0	0	0	0	0	0	0	0	10
	Energy intensity	-1	0	0	0	0	0	0	0	0	0	5
	CO2 emissions (eco)	1	0	0	0	2	0	0	0	0	0	12
	Tourism share in GDP	0	0	0	0	0	1	0	0	0	0	1
	PM2.5	0	0	0	0	0	0	0	0	0	0	4
	Hazardous waste	0	0	0	0	0	0	0	0	0	0	1
	Safe drinking services	1	2	2	0	0	2	0	0	0	0	10
	Waste waterflows treated	1	2	2	1	0	2	0	0	0	0	10
	Healthcare Index	0	0	0	0	0	0	0	0	0	0	0
	Passive SUM	19	20	21	3	17	13	12	2	6	3	

1	Poverty rate	8	1	1	0	1	0	0	0	0	0	10
2	Acces to water	8	1	1	0	1	0	0	0	0	0	10
3	Access sanitation	8	1	1	0	1	0	0	0	0	0	10
4	Government spending for basic s	8	1	1	0	1	0	0	0	0	0	10
5	Homelessness	8	1	1	0	1	0	0	0	0	0	10
6	Cost of living Index	8	1	1	0	1	0	0	0	0	0	10
7	Monthly salary after tax	8	1	1	0	1	0	0	0	0	0	10
8	Safety Index	8	1	1	0	1	0	0	0	0	0	10
9	Property to Income ratio Index	8	1	1	0	1	0	0	0	0	0	10
10	Acces to public transport	8	1	1	0	1	0	0	0	0	0	10
	Traffic commute time Index	8	1	1	0	1	0	0	0	0	0	10
	Water stress	8	1	1	0	1	0	0	0	0	0	10
	Water quality	8	1	1	0	1	0	0	0	0	0	10
	Pollution Index	8	1	1	0	1	0	0	0	0	0	10
	Climate Index	8	1	1	0	1	0	0	0	0	0	10
	Access to clean fuels	8	1	1	0	1	0	0	0	0	0	10
	Renewables share	8	1	1	0	1	0	0	0	0	0	10
	Energy intensity	8	1	1	0	1	0	0	0	0	0	10
	CO2 emissions (eco)	8	1	1	0	1	0	0	0	0	0	10
	Tourism share in GDP	8	1	1	0	1	0	0	0	0	0	10
	PM2.5	8	1	1	0	1	0	0	0	0	0	10
	Hazardous waste	8	1	1	0	1	0	0	0	0	0	10
	Safe drinking services	8	1	1	0	1	0	0	0	0	0	10
	Waste waterflows treated	8	1	1	0	1	0	0	0	0	0	10
	Healthcare Index	8	1	1	0	1	0	0	0	0	0	10
	Active SUM	14	10	10	11	13	16	18	3	11	2	

1	Poverty rate	1	1	1	0	1	0	0	0	0	0	5
2	Acces to water	1	1	1	0	1	0	0	0	0	0	5
3	Access sanitation	1	1	1	0	1	0	0	0	0	0	5
4	Government spending for basic s	1	1	1	0	1	0	0	0	0	0	5
5	Homelessness	1	1	1	0	1	0	0	0	0	0	5
6	Cost of living Index	1	1	1	0	1	0	0	0	0	0	5
7	Monthly salary after tax	1	1	1	0	1	0	0	0	0	0	5
8	Safety Index	1	1	1	0	1	0	0	0	0	0	5
9	Property to Income ratio Index	1	1	1	0	1	0	0	0	0	0	5
10	Acces to public transport	1	1	1	0	1	0	0	0	0	0	5
	Traffic commute time Index	1	1	1	0	1	0	0	0	0	0	5
	Water stress	1	1	1	0	1	0	0	0	0	0	5
	Water quality	1	1	1	0	1	0	0	0	0	0	5
	Pollution Index	1	1	1	0	1	0	0	0	0	0	5
	Climate Index	1	1	1	0	1	0	0	0	0	0	5
	Access to clean fuels	1	1	1	0	1	0	0	0	0	0	5
	Renewables share	1	1	1	0	1	0	0	0	0	0	5
	Energy intensity	1	1	1	0	1	0	0	0	0	0	5
	CO2 emissions (eco)	1	1	1	0	1	0	0	0	0	0	5
	Tourism share in GDP	1	1	1	0	1	0	0	0	0	0	5
	PM2.5	1	1	1	0	1	0	0	0	0	0	5
	Hazardous waste	1	1	1	0	1	0	0	0	0	0	5
	Safe drinking services	1	1	1	0	1	0	0	0	0	0	5
	Waste waterflows treated	1	1	1	0	1	0	0	0	0	0	5
	Healthcare Index	1	1	1	0	1	0	0	0	0	0	5
	Mean	1	1	1	0	1	0	0	0	0	0	5

Indicator	Passive	Active
Poverty rate	19	14
Acces to water	20	10
Access sanitation	21	10
Government spending for basic serv	3	11
Homelessness	17	13
Cost of living Index	13	16
Monthly salary after tax	12	18
Safety Index	2	3
Property to Income ratio Index	6	11
Acces to public transport	3	2
Traffic commute time Index	8	1
Water stress	2	10
Water quality	0	9
Pollution Index	13	6
Climate Index	8	7
Access to clean fuels	6	11
Renewables share	4	10
Energy intensity	6	5
CO2 emissions (eco)	5	12
Tourism share in GDP	2	1
PM2.5	2	4
Hazardous waste	1	1
Safe drinking services	4	10
Waste waterflows treated	4	10
Healthcare Index	24	0
Mean	8,2	8,2

Sustainability Assessment of Urban Systems

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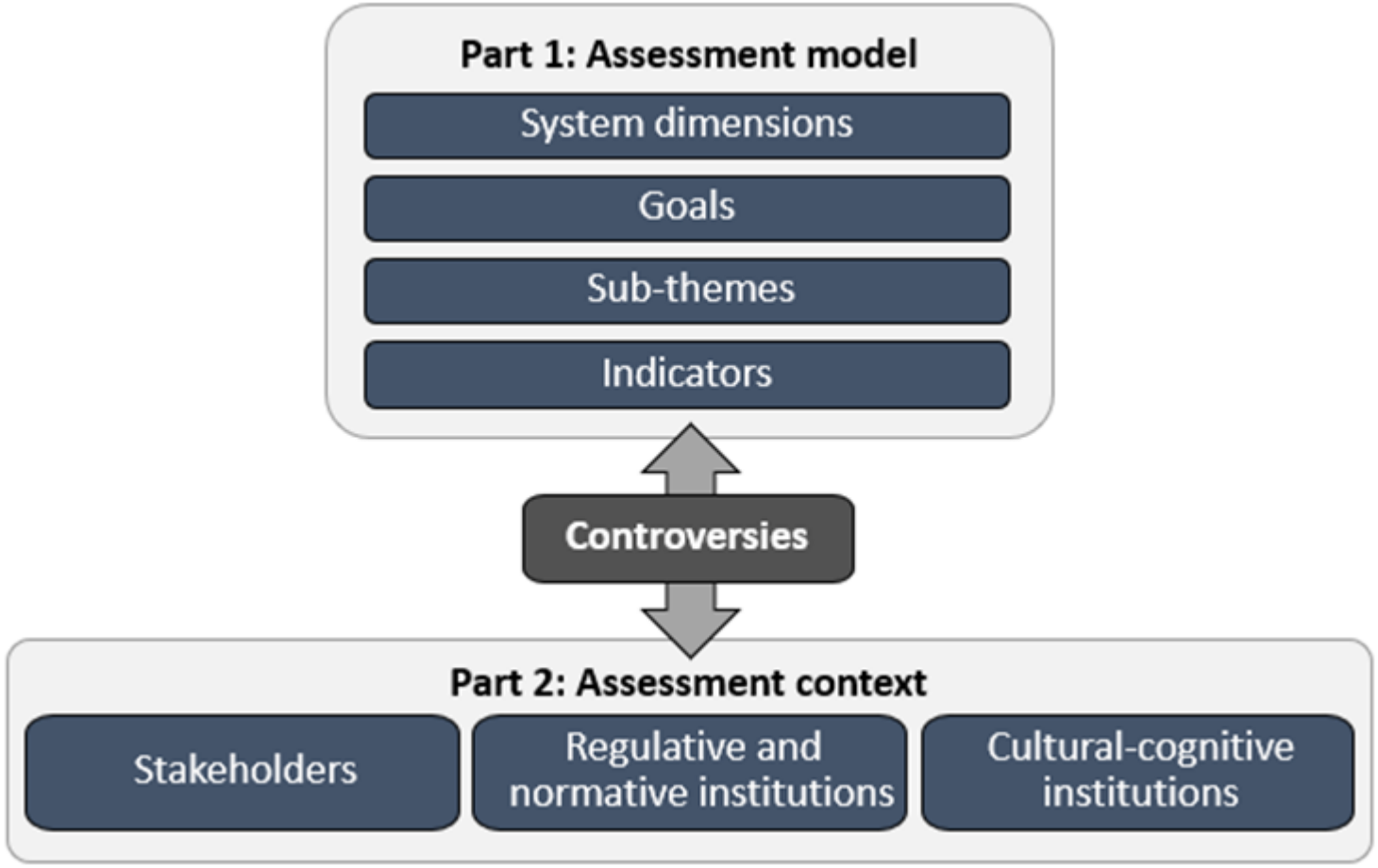
Controversies within policy development

What could hinder our "policies" to be effective?



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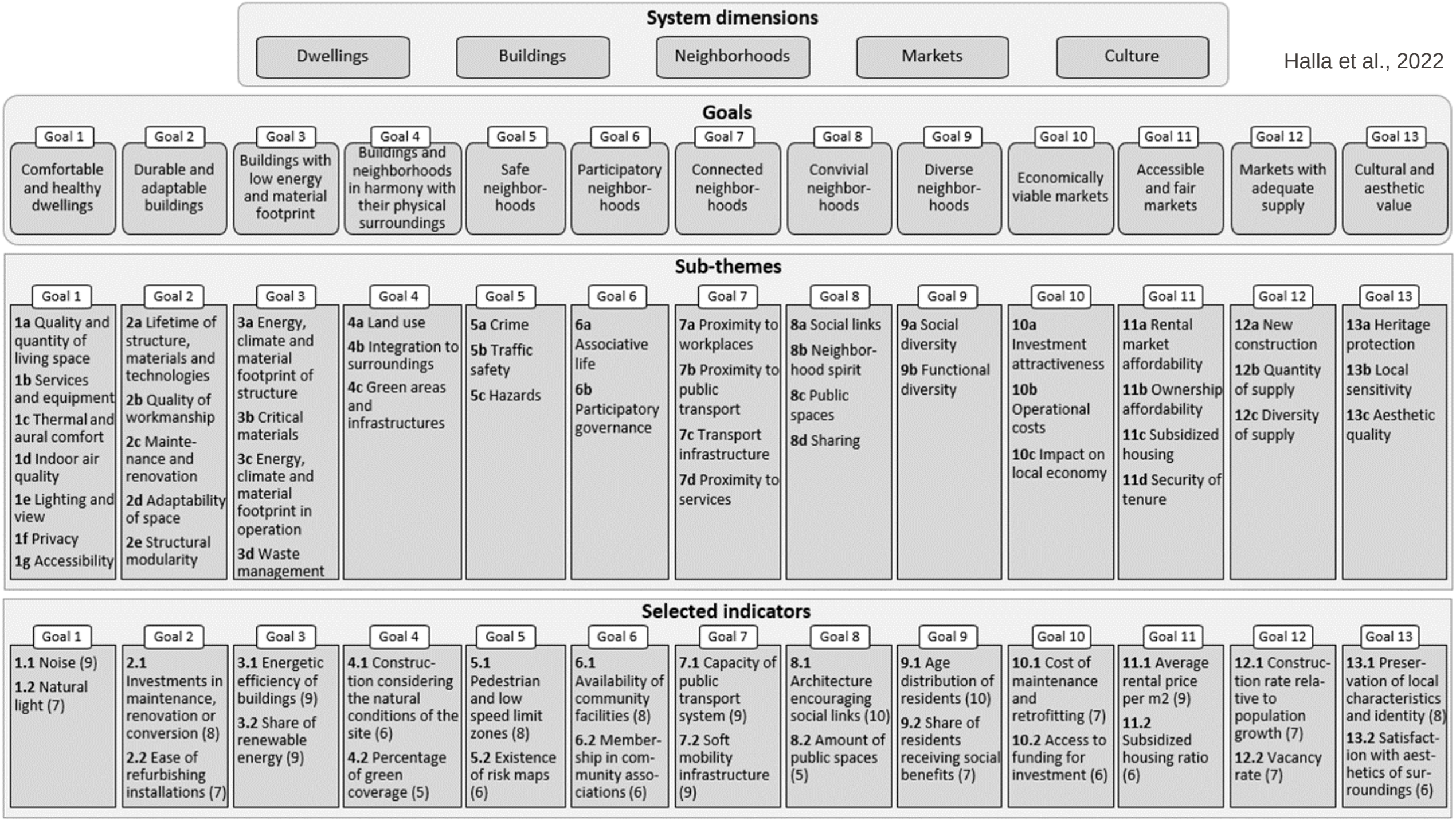
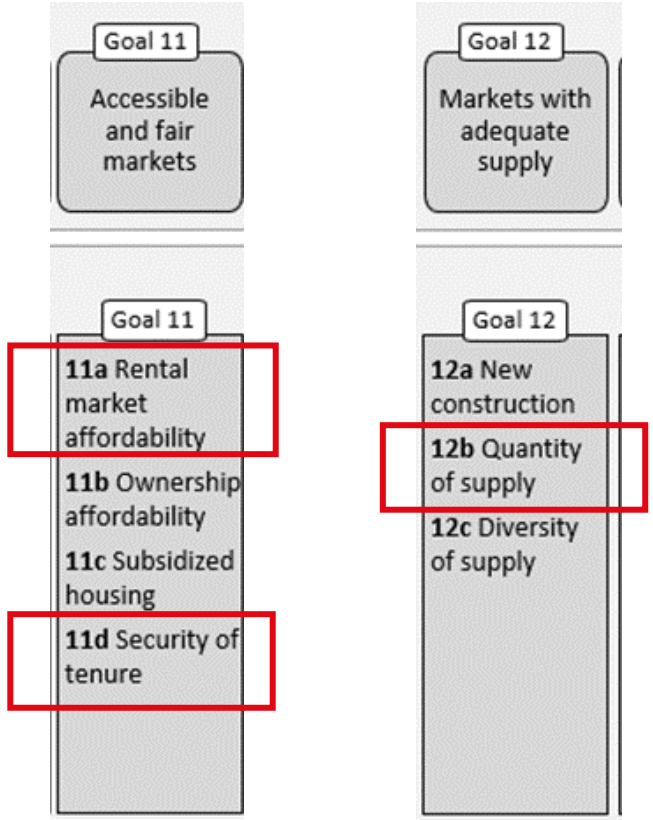

System dimensions
Dwellings
Buildings
Neighborhoods
Markets
Culture
Halla et al., 2022
Goals
Goal 1
Comfortable and healthy dwellings
Goal 2
Durable and adaptable buildings
Goal 3
Buildings with low energy and material footprint
Goal 4
Buildings and neighborhoods in harmony with their physical surroundings
Goal 5
Safe neighbor-hoods
Goal 6
Participatory neighbor-hoods
Goal 7
Connected neighbor-hoods
Goal 8
Convivial neighbor-hoods
Goal 9
Diverse neighbor-hoods
Goal 10
Economically viable markets
Goal 11
Accessible and fair markets
Goal 12
Markets with adequate supply
Goal 13
Cultural and aesthetic value
Sub-themes
Goal 1
1a Quality and quantity of living space
1b Services and equipment
1c Thermal and aural comfort
1d Indoor air quality
1e Lighting and view
1f Privacy
1g Accessibility
Goal 2
2a Lifetime of structure, materials and technologies
2b Quality of workmanship
2c Mainte-nance and renovation
2d Adaptability of space
2e Structural modularity
Goal 3
3a Energy, climate and material footprint of structure
3b Critical materials
3c Energy, climate and material footprint in operation
3d Waste management
Goal 4
4a Land use
4b Integration to surroundings
4c Green areas and infrastructures
Goal 5
5a Crime
5b Traffic safety
5c Hazards
Goal 6
6a Associative life
6b Participatory governance
Goal 7
7a Proximity to workplaces
7b Proximity to public transport
7c Transport infrastructure
7d Proximity to services
Goal 8
8a Social links
8b Neighbor-hood spirit
8c Public spaces
8d Sharing
Goal 9
9a Social diversity
9b Functional diversity
Goal 10
10a Investment attractiveness
10b Operational costs
10c Impact on local economy
Goal 11
11a Rental market affordability
11b Ownership affordability
11c Subsidized housing
11d Security of tenure
Goal 12
12a New construction
12b Quantity of supply
12c Diversity of supply
Goal 13
13a Heritage protection
13b Local sensitivity
13c Aesthetic quality
Selected indicators
Goal 1
1.1 Noise (9)
1.2 Natural light (7)
Goal 2
2.1 Investments in maintenance, renovation or conversion (8)
2.2 Ease of refurbishing installations (7)
Goal 3
3.1 Energetic efficiency of buildings (9)
3.2 Share of renewable energy (9)
Goal 4
4.1 Construc-tion considering the natural conditions of the site (6)
4.2 Percentage of green coverage (5)
Goal 5
5.1 Pedestrian and low speed limit zones (8)
5.2 Existence of risk maps (6)
Goal 6
6.1 Availability of community facilities (8)
6.2 Member-ship in com-munity asso-ciations (6)
Goal 7
7.1 Capacity of public transport system (9)
7.2 Soft mobility infrastructure (9)
Goal 8
8.1 Architecture encouraging social links (10)
8.2 Amount of public spaces (5)
Goal 9
9.1 Age distribution of residents (10)
9.2 Share of residents receiving social benefits (7)
Goal 10
10.1 Cost of maintenance and retrofitting (7)
10.2 Access to funding for investment (6)
Goal 11
11.1 Average rental price per m2 (9)
11.2 Subsidized housing ratio (6)
Goal 12
12.1 Construc-tion rate rela-tive to population growth (7)
12.2 Vacancy rate (7)
Goal 13
13.1 Preser-vation of local characteristics and identity (8)
13.2 Satisfact-ion with aest-hetics of sur-roundings (6)

Regulation on demolitions, transformations and renovations

Cantonal law on demolitions, transformations and renovations (LDTR).

- curb the loss of residential housing in the city center by placing restrictions on the ability of owners to remodel or change the use purpose of their properties.
- ceiling on possible rent increases following these types of work.

Indicator (2021):
Rental prize: 29.8CHF/m2



Indicator (2021):
Vacancy rate: 0.6%

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Regulation on demolitions, transformations and renovations

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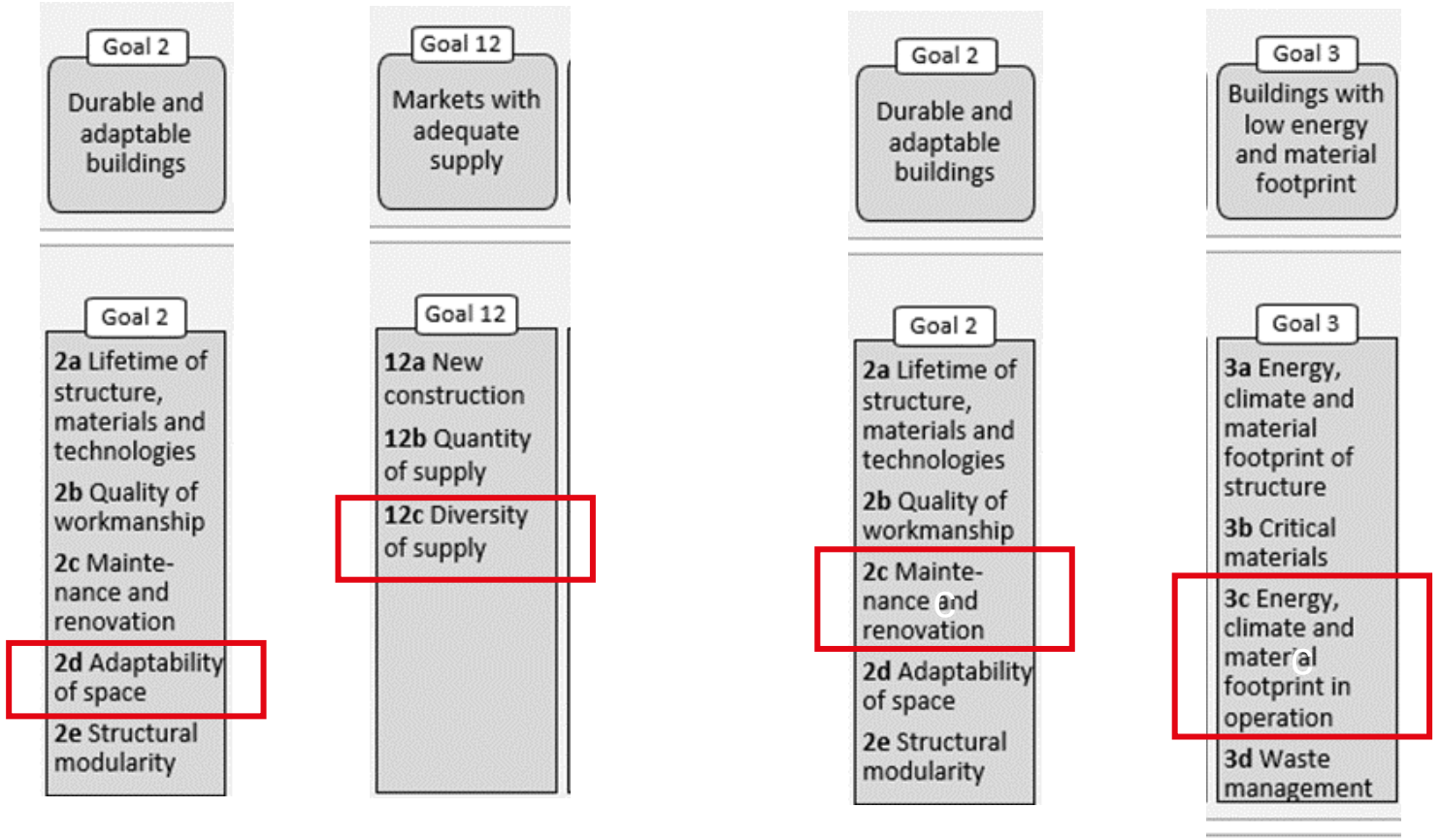
- ceiling on possible rent increases following these types of work.



Indicator (2021):
Energy efficiency : 486 MJ/m2
Goal: 350MJ/m2

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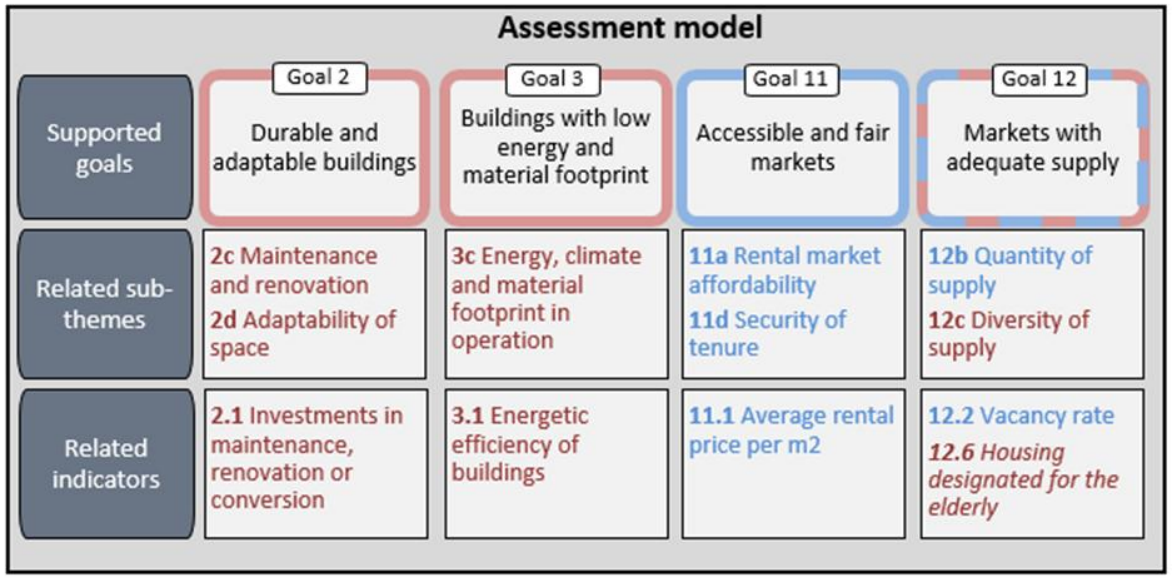
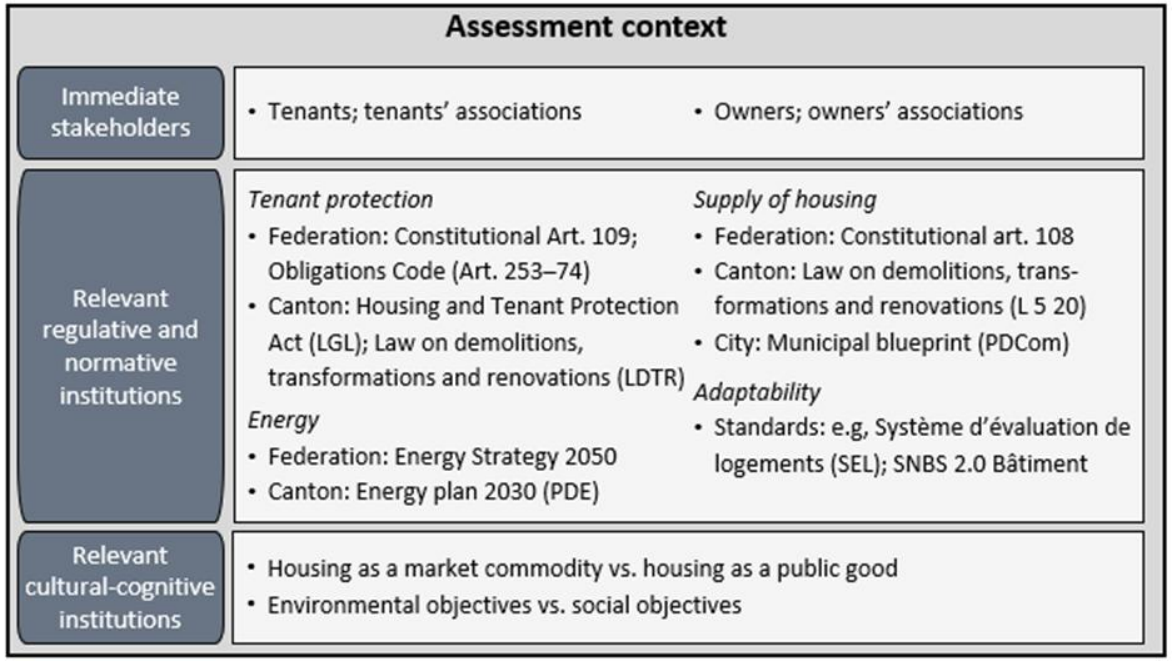
Regulation on demolitions, transformations and renovations





Trade-off:
- Energy performance and availability of affordable housing

Opposing:
- Interests of owners and tenants

Competing regulations:
- Energy plan 2030 vs rent protection

Underlying trade-offs:
- Cultural, cognitive views on housing

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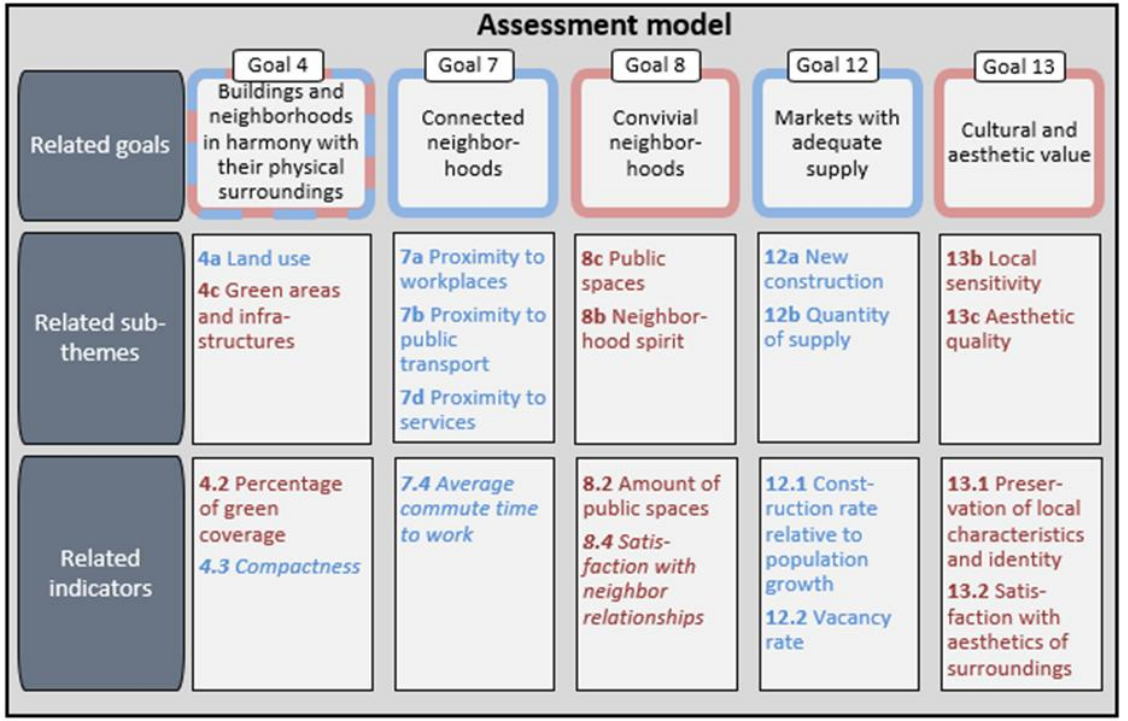
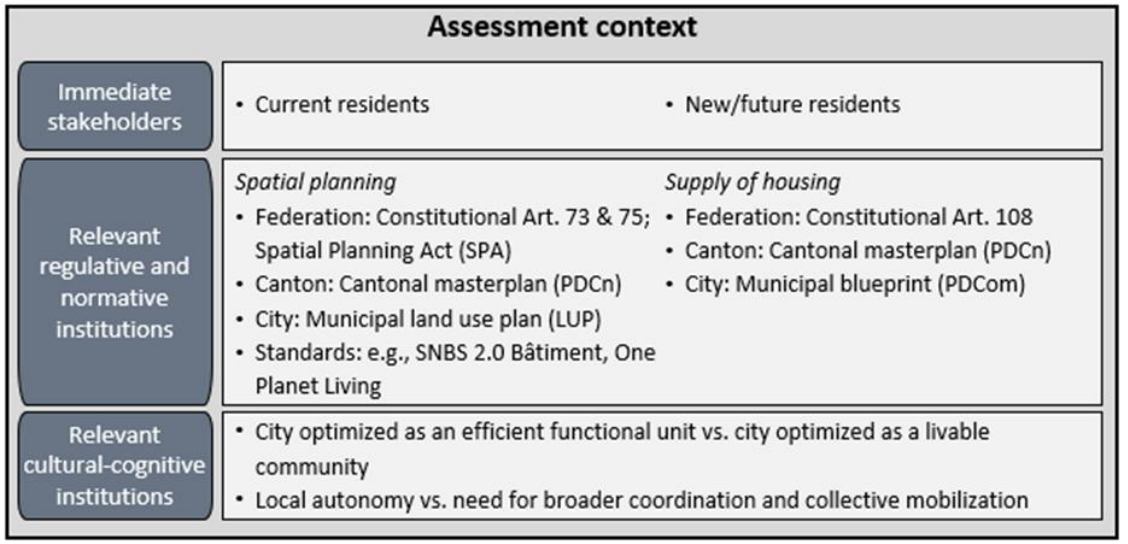
Densification of the city





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Geneva compared to Basel and Zurich

	Geneva City	Comparison
Population (Yearly growth; 5-year average)	203 951 (0.9 %)	(Zürich 1.4 %; Basel 0.5 %)
Population density	12 669 per km^2	Zürich 4 724 per km^2; Basel 7 223 per km^2
Foreign resident population	48 %	Zürich 32 %; Basel 38 %
Average taxable income per taxpayer	83 823 CHF	Zürich 79 012 CHF; Basel 76 701 CHF
Employment rate (ages 20-64)	70 %	Zürich 81 %; Basel 74 %
Share of owner-occupied dwellings (data for cantons)	18 %	Zürich 28 %; Basel 16 %
Share of dwellings built after 1981	19 %	Zürich 24 %; Basel 12 %

Summary

- Policy cycle
  - Indicators are most important in the beginning (the agenda setting, policy formulation) and the end (policy evaluation) of the policy cycle
  - Particularly during decision-making phases, indicators may prone to partisan-based motivated reasoning, i.e. the selective processing of information
  - Not all indicators can equally easily be taken up
- To derive policies we can use:
  - MCDA assessment: as Benchmark
  - Activity- Passivity plot: driving variables
  - Influence Matrix: analysis of trade-offs
- When aiming at implementing the policies we might encounter controversies which could inhibit progress towards sustainability