Sustainability Assessment of Urban Systems

(ENV-461) – MA B1 11

1: Introduction into sustainability and sustainability assessment

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Teaching team from HERUS

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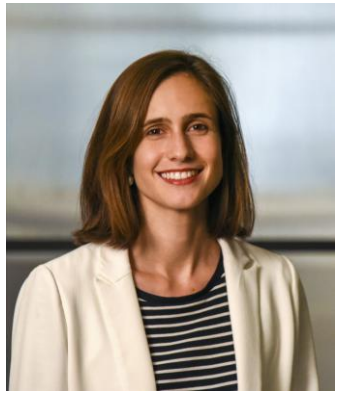

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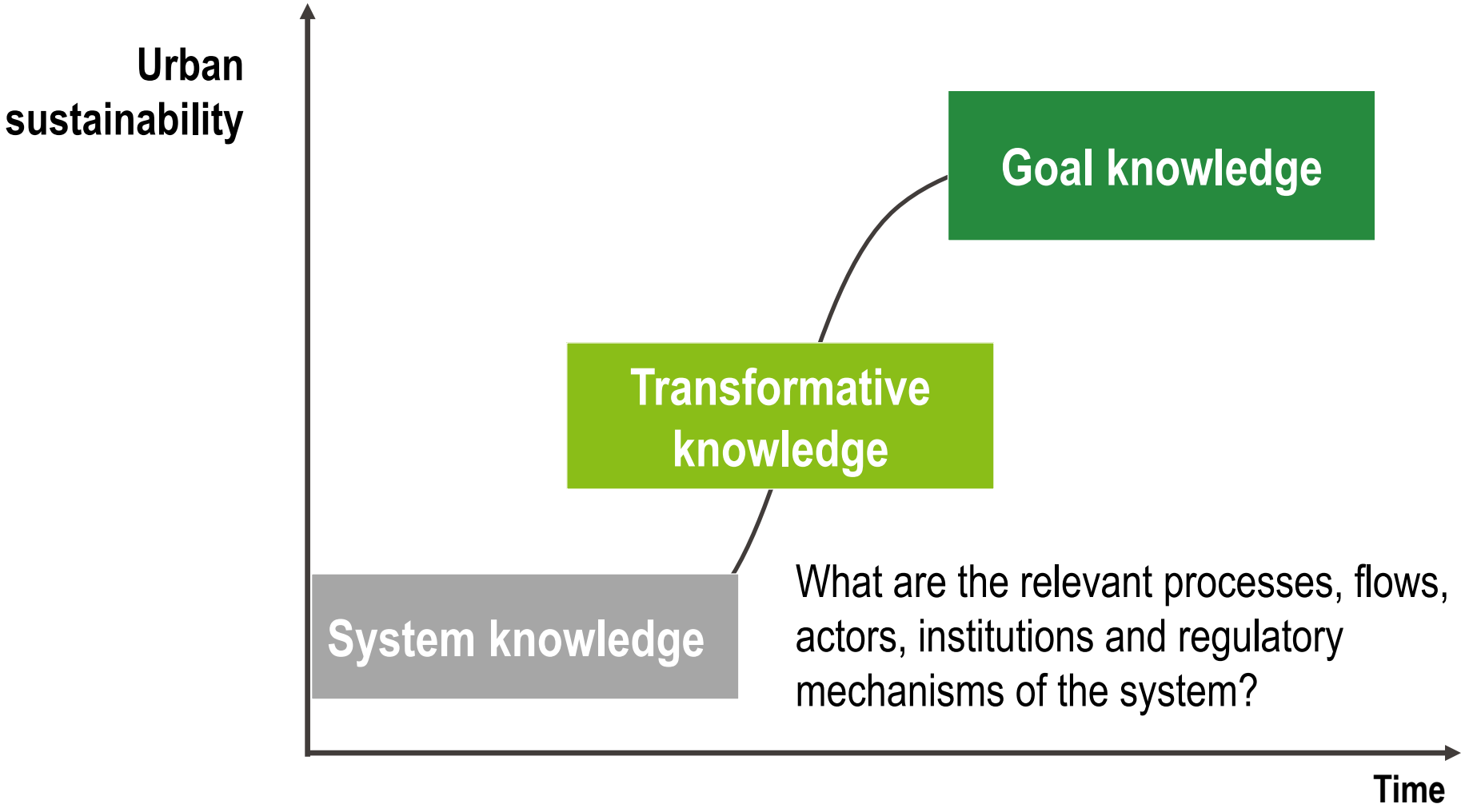
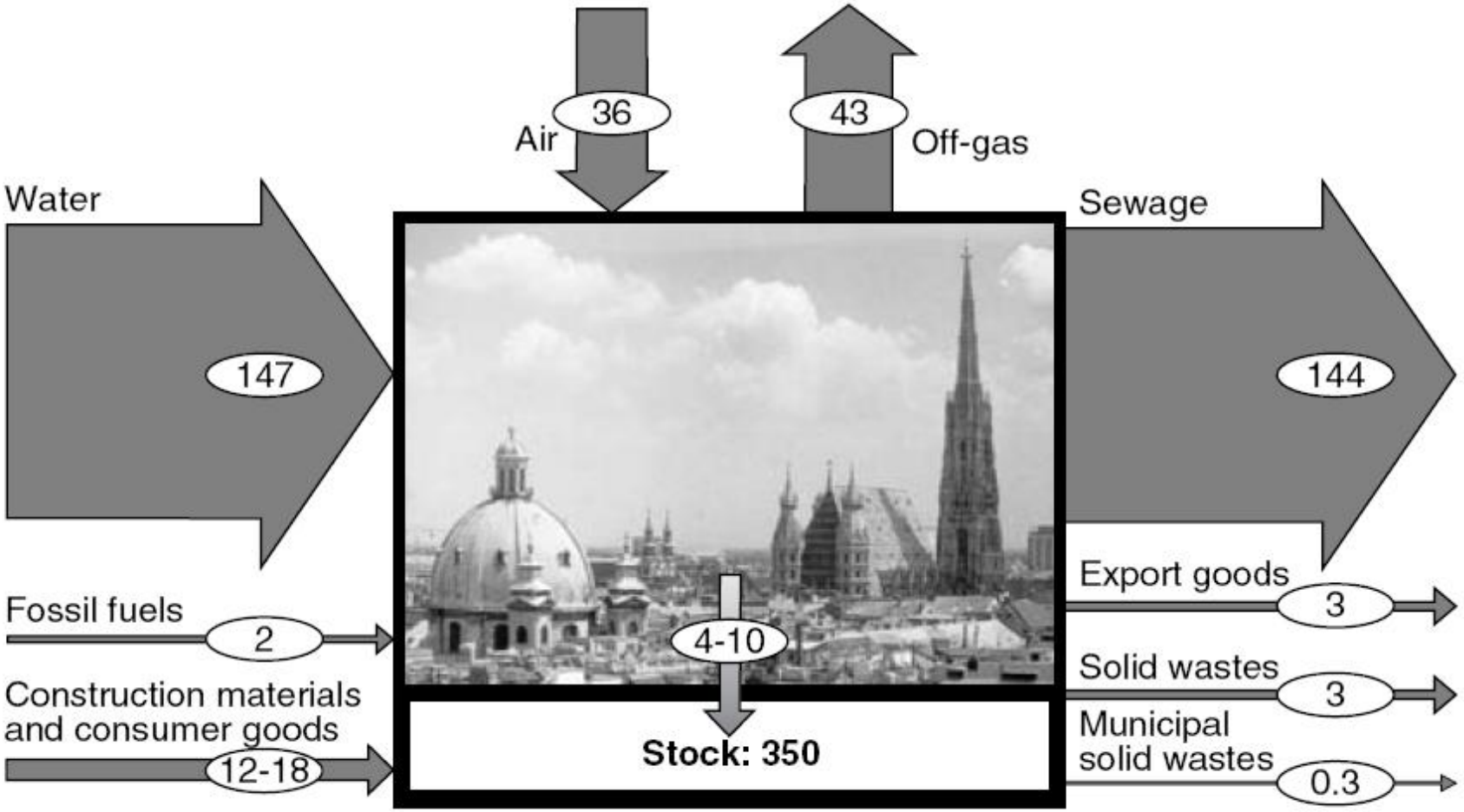
HERUS and Sustainability transition



Binder | Heinrich

Urban Metabolism of Vienna in 1990s (tons/cap/year)

Urban metabolism is "the sum total of the technical and socio-economic process that occur in cities, resulting in growth, production of energy and elimination of waste." (Kennedy, 2007)



Brunner & Rechberger (2004), Kennedy (2007)

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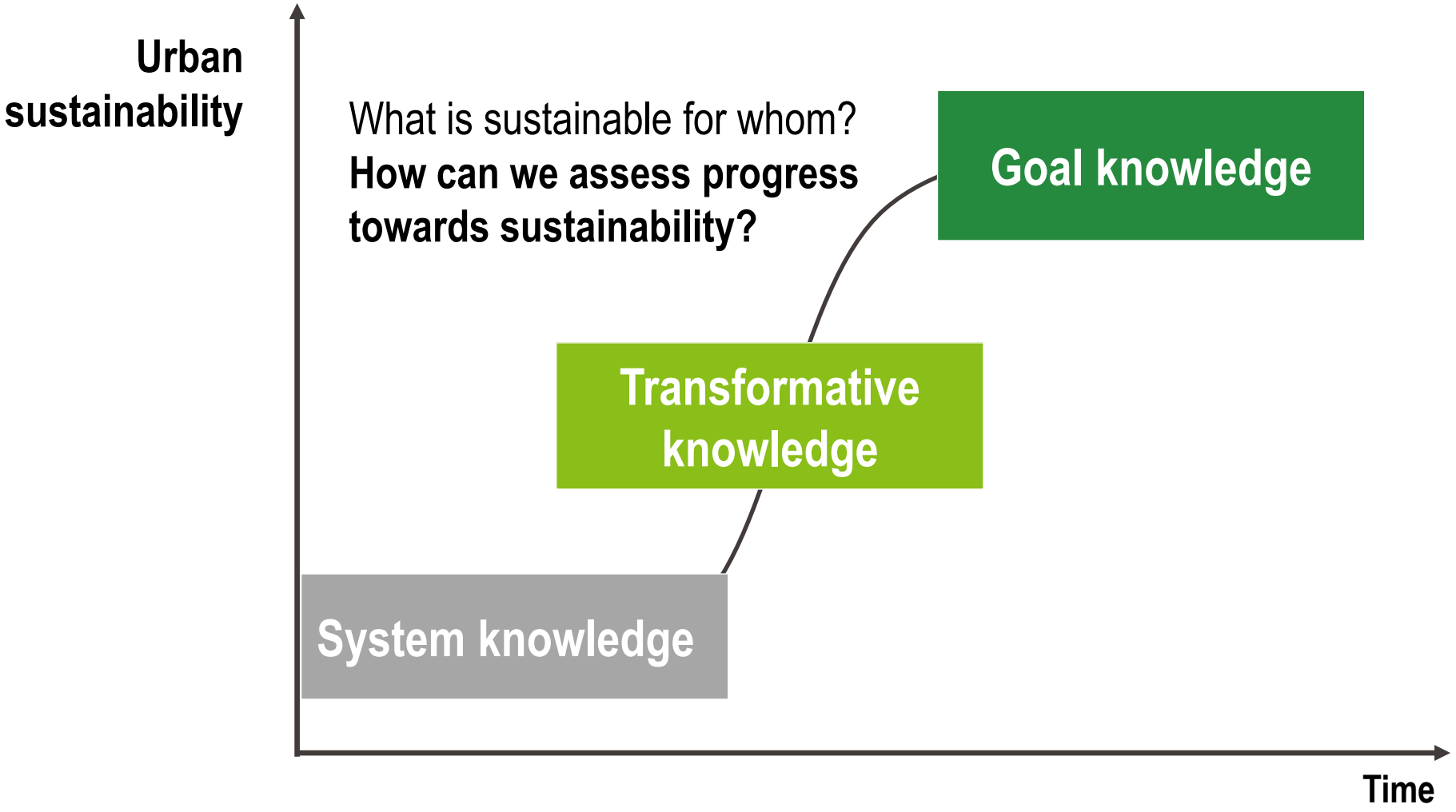
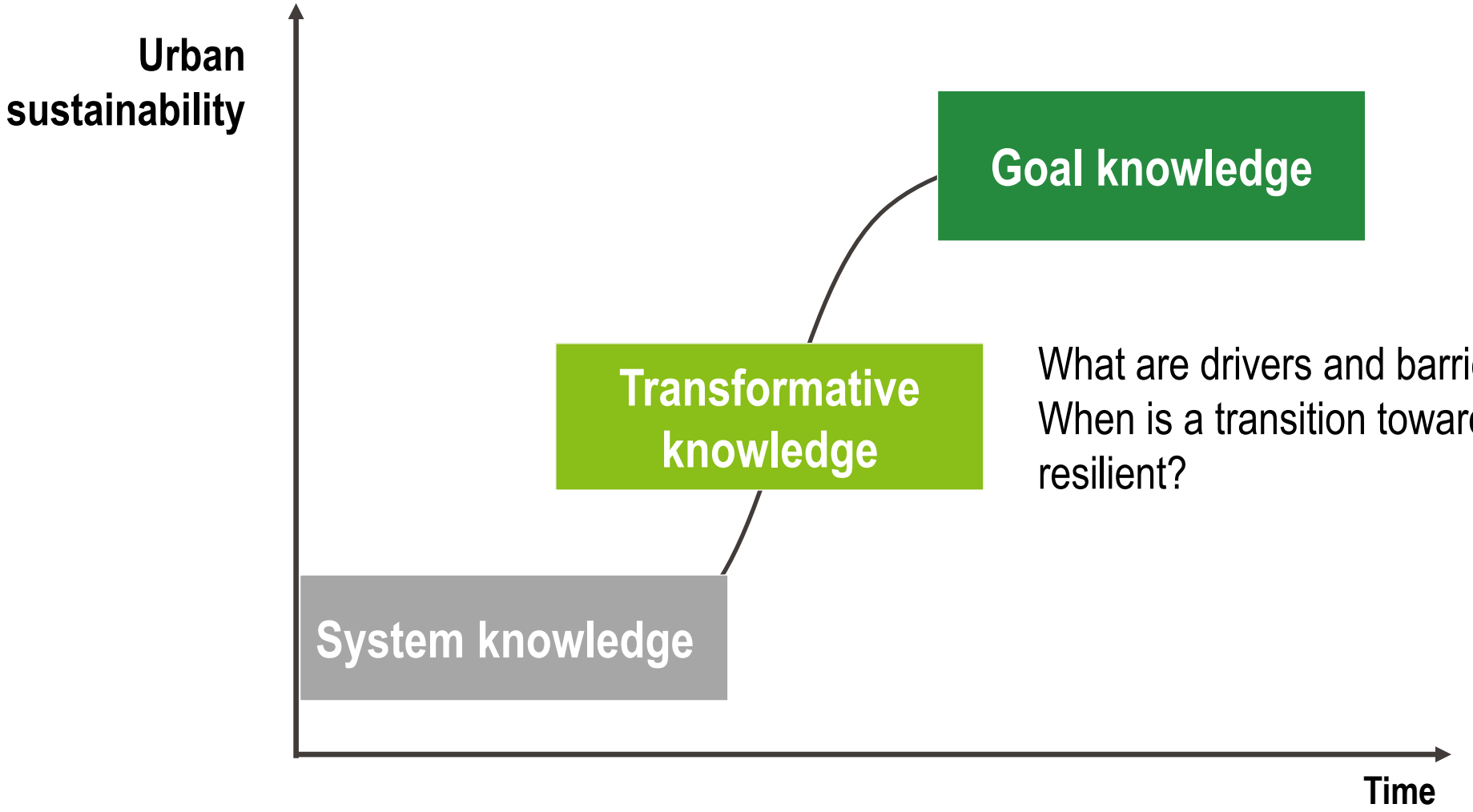
Sustainability transition



Sustainability transition



What are drivers and barriers of change?
When is a transition towards sustainability resilient?

Sustainability assessment of urban systems : «Kèsako» (What's that all about ?)

Lausanne : A «sustainable city» ?

Ville de Lausanne

“Resolutely committed to sustainable development, Lausanne has adopted the multi-dimensional approach of the UN's Agenda 2030 and has placed responsible consumption and production, the conservation of resources, food, energy savings, living together and health promotion at the heart of its ambitious policy.”
Ville de Lausanne

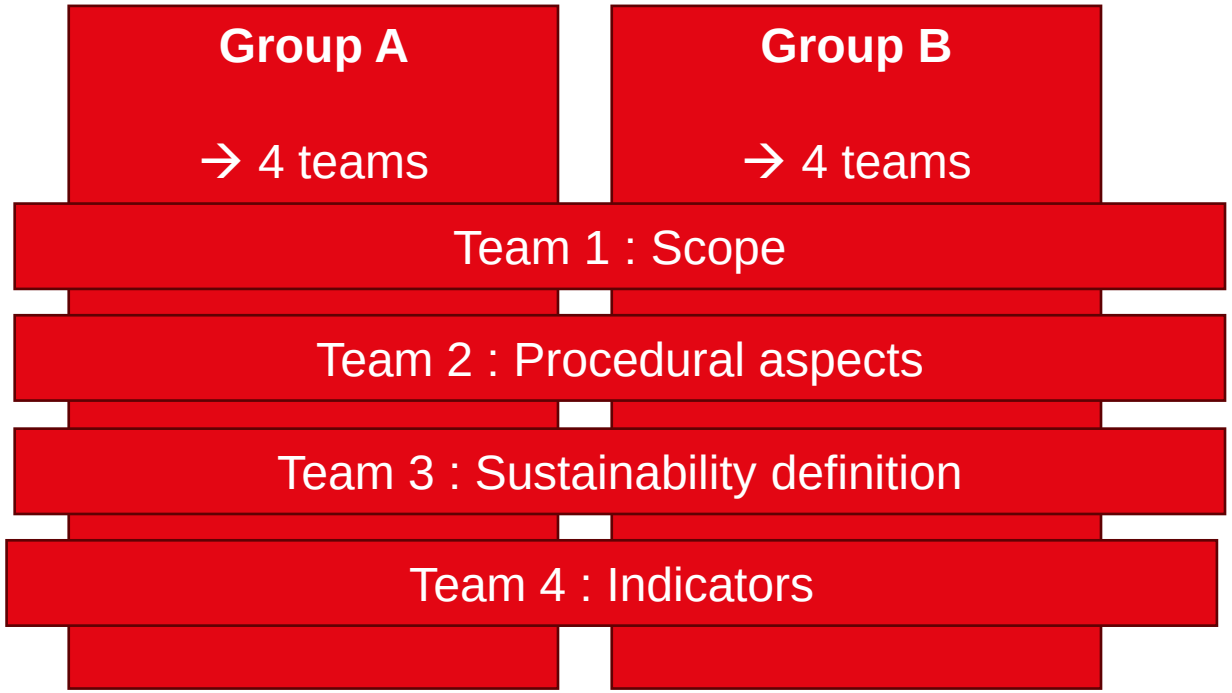
“You are part of a sustainability assessment group and have been asked to provide elements for assessing the sustainability of Lausanne.”

Lausanne : A «sustainable city» ?

Ville de Lausanne

Binder | Heinrich

"You are part of a sustainability assessment group and have been asked to provide elements for assessing the sustainability of Lausanne."



Questions are available for each team are here

https://go.epfl.ch/SA_intro

Step 1 : Group work

10 min

Step 2 : Presentation

1 Person / team

3 min. max

Group 1 : Defining the scope of the study

Questions

What is the goal of the assessment?

How do you define the limits of the city of Lausanne?

Which time period does the assessment comprise?

What are the main characteristics of the city ?

Group 2: Procedure

Questions

What key stages need to be considered to carry out a sustainability analysis?

What assessment tools or frameworks can be used (e.g. SWOT analysis, impact assessment)?

Which stakeholders should be involved in the assessment process ? When and how should we involve them ?

Group 3: Definition of sustainability

Questions

How do you define sustainability in general ?

What are the specific sustainability issues for the city of Lausanne ?

How do you refine the definition of sustainability for the project ?

Group 4: Sustainability indicators

Questions

What are the key indicators to measure the sustainability of Lausanne ?

How can these indicators be measured? What tools or methodologies can be used to collect data on these indicators?

Can these indicators be used to compare the sustainability of different cities?

Summary of the group work

What is difficult to define ?

Any contradictions between the group ouputs ?

Any modification to propose ?

Objectives of the course today

- Different approaches, perspectives to sustainability/sustainable development
- Why do we need sustainability assessment?
- A brief introduction to sustainability assessment
- Goals and structure of the course

What is sustainability ?

Different perspectives, approaches to sustainability

Definitions of Sustainability

What is sustainability … for you ?

“Sustainable development” vs. “sustainability”

1. They have different priorities
   - “Sustainable development” prioritises (economic) growth
   - “Sustainability” prioritises the environment
2. They complement each other
   - “Sustainability” is an end state
   - “Sustainable development” is the process for reaching the end state
3. They are the same
   - “Sustainability” is a moving goal; it implies a dynamic state (= “development”)

Eco-efficiency

Definition by World Business Council for Sustainable Development

Eco-efficiency = Product or service value / Environmental influence

- A concept aiming to create more with less
- Encourages businesses to become aware of their impact over the whole life-cycle of their products and services

- Favored by industry
- But does improving efficiency lead to less impact in absolute terms?

Ethical relationship

Reminder:

"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs"

Brundtland Report – Our Common Future (1987)

Ethical relationship

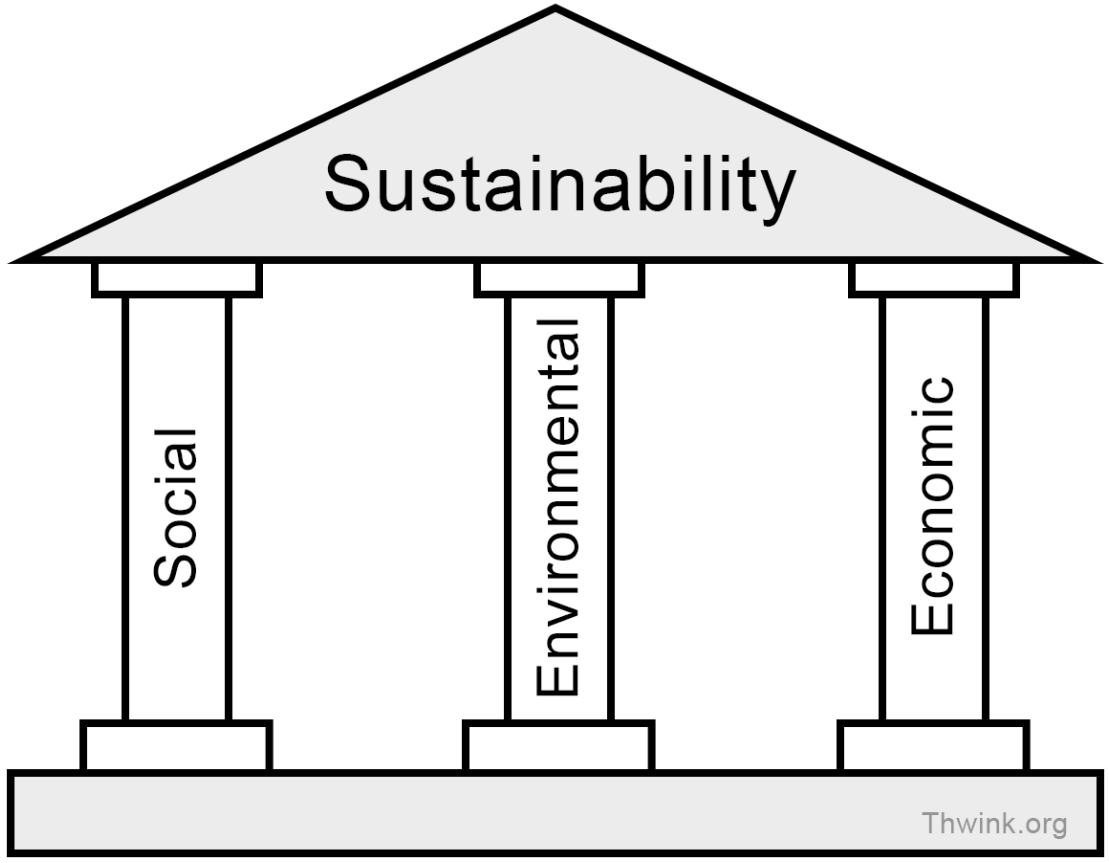
Intergenerational equity

- serves the n**eeds of the present** generation without compromising the ability of **future generations** to meet their needs

Intragenerational equity

- responsibilities of the **North and the Sout**h with respect to issues like reducing greenhouse gas emissions commonly draw on this kind of perspective to evaluate proposals
- evaluation of the distribution of the historical burdens of environmental contamination.

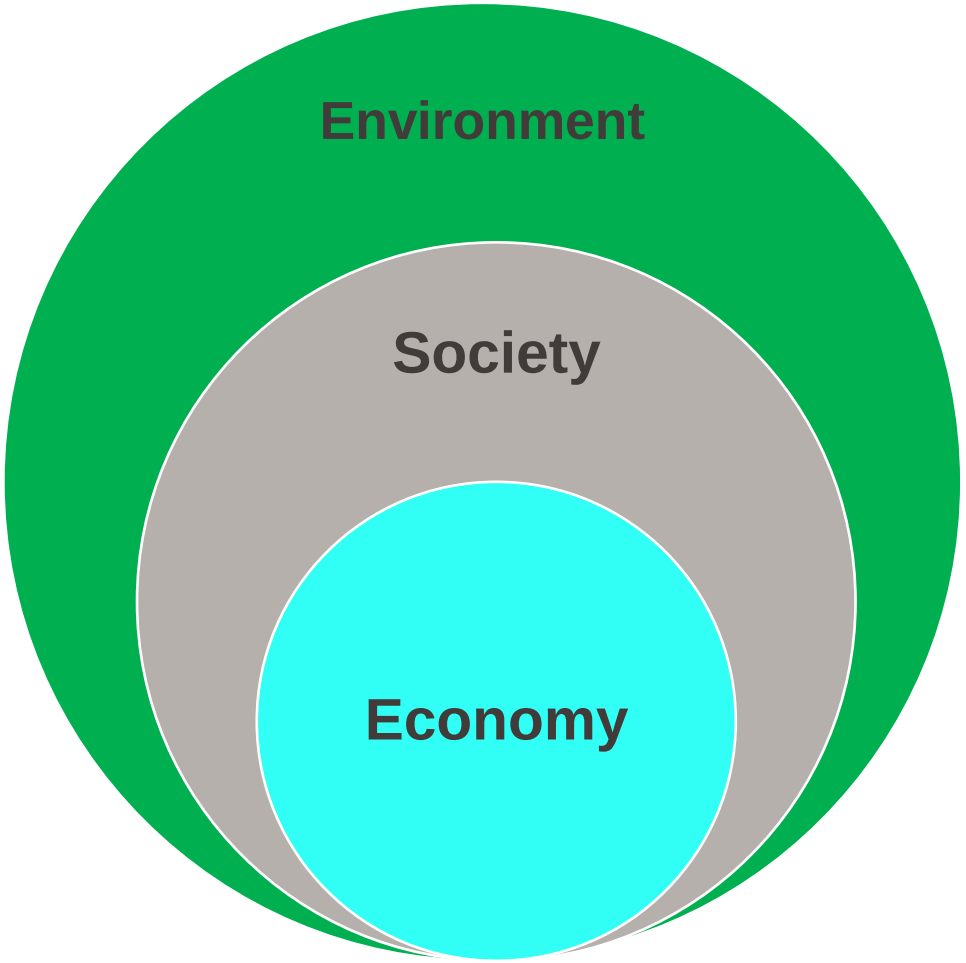
The three pillars of sustainability



- Triple bottom line
- Techno-centric
- Weak sustainability
- Strong sustainability

Adams, 2006

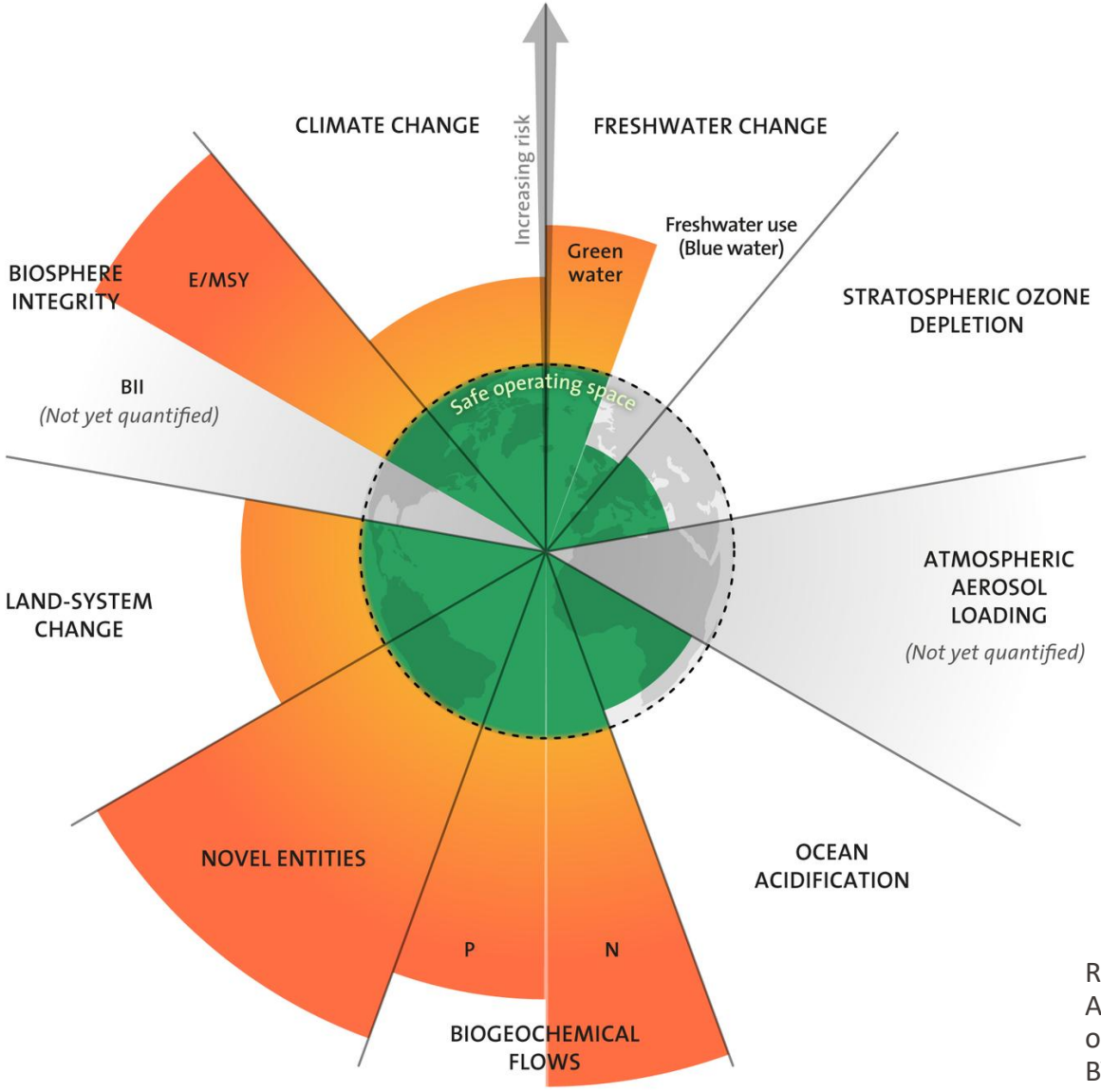
The concentric circles of sustainability



Maintenance of a system within functional limits

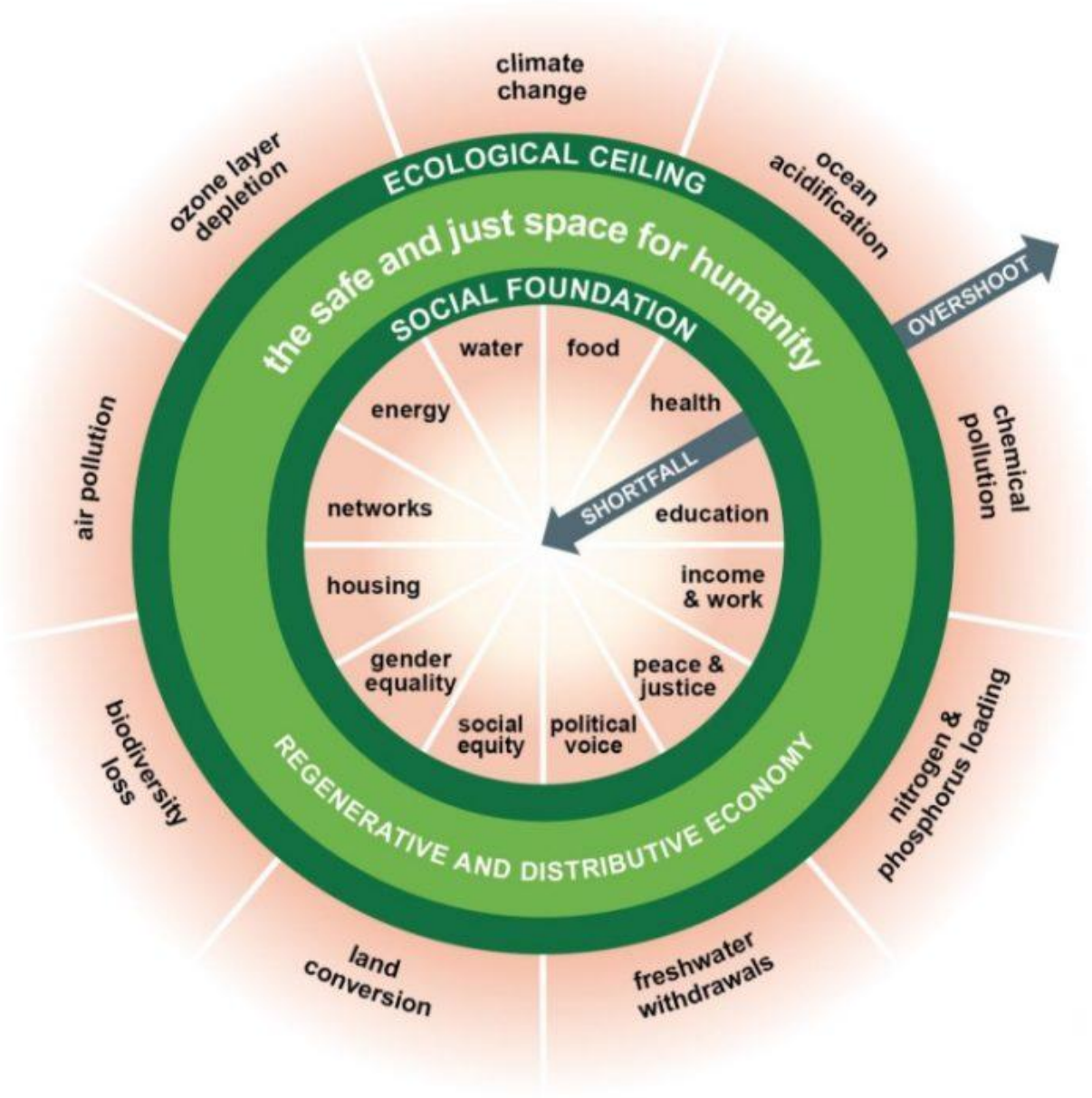
- Identifying functional limits and taking measures to operate within those limits
- Carrying capacity, adaptive capacity
- Resilience

Planetary boundaries



Reassessment of April 2022
Azote for Stockholm Resilience Centre, based on analysis in Wang-Erlandsson et al 2022 | CC BY-NC-ND 3.0

The doughnut of sustainability



"A safe and just space for humanity"

(Raworth 2012)

Source: Oxfam. The **11 dimensions of the social foundation are illustrative** and are based on governments' priorities for Rio+20. The nine dimensions of the environmental ceiling are based on the planetary boundaries set out by Rockström et al (2009b)

Sustainability principles

"Rules of action towards sustainable development" (Waas et al., 2011)

1. Normativity principle

- Sustainability implies choices that are based on societally defined **values**

2. Equity principle

- Inter- and intra-generational equity, geographical equity, procedural equity, interspecies equity

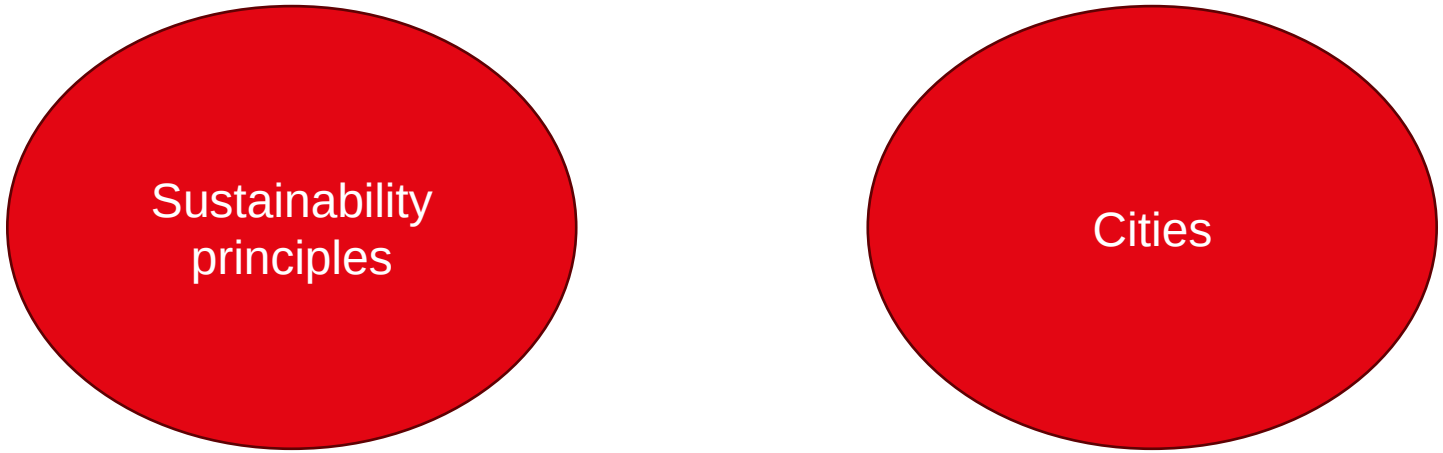
3. Integration principle

- Integration of socio-economic and institutional development objectives with environmental ones
- Contrasts with the idea of "balancing" or "trading-off"

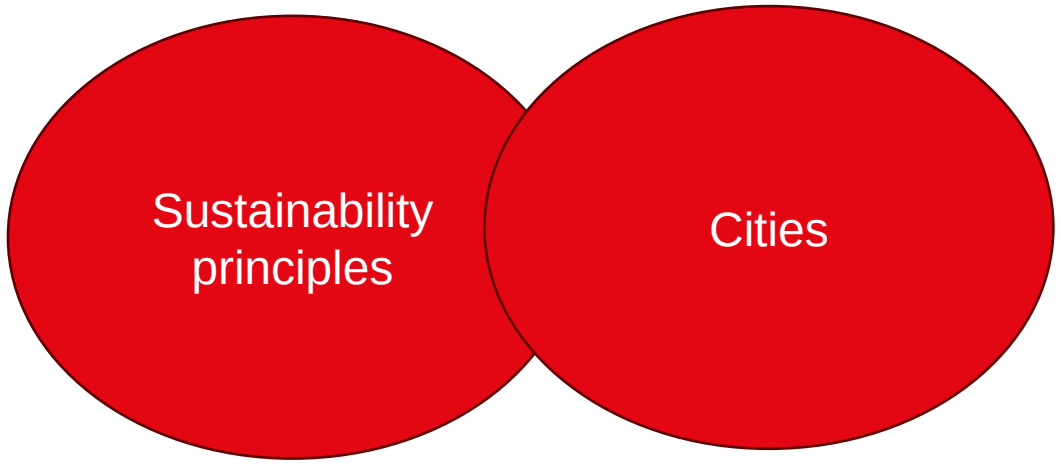
4. Dynamism principle

- Sustainability is not an end state, but a process of directed change, implying uncertainties and risks

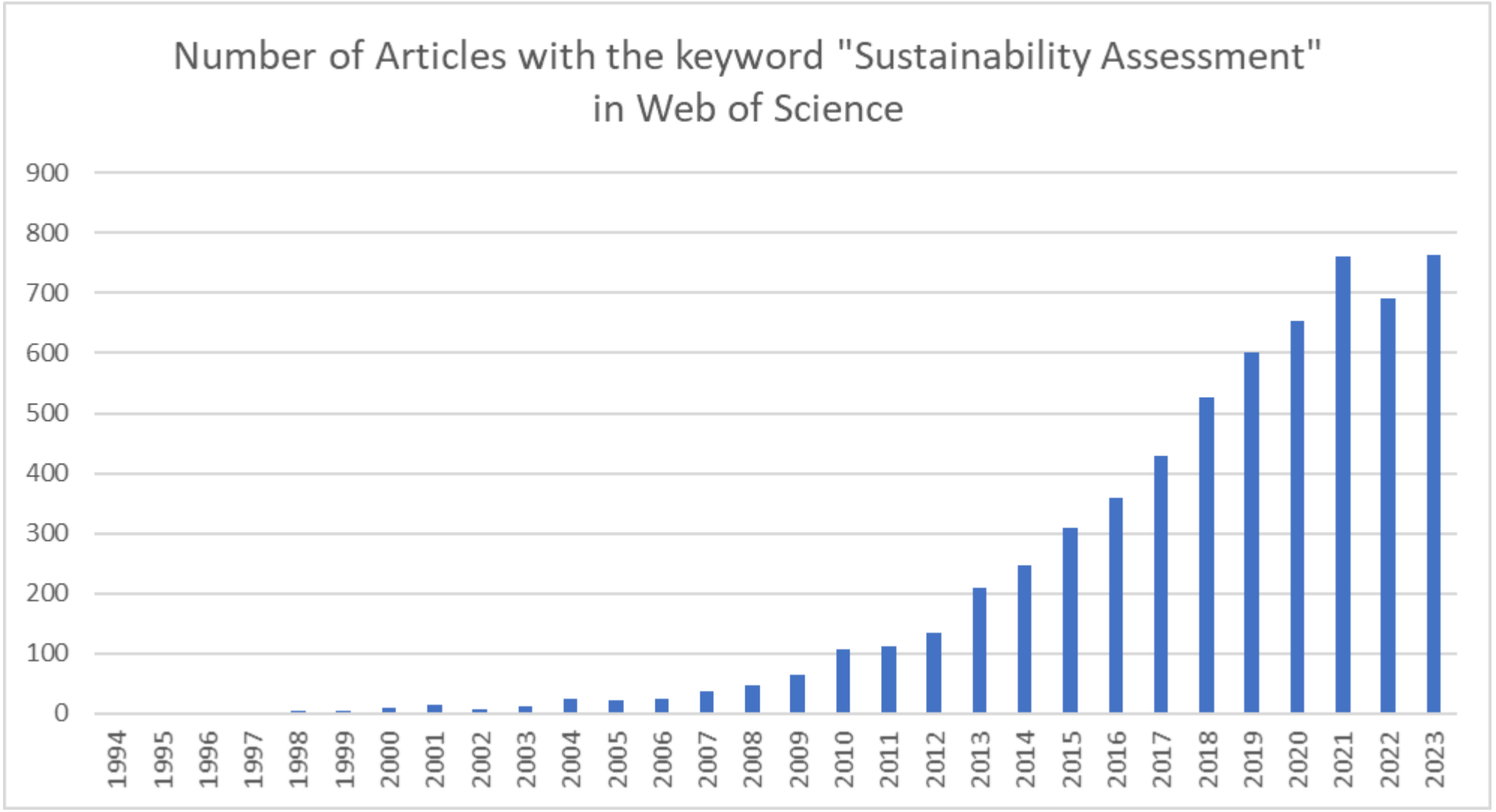
Why do we need to assess sustainability in urban systems?



Why do we need to assess sustainability in urban systems?



Sustainability assessment - increasing in popularity



Urbanization: Opportunity and challenge

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"Make cities *and human settlements inclusive, safe, resilient and sustainable*"

United Nations | https://sdgs.un.org/goals/goal11 | 16.01.2023

Sustainable Development Goal 11
United Nations | https://commons.wikimedia.org/wiki/File:Sustainable_Development_Goals.svg | Public Domain

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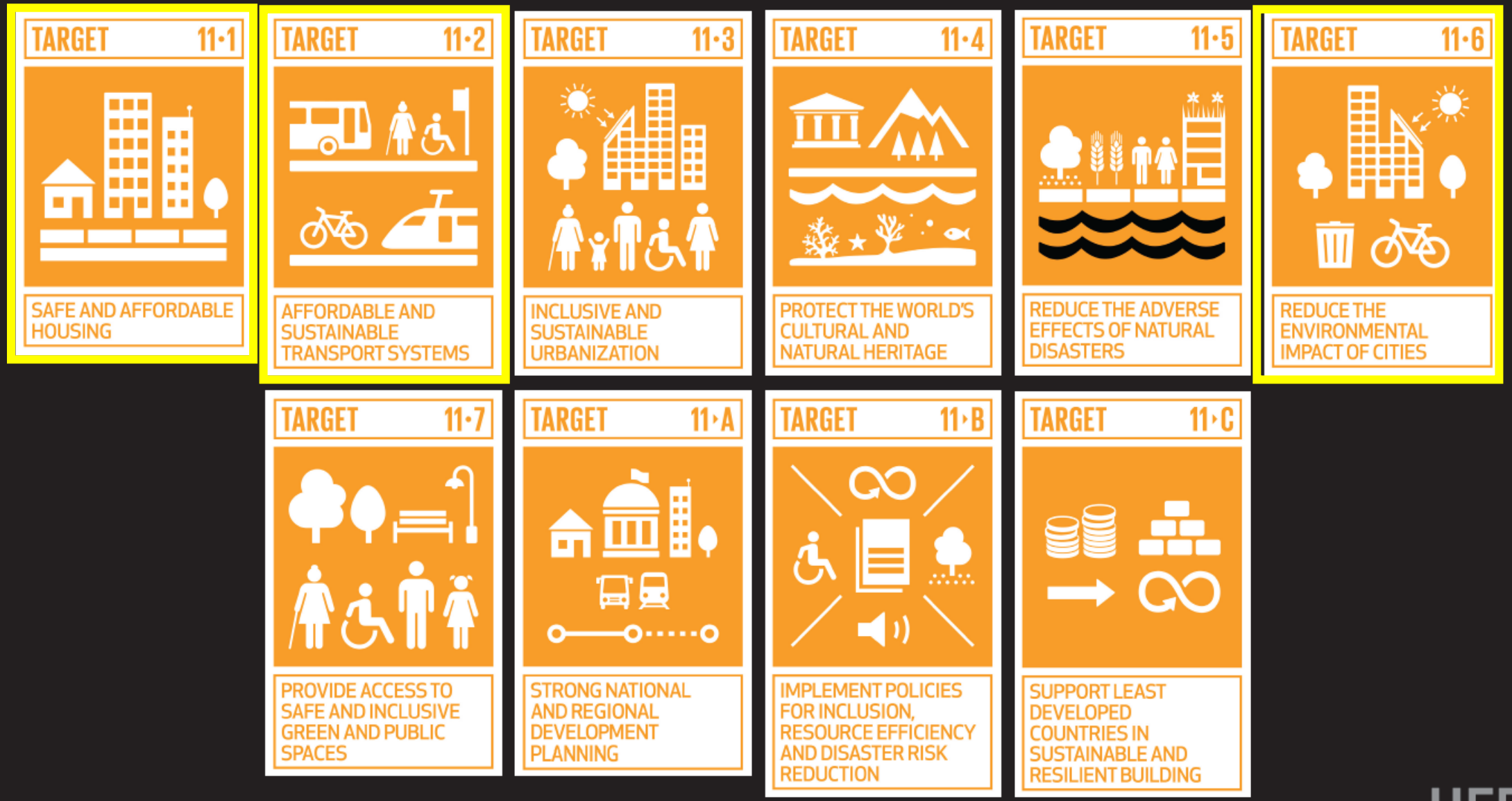

United Nations Targets for Goal 11

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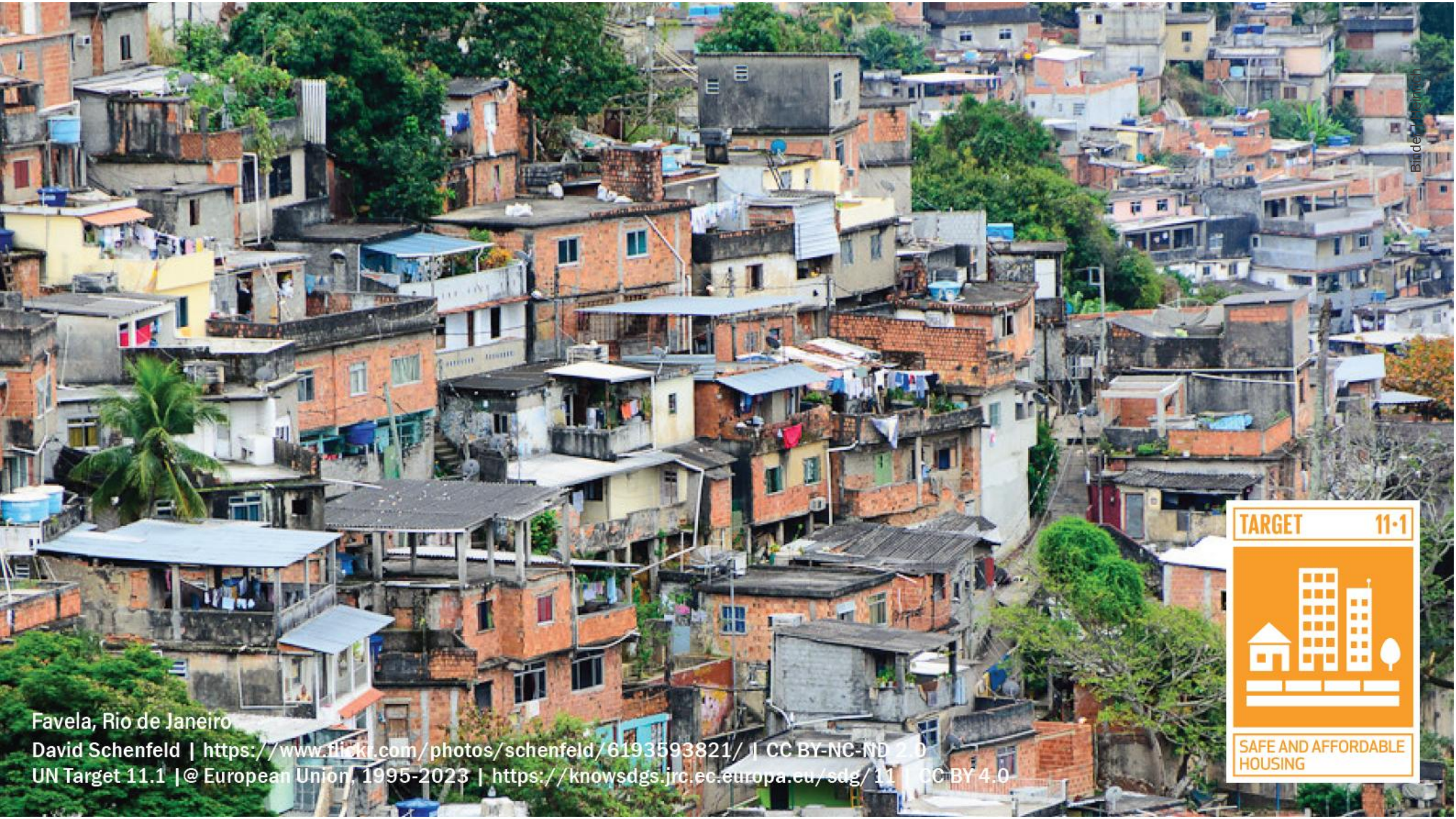

Favela, Rio de Janeiro

Cardboard recycling in Shanghai, China

Underground in Paris, France

Olivier Prt | https://www.flickr.com/photos/ol_pirot/32779166077/in/photostream/ | CC BY-ND 2.0

UN Target 11.7 |@ European Union, 1995-2023 | https://knowsdgs.jrc.ec.europa.eu/sdg/11 | CC BY 4.0

Binder | Heinrich

What is a sustainable urban system?

Which city is most sustainable? Why?


Paris: Banlieue


Rio de Janeiro: Favelas


Dubai


Lausanne

Sustainability assessment

The “supertrees” tower over Gardens by the Bay, Singapore
By Shiny Things | Wikipedia Commons| CC BY 2.0

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Sustainability assessment

- "Sustainability assessment is…a **tool** that can help **decision-makers** and policy-makers decide what actions they should take and should not take in an attempt to make society more sustainable" (Devuyst, 2001, p. 9 in Pope et al. 2004).
- "The aim of sustainability assessment is to ensure that "plans and activities make an optimal contribution to sustainable development" (Verheem, 2002 / in Pope et al. 2004).
- "Sustainability assessment can be simply defined as any process that directs decision making towards sustainability" (Bond et al. 2015)

Sustainability assessment

- "Sustainability assessment is any process that aims to …
  - Contribute to a **better understanding** of the meaning of sustainability and its contextual interpretation (interpretation challenge);
  - **Integrate sustainability issues** into **decision-making** by identifying and assessing (past and/or future) sustainability impacts (information-structuring challenge);
  - **Foster sustainability objectives** (influence challenge)" (Waas et al. 2014)

Value-Articulating Institution

Sustainability Assessment tools might be seen as a

"VALUE-ARTICULATING INSTITUTION" (VAI)

(Jacobs 1997; Vatn 2005)

In general terms, a VAI is a cognitive model defining a set of **rules** about the valuing process:

WHO ? (i) **Who** participates? On what premises (position/role)? How are participants involved in the assessment?

WHAT ? (ii) What counts as **data** and what form it should take (prices, weights, arguments, etc.)

HOW ? (iii) The kind of **data handling procedures** involved: how data is produced? How data are weighted or aggregated?

… So what???

Tool selection is most often made by the analyst on the basis of value-laden principles.

Tool selection inevitably frames the assessment and its results!

Researchers and practitioners in the field of Sustainability Assessments should function not as **“archaeologists”**, carefully uncovering what is there, but as **“architects”**, working to build a defensible expression of value…

(Gregory et al. 1993 ; Vatn & Bromley 1994).

… So what???

… Some principles to take into account when selecting Sustainability Assessment tools:

1. **Transparency**
2. **Inclusiveness** (from the very beginning…)
3. **Alignment with available resource and assessment goals**
4. **Procedural rationality**

Sustainability Assessment Steps

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Step 1 : Defining the scope of the study

(or contextualization)

Questions

What is the goal of the assessment? → **Selecting goal**

How do you define the limits of the city of Lausanne? → **Defining spatial boundaries**

Which time period does the assessment comprise? → **Defining temporal boundaries**

What are the main characteristics of the city ? → **Exploring the characteristics of the assessment object**

1. Contextualization

Selecting goal

"a tool that can **help decision-makers and policy-makers decide** what actions they should take and should not take in an attempt to make society more sustainable'' (Devuyst, 2001, p. 9 in Pope et al. 2004).

"The aim of sustainability assessment is to ensure that plans and activities make an optimal **contribution to sustainable development**'' (Verheem, 2002 / in Pope et al. 2004).

What do we do a sustainability assessment for?

"Sustainability assessment is any process that aims to …

- Contribute to a **better understanding** of the meaning of sustainability and its contextual interpretation (interpretation challenge);
- **Integrate sustainability issues** into **decision-making** by identifying and assessing (past and/or future) sustainability impacts (information-structuring challenge);
- **Foster sustainability objectives** (influence challenge)" (Waas et al. 2014)

1. Contextualization

Selecting goal

- Entity/object of the assessment: a project, a policy, a programme, **a system**, …
- Temporal perspective: Ex-ante, ex-post, **status quo**
- **Benchmarking** (comparison across cases)
- Monitoring (comparison over time)

See e.g. Pope et al. (2004)

1. Contextualization

Selecting goal

For whom am I making this sustainability assessment?

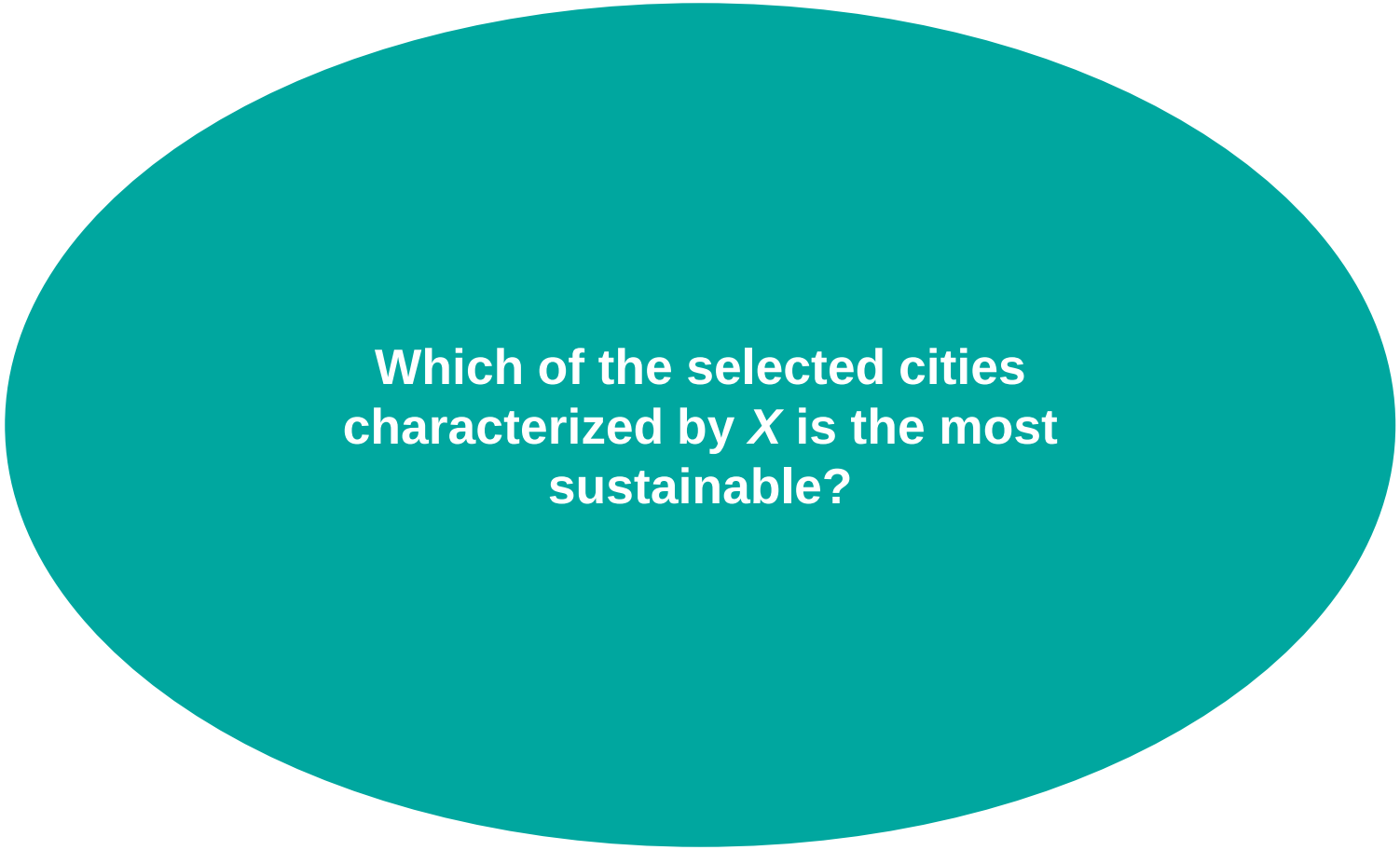
1. Contextualization

Selecting goal → Research question

Which question does your sustainability assessment of four cities respond to?

1. Contextualization

Selecting goal → Research question



1. Contextualization

Defining spatial boundaries

District

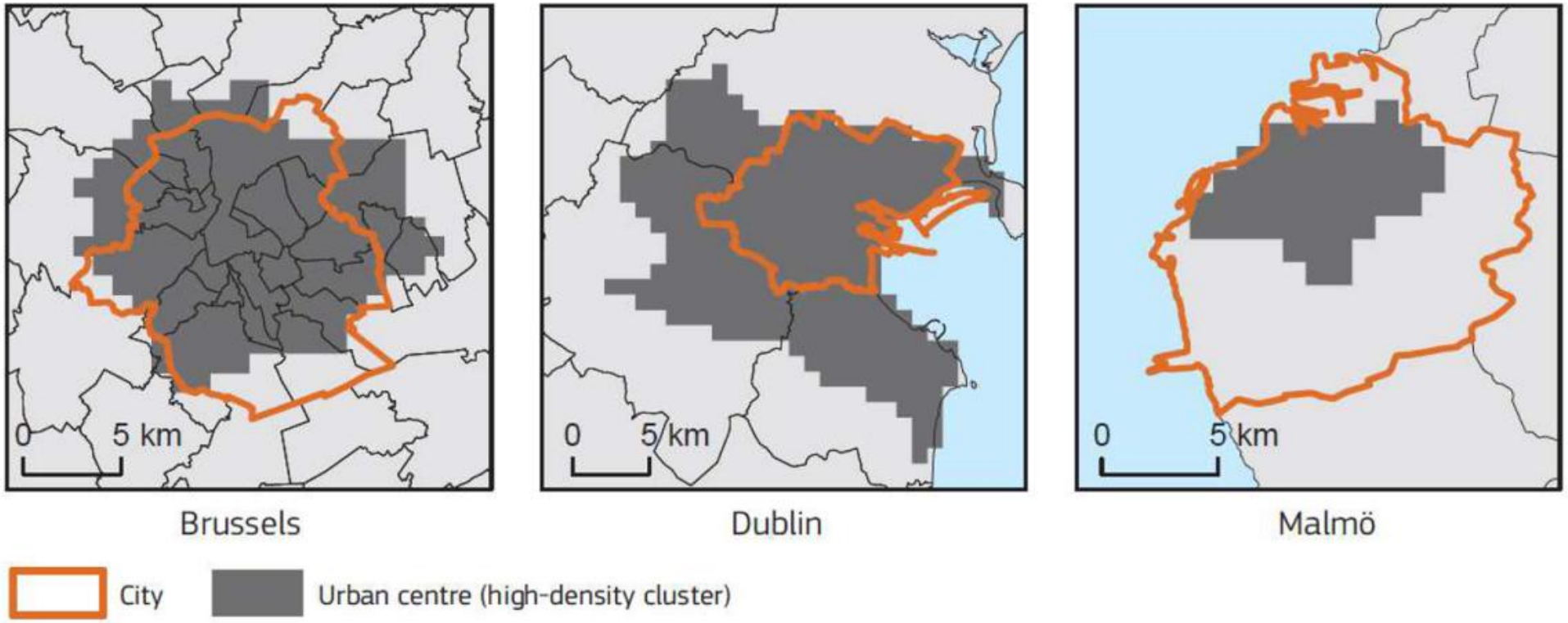
Canton

Confederation

Giampietro & Mayumi (2000)

1. Contextualization

Defining spatial boundaries



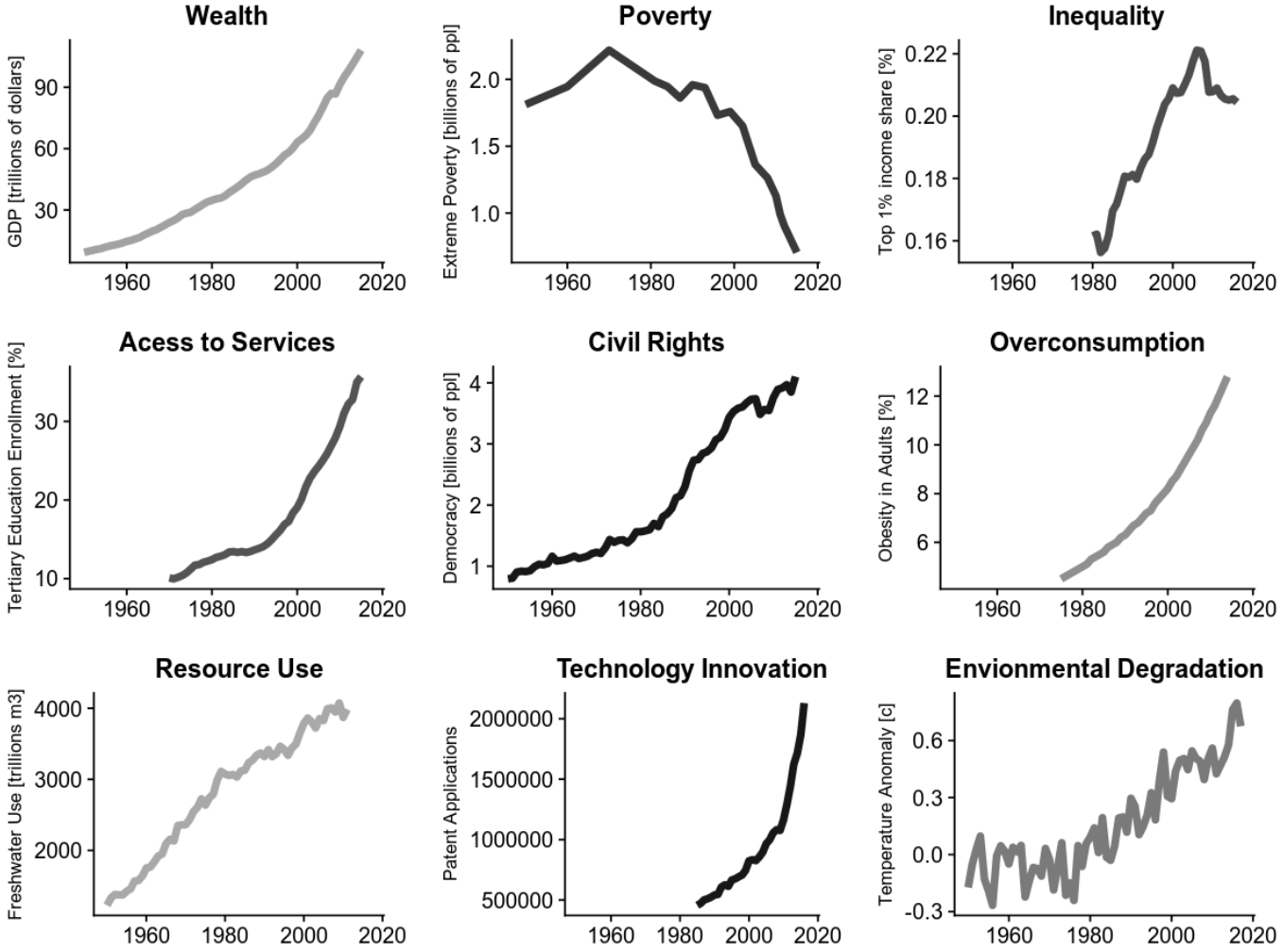
Which city would you predict to be best in terms of…

a) Green areas per capita?

b) Proximity to public transport stops?

1. Contextualization

Defining temporal boundaries



In your work
→ Assess a specific point in time for several cities and compare them (**not** a dynamic assessment)

Step 2: Procedure

Questions

What key stages need to be considered to carry out a sustainability analysis? → **Procedural Framework**

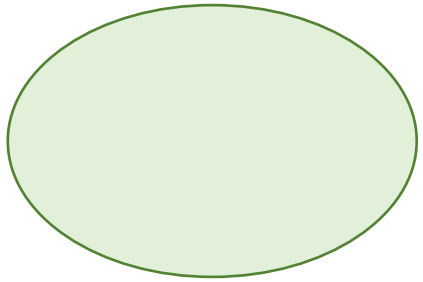
What assessment tools or frameworks can be used (e.g. SWOT analysis, impact assessment)? → **Assessment type**

Which stakeholders should be involved in the assessment process ? When and how should we involve them ? → **Identifying stakeholders**

2. Procedure

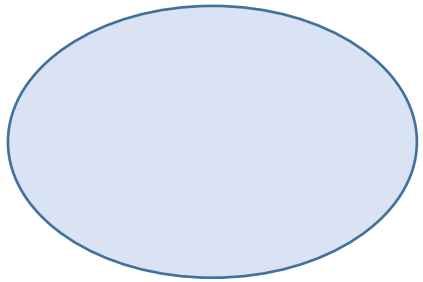
Procedural Framework

Conceptual frameworks



What is a sustainable city?

Procedural frameworks

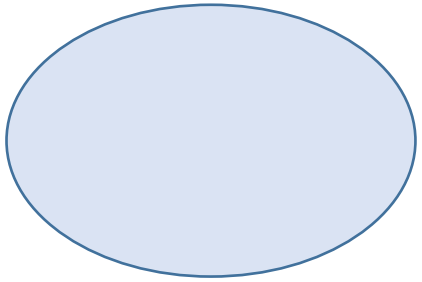


How can urban sustainability be measured?

2. Procedure

Procedural Framework

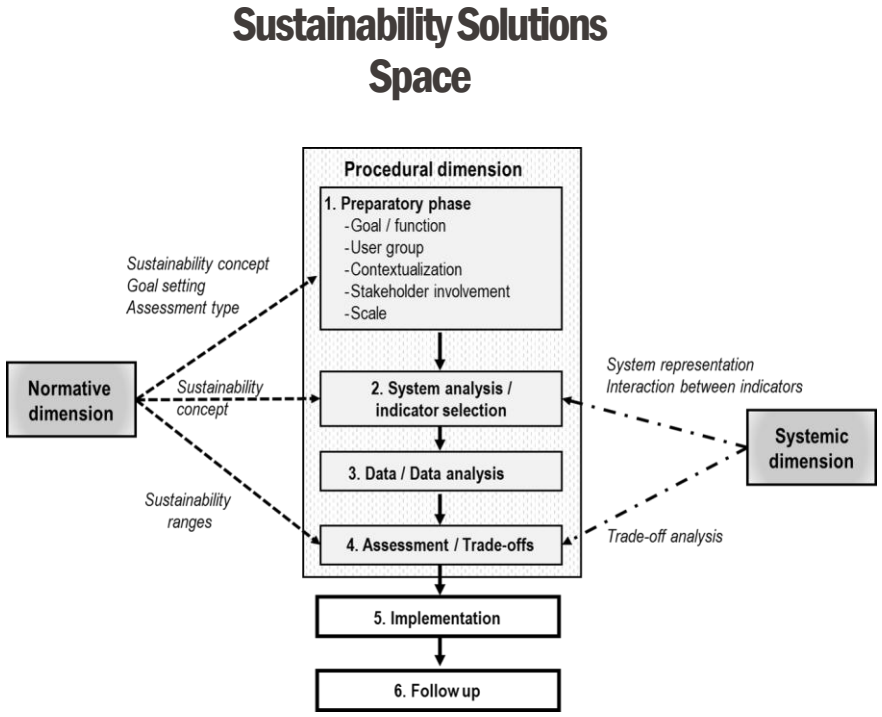
Procedural frameworks



How can urban sustainability be measured?

Procedural frameworks depict the **methodology** implemented to measure a particular concept

They most often consist of a **sequence of stages with dedicated tools**



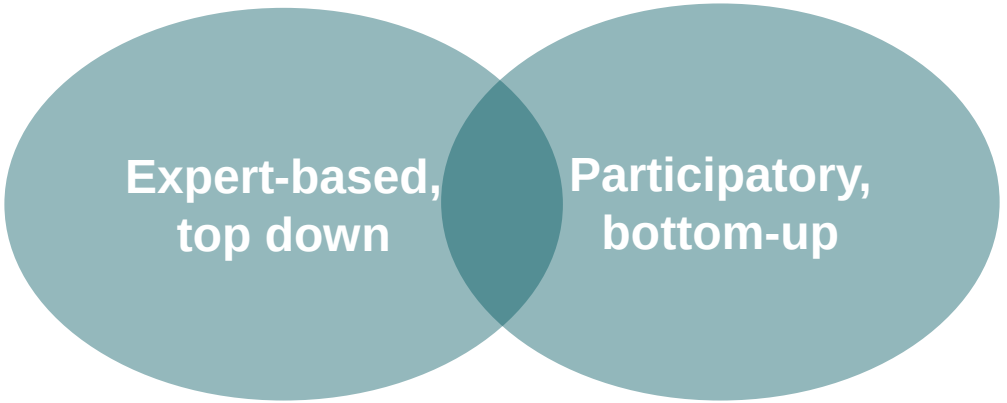
2. Procedure

Assessment type

(Reed et al. 2006; Binder et al. 2020)

2. Procedure

Assessment type



(Reed et al. 2006; Binder et al. 2020)

2. Procedure

Assessment type

The number of tools and approaches that claim that they can be used for assessing sustainability has rapidly grown in the last 20 year…

Risk Analysis

Contingent Valuation Method

Environmental Impact Assessment

Conceptual Modelling

Human Appropriation of Net Primary Production (HANPP)

Life Cycle Assessment (LCA)

Scenario Development & Analysis

Multi-Criteria Analysis (MCA)

Energy Analysis

Ecological Footprint

Exergy Analysis

System Dynamics

Cost-Benefit Analysis (CBA)

Material Flow Analysis (MFA)

Travel Cost Method

Hedonic Pricing

Input-Output Analysis

Numerous tools and approaches

… all these tools and approaches **might be categorized and compared with each other based on very different factors and criteria**!

In this introductory lecture, we present **one classification** of sustainability assessment tools that have been suggested in the scientific literature:

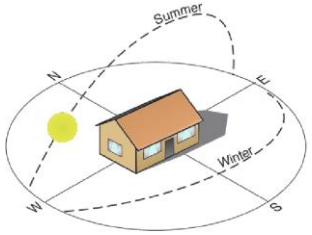
i) Ness et al. (2007)

Other classifications you can find in the reading material

- TEEB (2010)
- Gasparatos & Scolobig (2012)
- Vatn (2005)

Compass

GPS Tracker



Sun

Lichen

ECOLOGICAL ECONOMICS 60 (2007) 498–508

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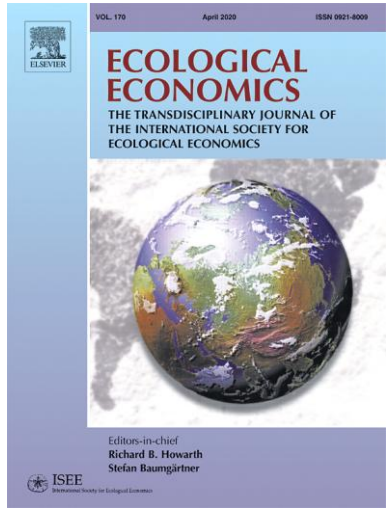

SURVEY

Categorising tools for sustainability assessment

Barry Ness[a,b,*,1], *Evelin Urbel-Piirsalu*[a,b,c,1], *Stefan Anderberg*[d], *Lennart Olsson*[a]

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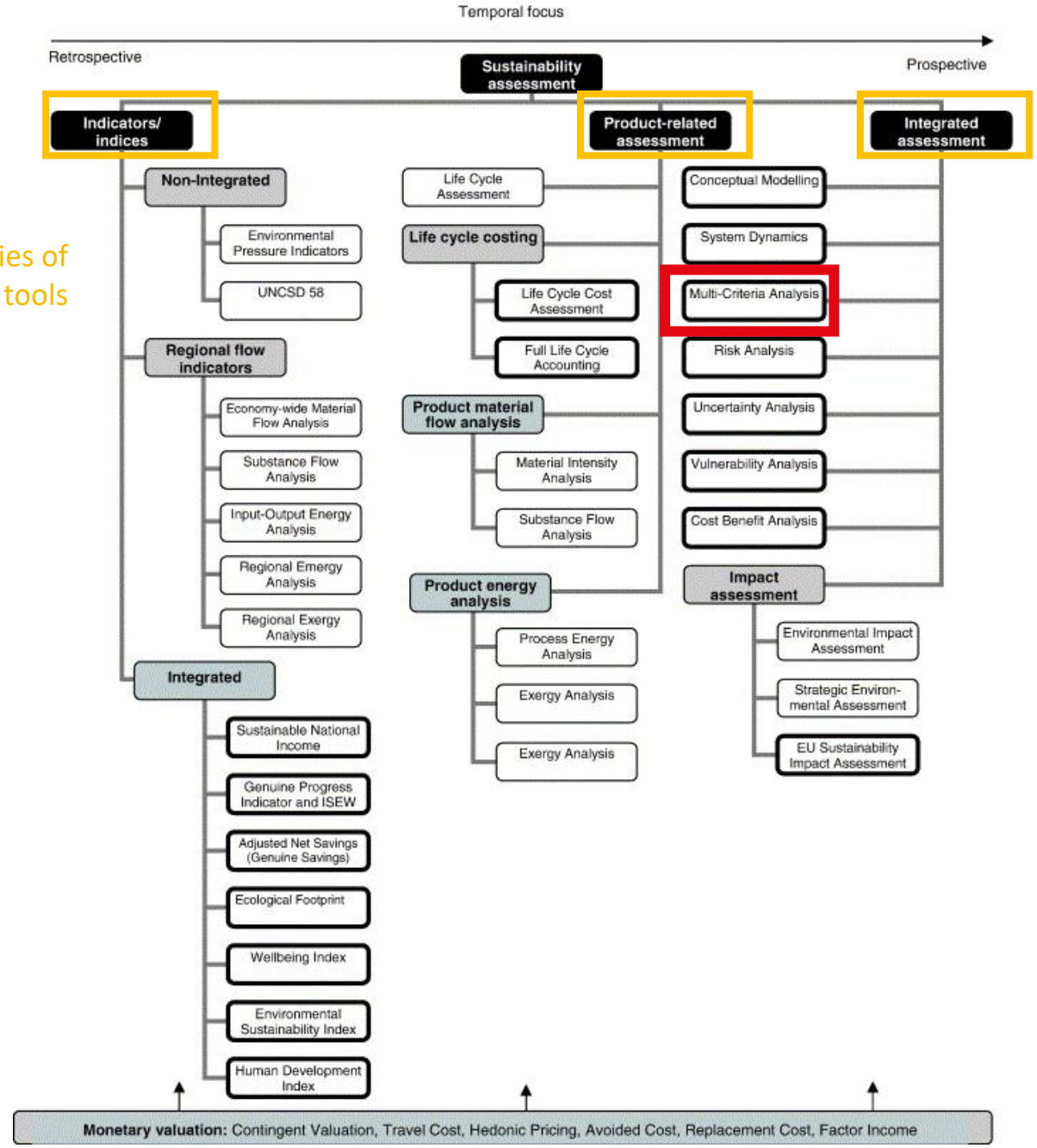
https://www.sciencedirect.com/science/article/pii/S0921800906003636

Ness et al. (2007)

2. Procedure

Assessment type

3 "**umbrella**" categories of sustainability assessment tools



Ness et al. (2007)

Focus on **flows** in connection with production and consumption of **goods and services**

Ex-post analysis (descriptive)

Ex-ante analysis (change-oriented)

3 "**umbrella**" categories of sustainability assessment tools

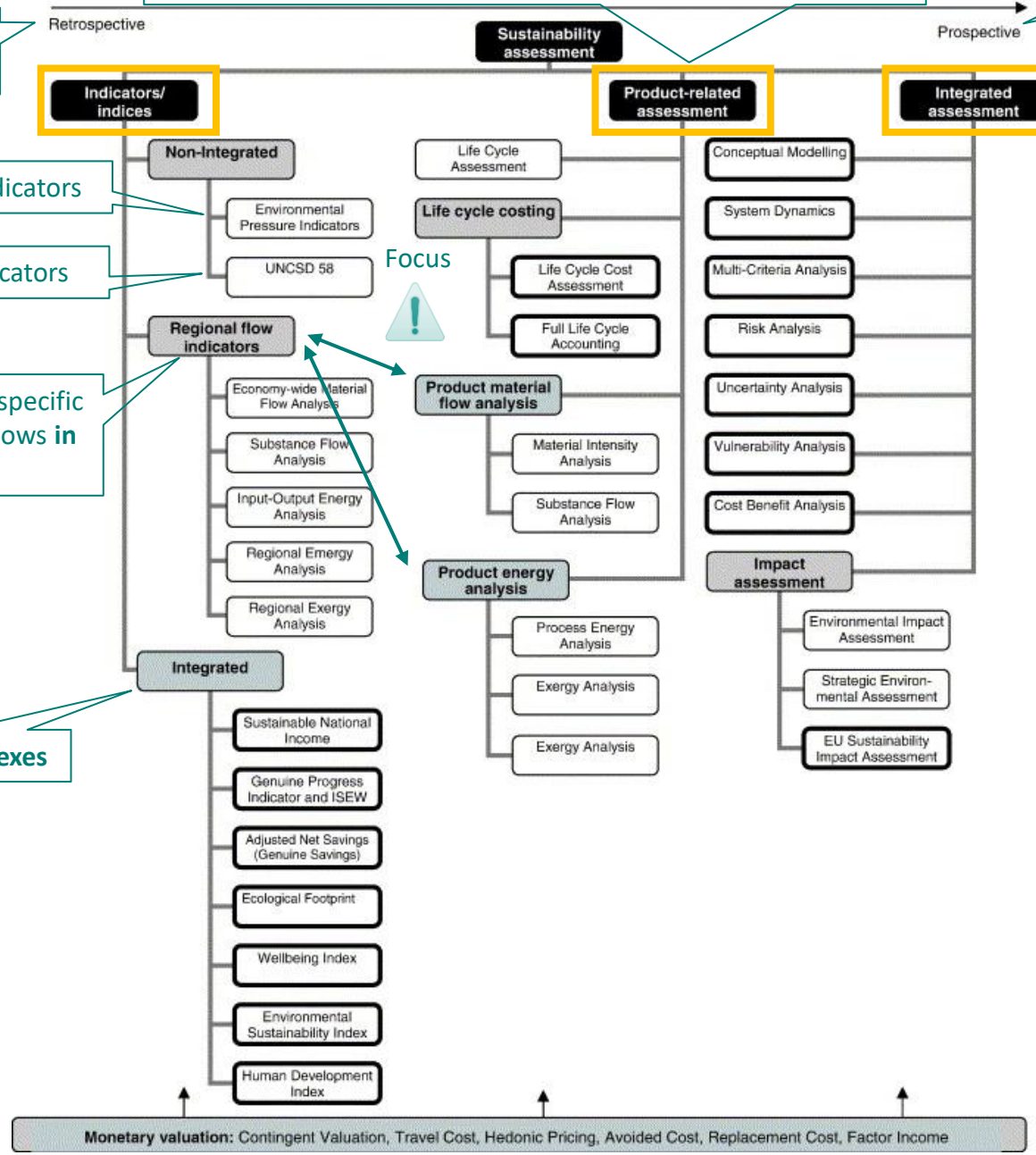
Unidimensional sets of indicators

Disaggregated sets of indicators

Focus on: (i) materials, (ii) specific substances or (iii) energy flows **in a particular region**.

Composite **indexes**

Often carried out in the form of **scenarios**. Many of them rely on **system analysis** approaches and **integrate** nature and society concerns



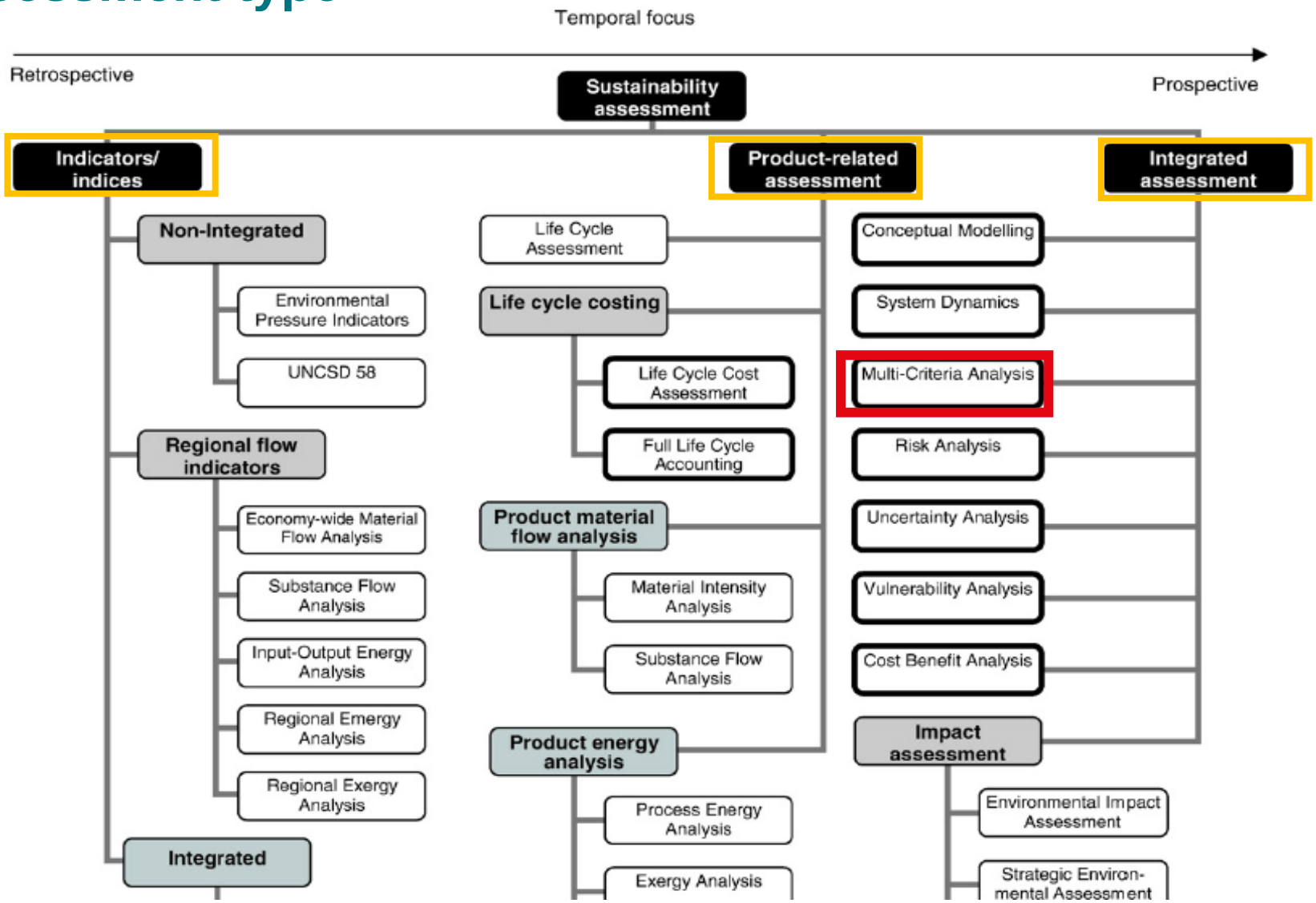
Integrated tools

NON-integrated tools

Ness et al. (2007)

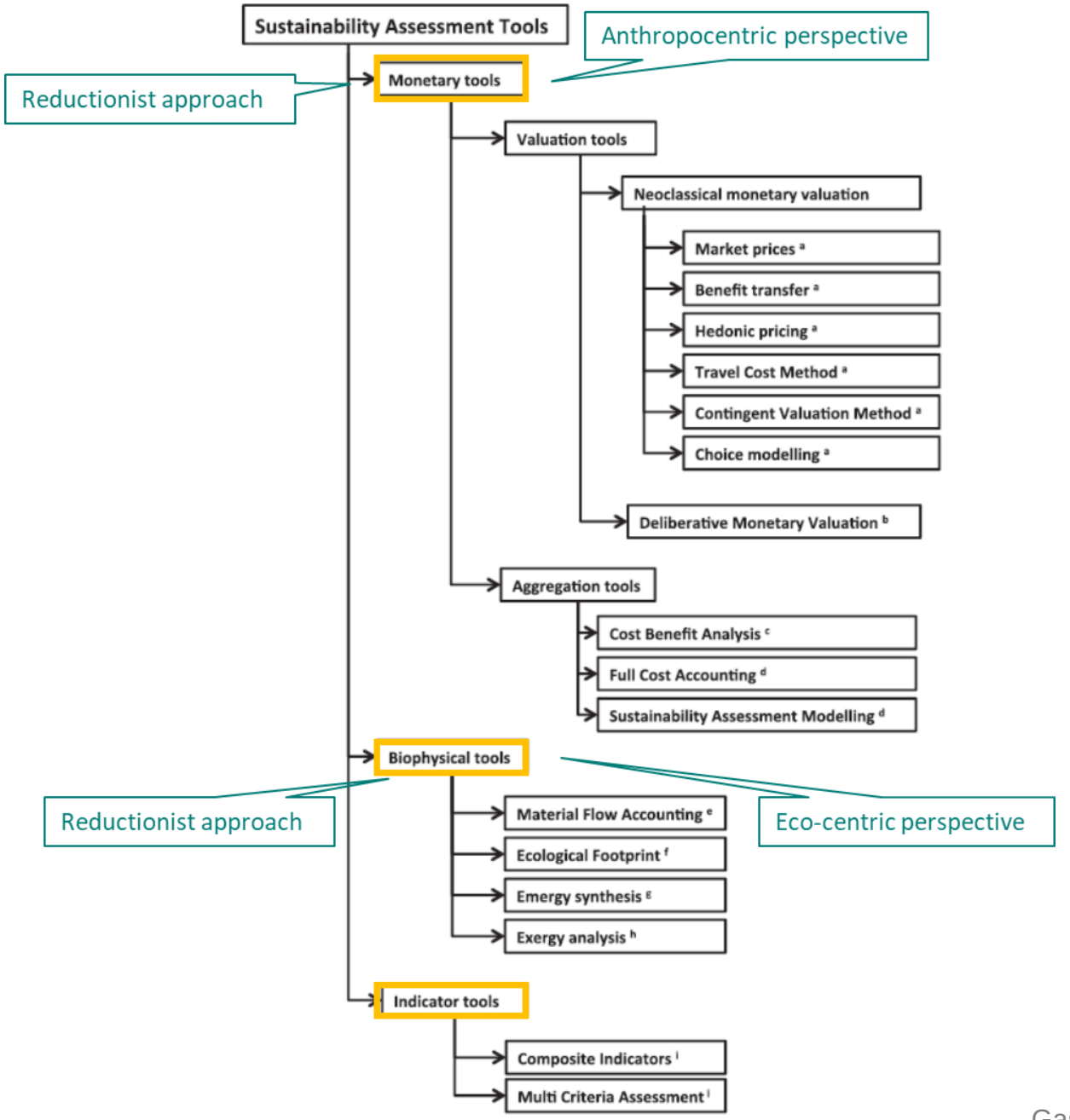
2. Procedure

Assessment type



2. Procedure

Assessment type



Gasparatos & Scolobig (2012)

2. Procedure

Identifying stakeholders

Mapping key stakeholders: illustration 1 (Sustainable finance - Geneva)

Step 3: Definition of sustainability

(or conceptualisation)

Questions

How do you define sustainability in general ? → **Selecting a sustainability definition**

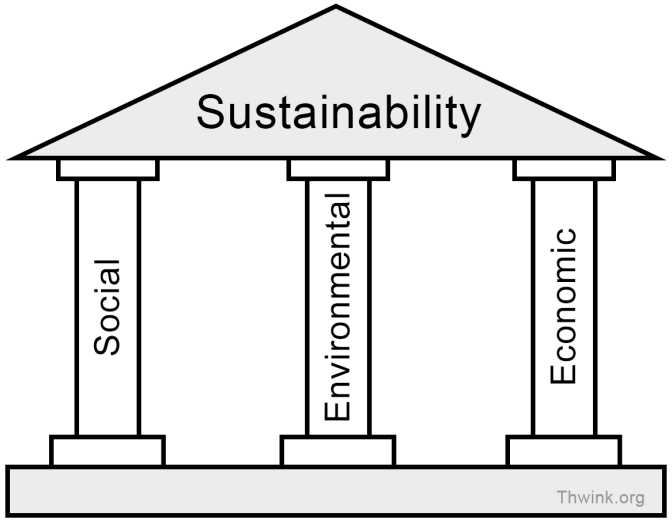
What are the specific sustainability issues for the city of Lausanne ? → **Identifying key sustainability issues**

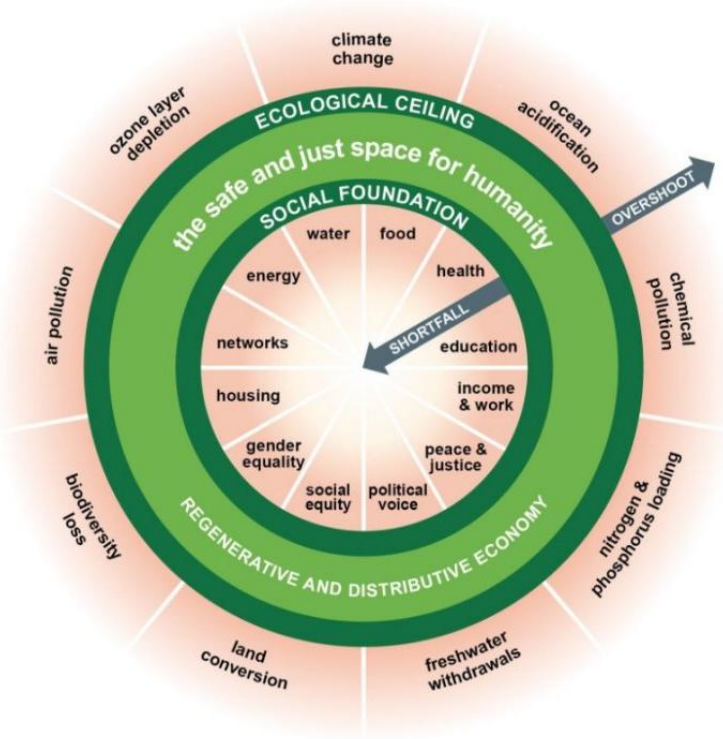
How do you refine the definition of sustainability for the project ? → **Tailoring sustainability definition**

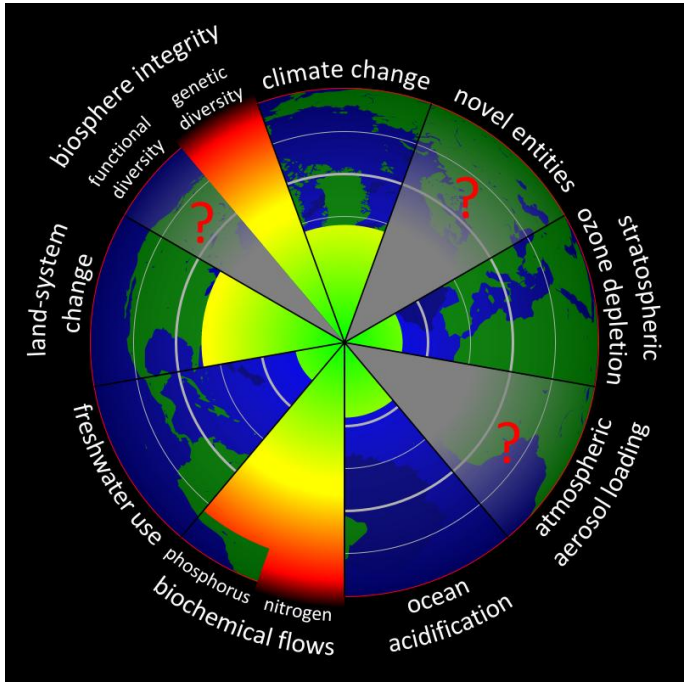
Developing indicator framework

3. Conceptualization

Selecting a sustainability definition







3. Conceptualization

Identify key sustainability issues

Berlin

- Education
- Primary care
- Public security
- Health
- Social cohesion
- Soil protection
- Noise pollution and air quality
- Climate protection
- Water quality
- Biodiversity
- Economic performance
- Employment
- Innovation
- Conservation of resources
- Public expenditure
- Equality

Dublin

- Innovation
- Society
- Economy
- Biodiversity
- Infrastructure & land use
- Transportation
- Climate & Energy
- Resource Management

Calgary

- Community
- Economy
- Education
- Natural Environment
- Resource use
- Wellness

How to identify these issues?

Who decides what is a key issue and what is not?

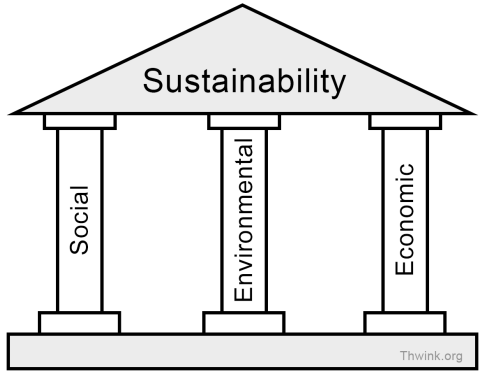
3. Conceptualization

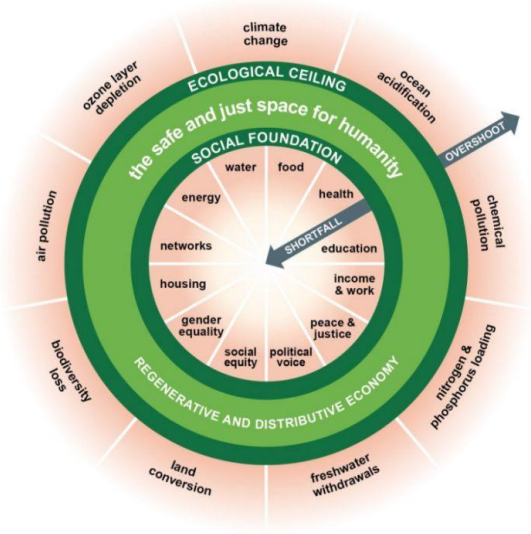
Tailoring sustainability definition

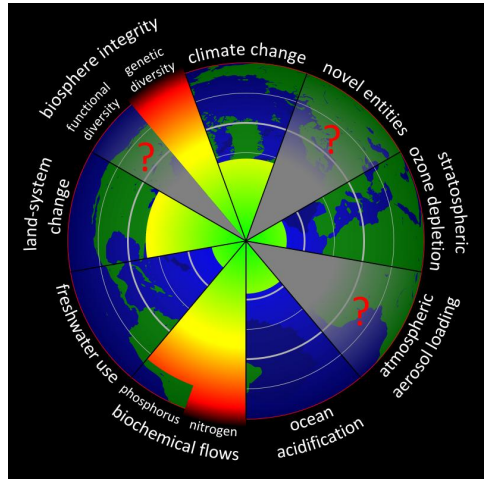
Selected cities

- Education
- Primary care
- Public security
- Health
- Social cohesion
- Soil protection
- Noise pollution and air quality
- Climate protection
- Water quality
- Biodiversity
- Economic performance
- Employment
- Innovation
- Conservation of resources
- Public expenditure
- Equality

Integrate into our sustainability definition







3. Conceptualization

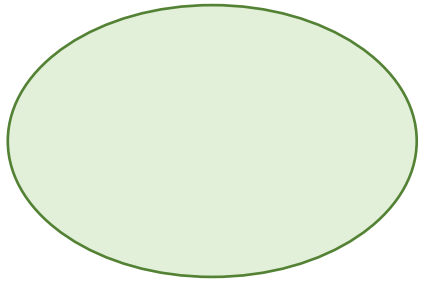
Developing indicator framework

2030 Agenda for Sustainable Development UN (2015)

3. Conceptualization

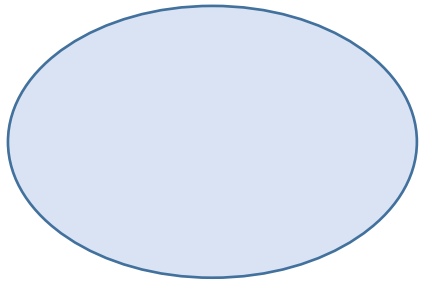
Developing indicator framework

Conceptual frameworks



What is a sustainable city?

Procedural frameworks

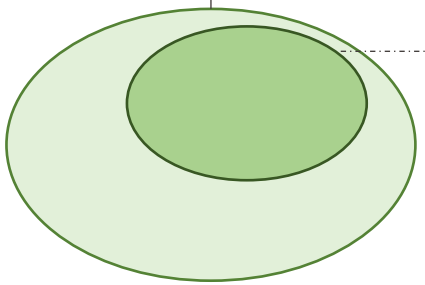


How can urban sustainability be measured?

3. Conceptualization

Developing indicator framework

Conceptual frameworks



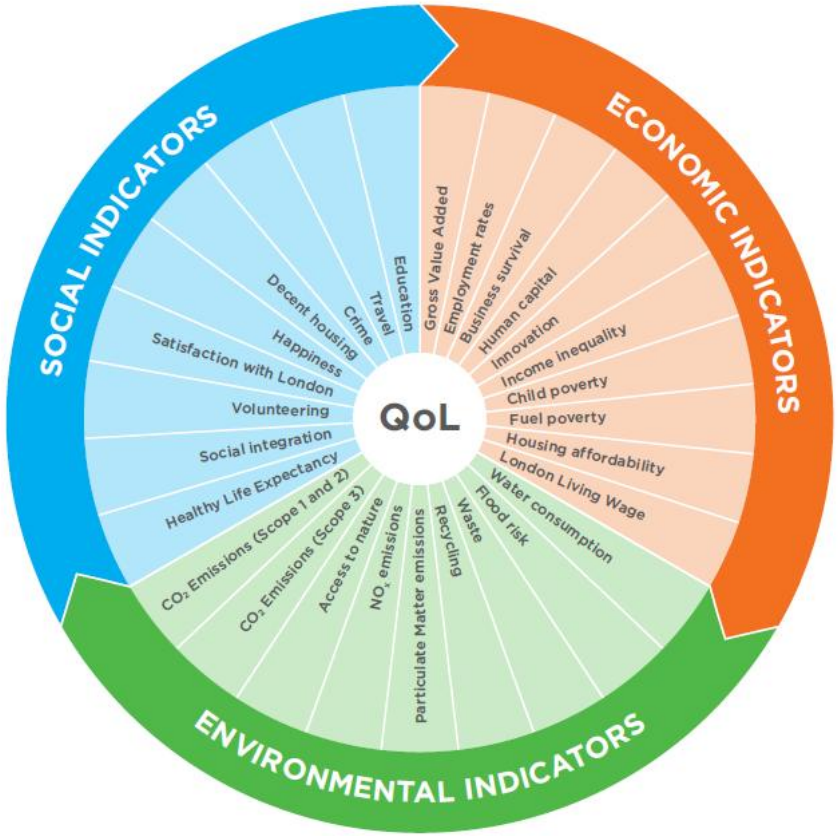
What is a sustainable city?

Conceptual frameworks are **centered on the concept itself**, its representation and its subsequent translation into metrics

Indicator frameworks

3. Conceptualization

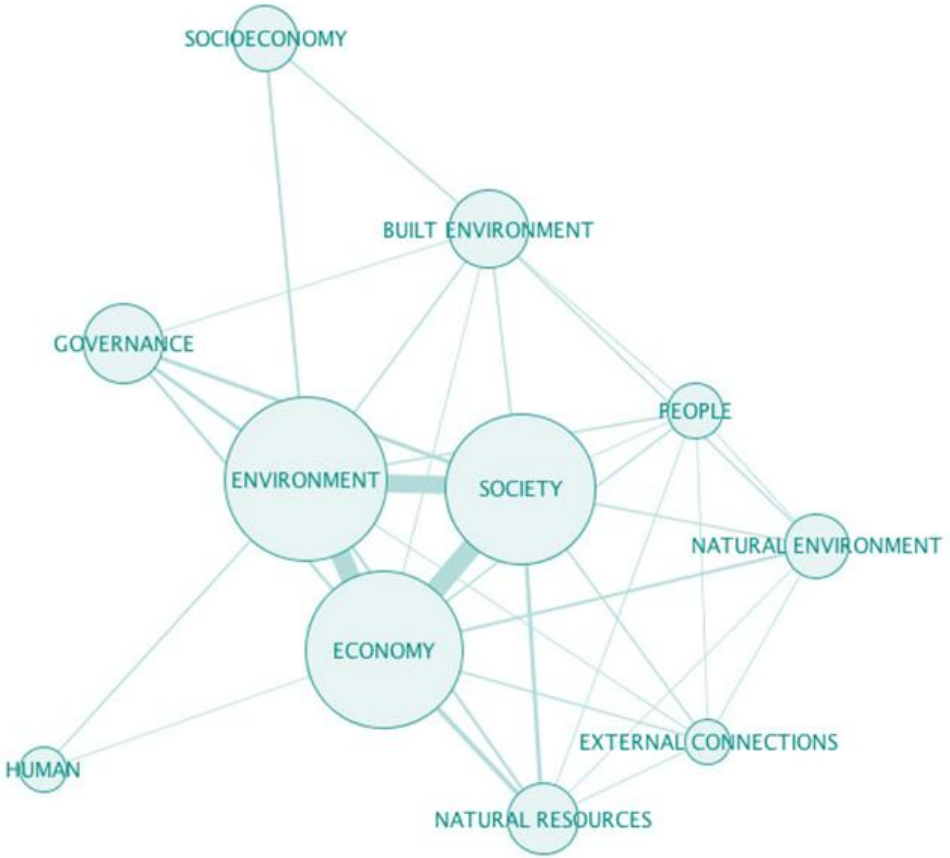
Developing indicator framework



City of London (2017)

3. Conceptualization

Developing indicator framework



Halla & Merino-Saum (2021)

Step 4: Sustainability indicators

(or operationalization)

Questions

What are the key indicators to measure the sustainability of Lausanne ?

How can these indicators be measured? What tools or methodologies can be used to collect data on these indicators?

Can these indicators be used to compare the sustainability of different cities?

Selecting potential indicators

Analysing interactions

Selecting final set of indicators

Setting thresholds and targets

4. Operationalisation

Combining '***opening up***' and '***closing down***' steps…

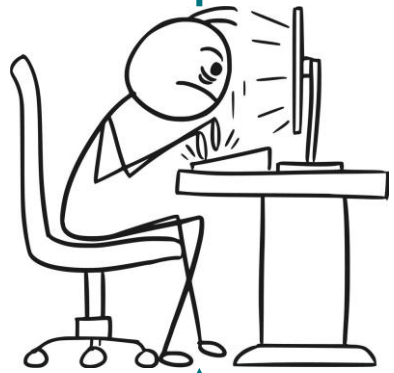
Indicator Framework → Exploration of candidate indicators → Selection of potential indicators → Analysing interactions → Final set of indicators

Based on Stirling 2008

4. Operationalisation

Selecting potential indicators

Validation



Translate Contrast Compose

4. Operationalisation

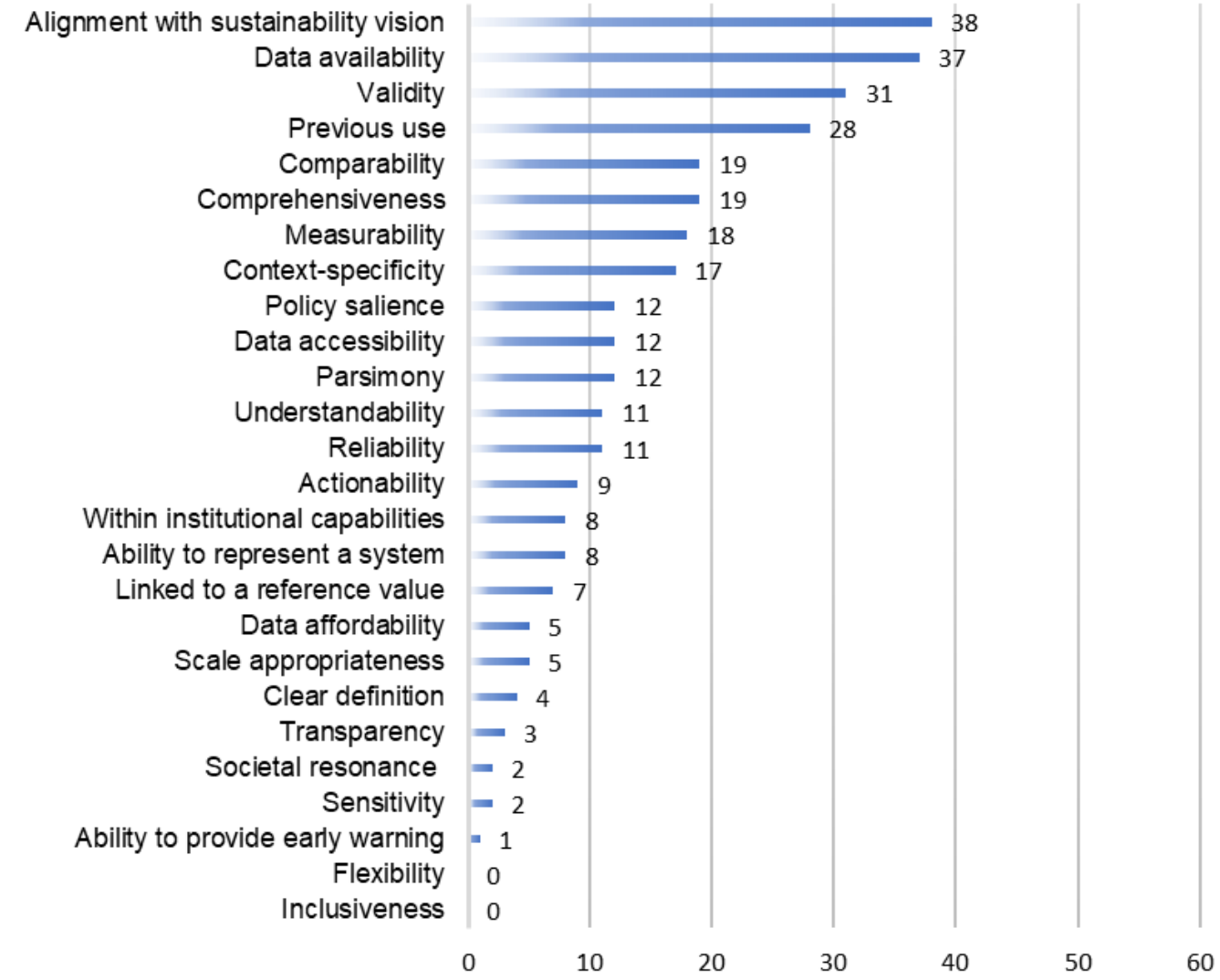
Analysing interactions

		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	

4. Operationalisation

Selecting final set of indicators

Which criteria can guide the selection of indicators?



4. Operationalisation

Setting thresholds and targets

- **Targets sets by the city itself, by the law, by international organizations, etc.**

  Ex: Air pollution

  https://www.admin.ch/opc/en/classified-compilation/19850321/index.html

- **Comparison with similar cities (statistical approach)**

- **Scientific literature**

5. Analysis

Multi-Criteria Assessment (MCA)

Several **alternatives**

A finite set of **evaluative criteria**

Performance scores

Aggregative procedure

(Martel & Rousseau 1993; Banville et al. 1998)

5. Analysis (MCA)

Data collection

Normalization

Assignment of weights

Sensitivity analysis

6. Assessment

Relating main findings with framework and sustainability definition

Discussing trade-offs and interactions

Developing policy recommendations

Reflecting on limitations

GOALS & SKILLS

GRADING

PROGRAM

GROUP PROJECT

Introduction to the course

General goals of the course

The goal of this course is for you to learn:

- how to apply sustainability assessment methods to provide an answer to a specific problem;
- to distinguish between and integrate the procedural, normative, and systemic dimensions of the sustainability assessment;
- To learn the analytical tools for conducting sustainability assessment
- how to interact with people from other disciplines and contribute to a critical and reflexive view on sustainability assessment.

General goals: transversal skills

To achieve this goal, you will learn to:

- **design and conduct a research project in an interdisciplinary team**
- read, elaborate and reflect scientific and gray literature
- present findings both in oral and written form
- critically question ideas and models, to assess those and to develop new ones

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**: Introduction, indicator frameworks	**Groups formed**
4	12/03/2025	**Key steps in SA #2**: Participatory and normative dimension	
5	19/03/2025	**Key steps in SA #3**: Systemic 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	**Sustainability Assessment in practice**	
11	07/05/2025	**Policy implications**	
12	14/05/2025	**Deriving policy recommendations**	
13	21/05/2025	**Presentation of semester work_1 ***	
14	28/05/2025	**Presentation of semester work_2**	

* May be updated depending on the number of students enrolled

Milestones and Grading

Groups formed 05.03.2025

Submission of Outlines for group projects 19.03.2025

Submission of posters 16.05.2024 * (20%)

Presentation (10%) and Critical evaluation of another poster (10%)
21/288.05.2024 *

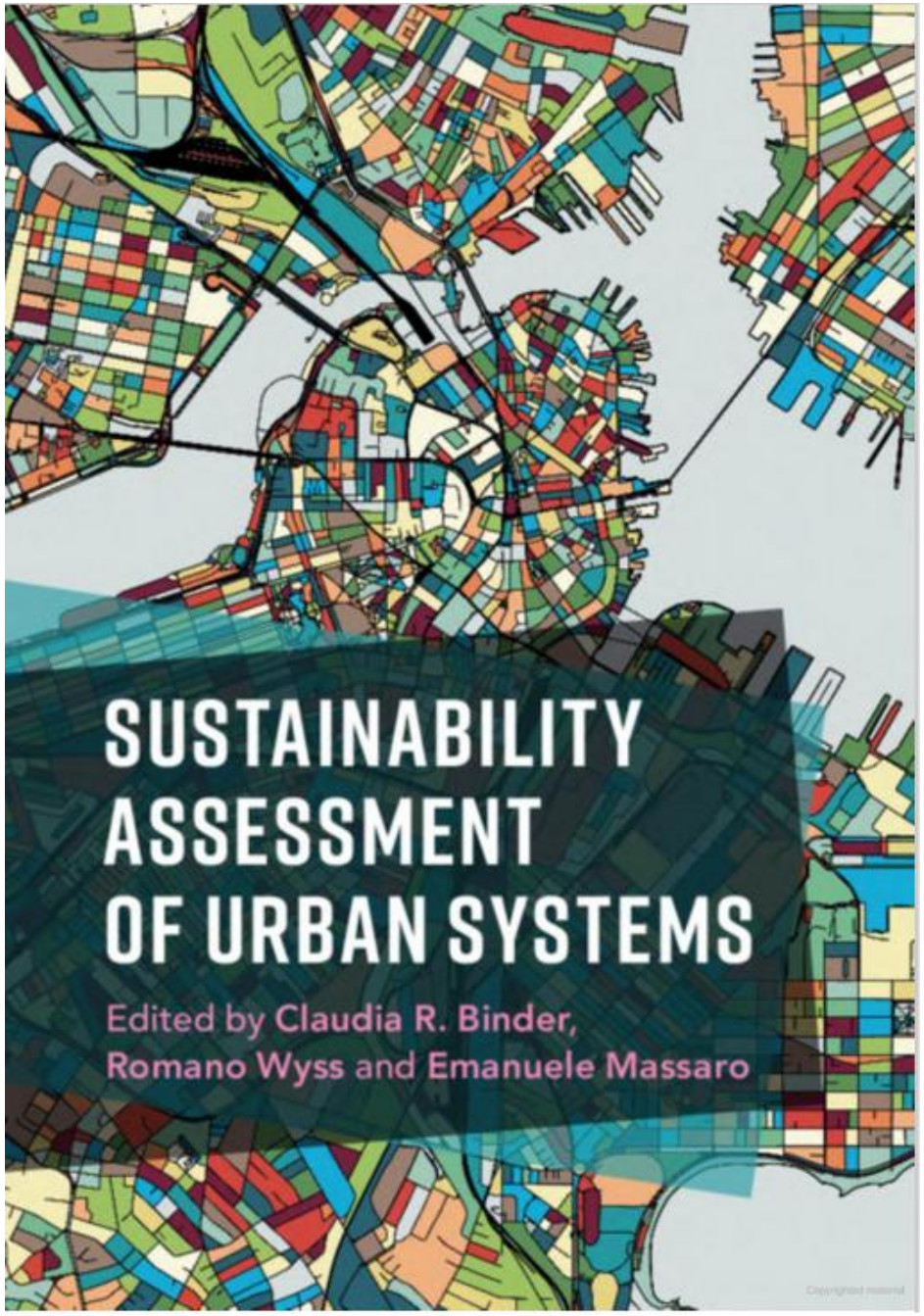
Final Exam XX.06.2024 (60%)

** May be updated depending on the number of students enrolled*

Details on the project will be given during Lecture 2

Recent book from Cambridge University Press

- Course will be based on the book
- Chapters discussing different aspects of assessing the sustainability of cities
- Contributions by several members of the HERUS laboratory
- Hard copy available for



https://doi.org/10.1017/9781108574334

Your expectations

Welcome to the course !

- What are your main expectations for this course?
- How do you envision applying what you learn in this course to your future career or studies?
- https://moodle.epfl.ch/mod/feedback/view.php?id=975804

Questions?

Matthias Heinrich – matthias.heinrich@epfl.ch

Simon Ladino Cano – simon.ladinocano@epfl.ch
Giulia Frigo – giulia.frigo@epfl.ch
Ankita Singhvi – ankita.singhvi@epfl.ch
Gloria Serra Coch - gloria.serracoch@epfl.ch

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- Clark, William C. & Dickson, Nancy M. (2003): Sustainability science: The emerging research program. *Havard University, Cambridge*.
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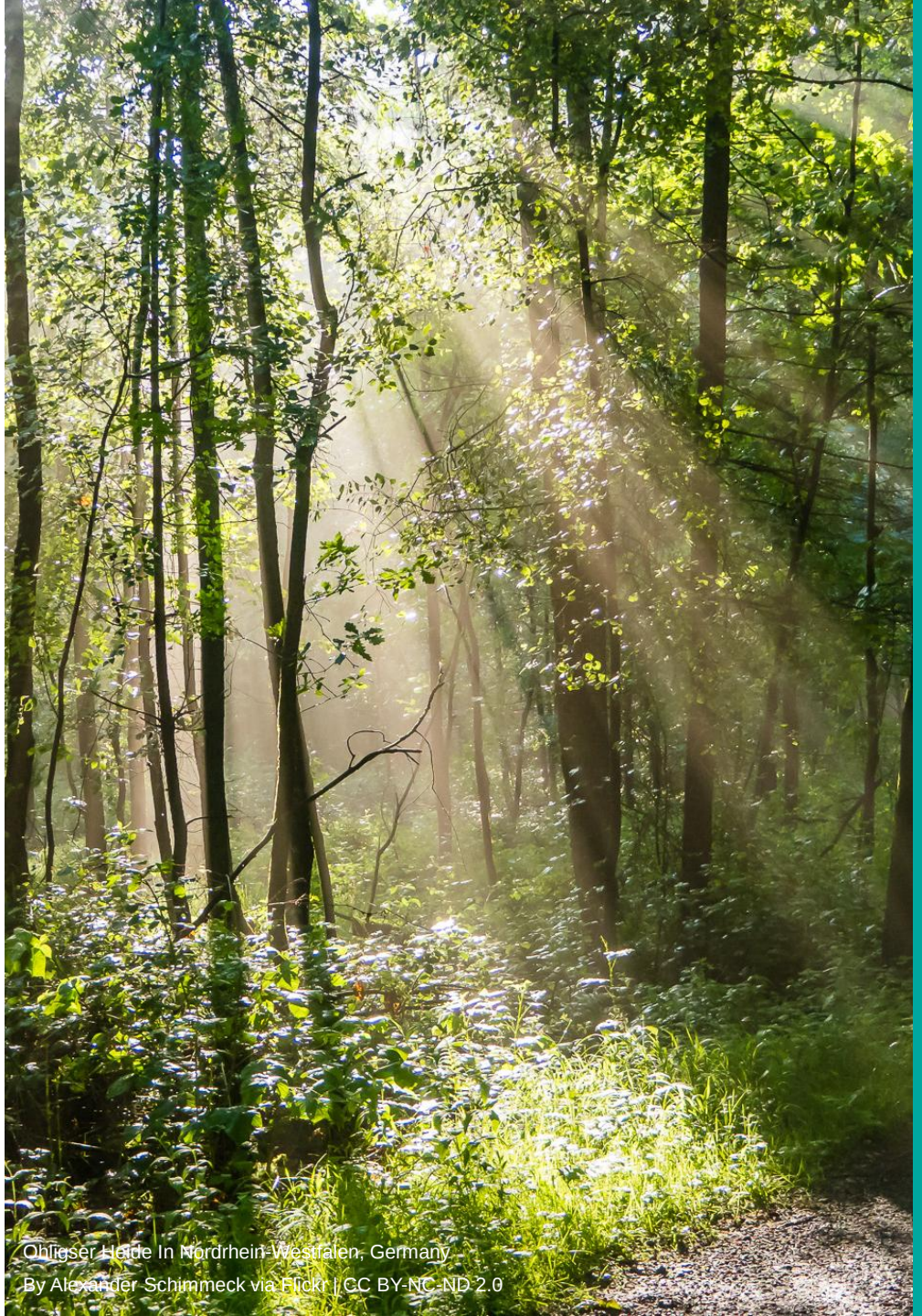
Origins of sustainability / sustainable development



Ohligser Heide In Nordrhein-Westfalen, Germany

1713: von Carlowitz wrote about the "sustainable use" of wood

Early Accounts of Sustainability

© bpk/Staatliche Kunstsammlungen Dresden/Herbert Boswank

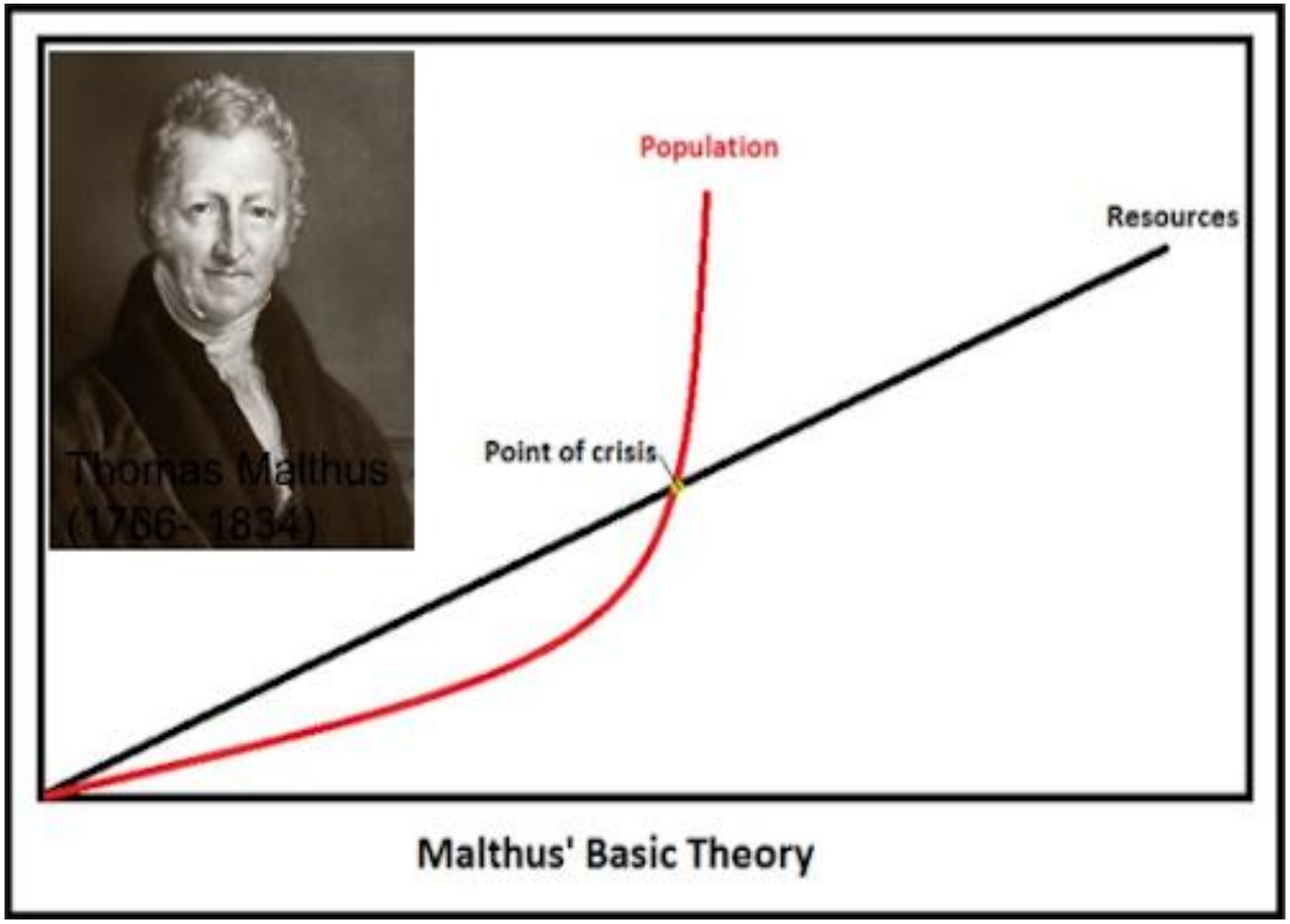
Hans Carl von Carlowitz (1713)

“How to conserve and use wood so that a continous and sustainable utilization of the wood resources is possible“

1713: von Carlowitz wrote about the sustainable use of wood

1798: Thomas Malthus introduced his population theory

Thomas Malthus – An Essay on the Principle of Population (1798)



https://www.econ.cam.ac.uk/events-files/news/images/malthus/Malthus-graph.png

- Human population increases geometrically, while food production increases arithmetically
- Results in disease, famine, wars, calamity
- Earth may not sustain itself, resources are finite and there is «limits to growth»

1713: von Carlowitz wrote about the sustainable use of wood

1798: Thomas Malthus introduced his population theory

1937: G.S. Callendar warned about global warming linked to CO2 emissions

Early Warnings of Climate Change

THE ARTIFICIAL PRODUCTION OF CARBON DIOXIDE AND ITS INFLUENCE ON TEMPERATURE

By G. S. CALLENDAR

(Steam technologist to the British Electrical and Allied Industries Research Association.)

(Communicated by Dr. G. M. B. Dobson, F.R.S.)

[Manuscript received May 19, 1937—read February 16, 1938.]

*'As man is now **changing the composition** of the atmosphere **at a rate** which must be **very exceptional** on the geological time scale, it is natural to seek for the **probable effects of such a change**. From the best laboratory observations it appears that the principal result of increasing atmospheric carbon dioxide… would be **a gradual increase in the mean temperature** of the colder regions of the Earth.'*

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1962: Rachel Carlson published her best-seller book «Silent Spring»

Rachel Carlson – Silent Spring (1962)

"How silent the spring." Associated Press photo, 1963. Prints and Photographs Division of the Library of Congress.

- Misuse of pesticides without knowing the full extent of their effect and harm
- Advocated questioning authorities: «who speaks and why?»
- Best-seller
- Villified by the pesticide and chemical industry

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1970: First Earth Day celebrated in USA with 20 millions of participants

First Earth Day – April 22, 1970

https://www.nypl.org/blog/2020/04/22/earth-arbor-day-virtual-events-books-websites

Kids with sweepers gather in New York City to clean the streets on the first-ever Earth Day in 1970.

PHOTOGRAPH BY BETTMANN, GETTY IMAGES

https://kids.nationalgeographic.com/celebrations/article/earth-day

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UN Conference on the Human Environment (1972)

Binder | Heinrich

https://www.youtube.com/watch?v=9zOSRqa-h3Q

UN environment programme 50 1972-2022

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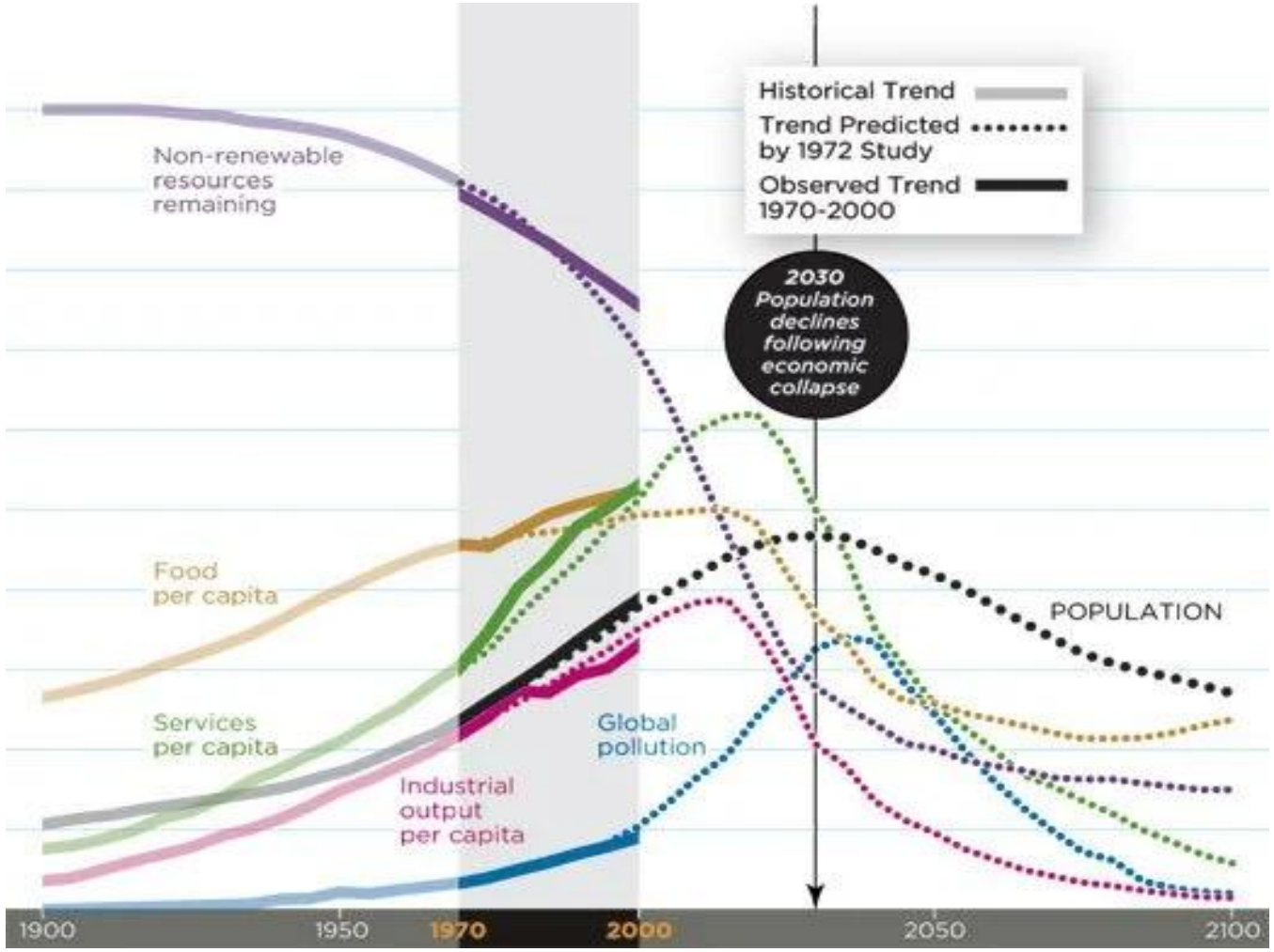
Club of Rome – The Limits to Growth (1972)



- Indefinite growth is not possible
- System dynamics model
- Peak and a collapse around 2050
- Current empirical data validates the model's projections

https://www.smithsonianmag.com/science-nature/looking-back-on-the-limits-of-growth-125269840/

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1987: Brundtland Report introduced the concept «Sustainable Development»

1988: IPCC (International Panel on Climate Change) was founded

Brundtland Report – Our Common Future (1987)

"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs"

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Rio Earth Summit (1992)

"https://thegreenpolitics.com/the-rio-summit-1992/

- Rio Declaration on Environment and Development
- Led to the establishment of UNFCCC, COP annual climate conferences
- Agenda 21, non-binding UN action plan for sustainable development
- No legal framework or mandate for the countries

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2005: C40 Cities Climate Leadership Group was founded

Foundation of ICLEI (1990)

- First environmental city network
- Promoting action on the local level
- Today active in 125+ countries, 2500 members

https://www.iclei.org/en/ACP.html

Foundation of C40 (2005)

- Started off with an alliance of 18 megacities
- Currently has 97 member cities making up 25% of the global economy
- Mission: halving the emissions within a decade
- Membership through action

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2015: 2030 Agenda for Sustainable Development - 17 SDGs

Agenda 2030 for Sustainable Development (2015)

- Adopted by all United Nation Member States
- 17 Sustainable Development Goals (SDGs) and 169 targets

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2015: 2030 Agenda for Sustainable Development, 17 SDGs

2015: Paris Agreement

COP 21 - Paris Agremeent (2015)

- First-ever universal, legally binding (?) climate deal
- It committed all states to reduce GHG emissions
- Each state must set Nationally Determined Contribution (NDCs)
- While their attainment is only politically binding, there is legal obligation for their implementation

UNFCCC COP21 Final Plenary, 12 December 2015, Le Bourget-Paris. Photo: Nicola Tollin

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2015: 2030 Agenda for Sustainable Development - 17 SDGs

2015: Paris Agreement

Late lessons from early warnings

"The important thing in science is not so much to obtain new facts as to discover new ways of thinking about them" - **William Lawrence Bragg**