



Marine Litter

Global Platform for Monitoring Marine Litter and **Informing Action - best practices**

1. What data and knowledge are needed?
2. Co-creation of research agendas and knowledge
3. Co-usage of knowledge

Co-Chairs:
Hans-Peter Plag
Daniel Martin

Based on discussions in a number of communities, including, e.g.
ConnectinGEO
IEEE-OES Plastic in the Ocean Initiative
Blue Planet Initiative

Discussions on:

1) **What data and knowledge are needed?** Best practices in gap analyses, identification and prioritizing of knowledge needs, including life cycle analyses and impact assessments;

(2) **Co-creation of research agendas and knowledge:** best practices in engaging with stakeholders, including participatory modeling;

(3) **Co-usage of knowledge:** best practices for the delivery of knowledge to decision and policy makers and for the engagement of scientists and researchers in policy making, including ethical considerations.

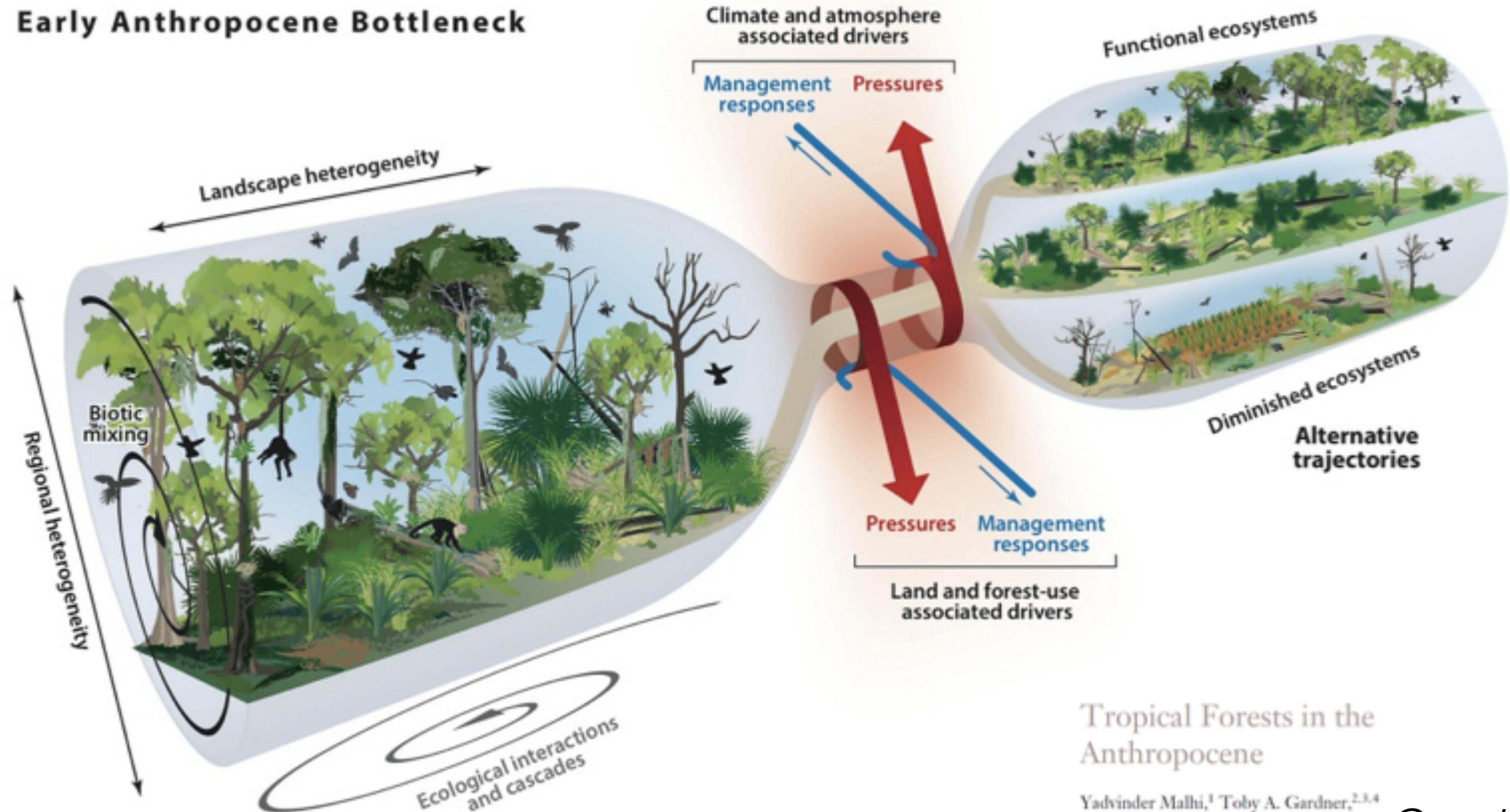
Discussions on:

1) **What data and knowledge are needed?** Best practices in gap analyses, identification and prioritizing of knowledge needs, including life cycle analyses and impact assessments;

What Data and Knowledge are Needed?

Focus: Addressing Anthropocene Risks (such as Marine Debris)

Early Anthropocene Bottleneck



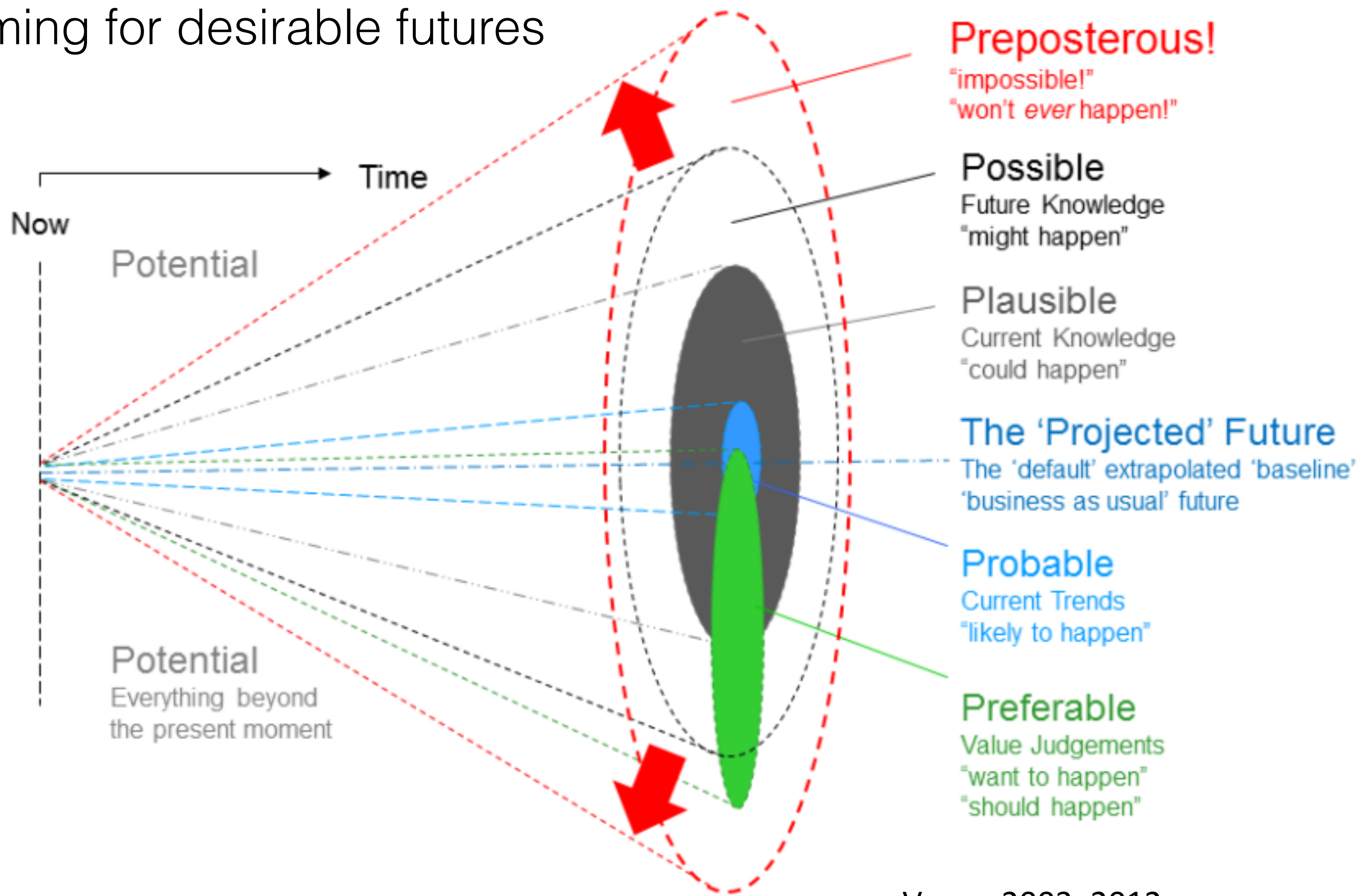
Tropical Forests in the Anthropocene

Yadvinder Malhi,¹ Toby A. Gardner,^{2,3,4}
Gregory R. Goldsmith,¹ Miles R. Silman,⁵
and Przemysław Zelazowski^{1,6}

Garcia, 2018

What Data and Knowledge are Needed?

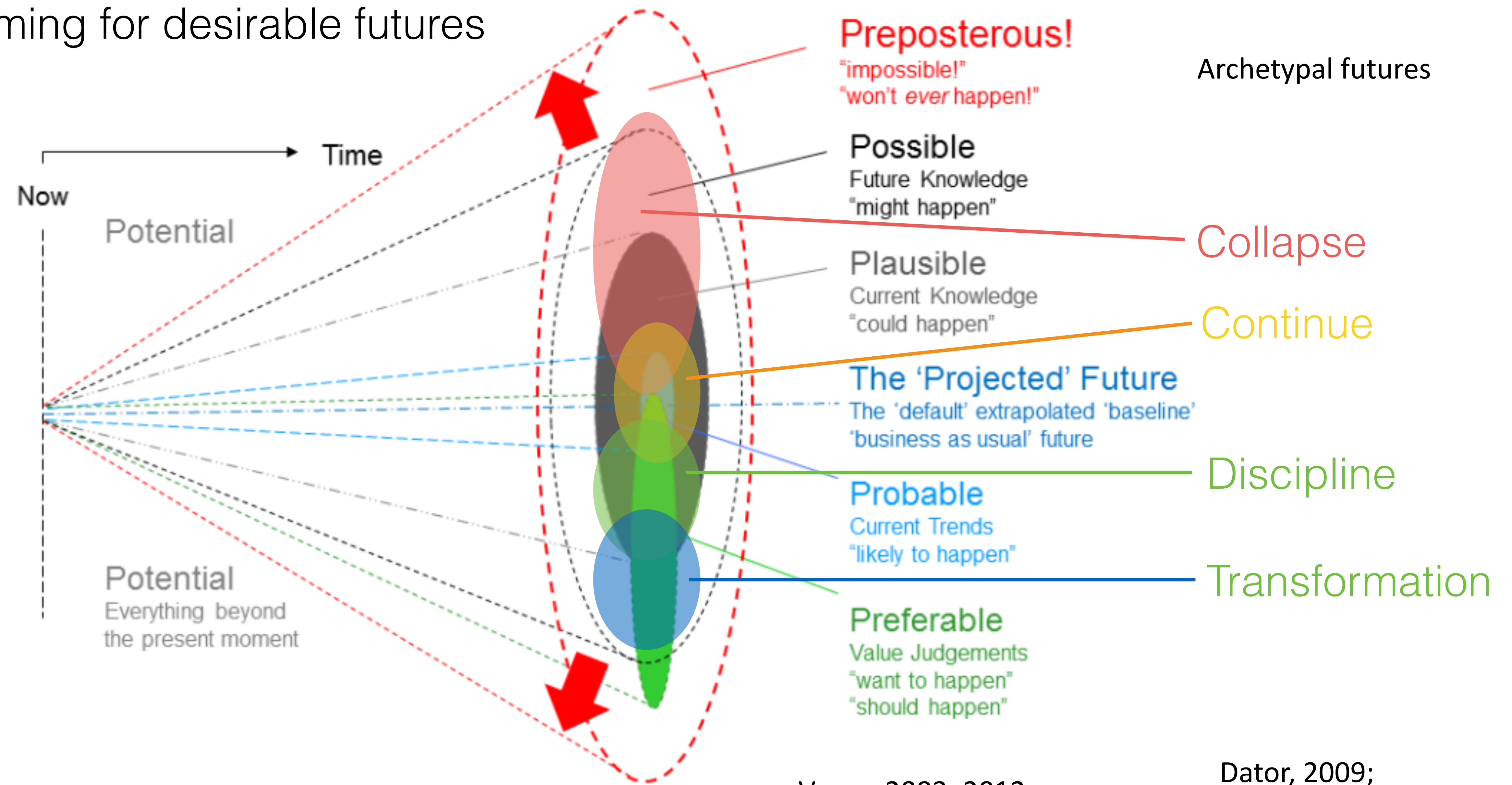
Aiming for desirable futures



Voros, 2003, 2012

What Data and Knowledge are Needed?

Aiming for desirable futures



Voros, 2003, 2012

Dator, 2009;
Bengtson, 2018

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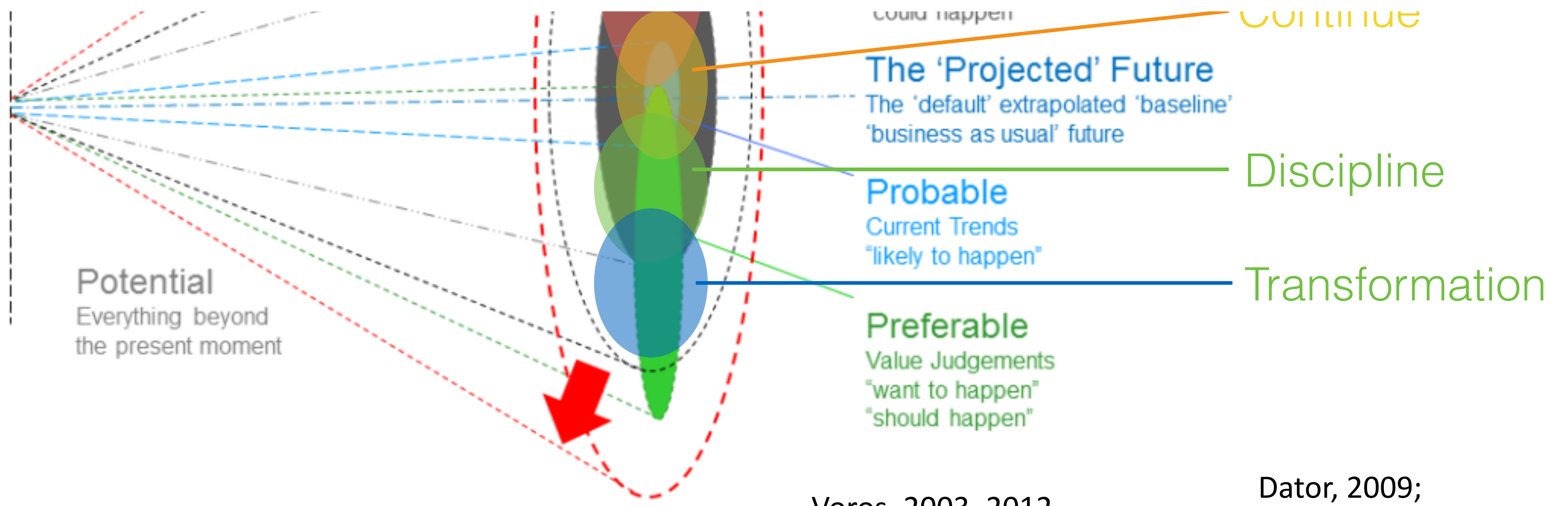
Aiming for desirable futures



Preposterous!
"impossible!"
"won't ever happen!"

Archetypal futures

What are our assumptions about knowledge needs that guide gap analyses and prioritization?



Voros, 2003, 2012

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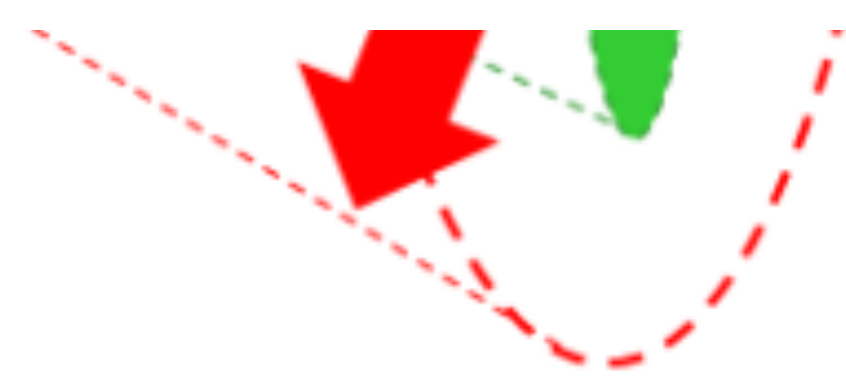
What are our assumptions about knowledge needs that guide gap analyses and prioritization?

In times of emerging Anthropocene Global Catastrophic Risks:

Can we continue to focusing on avoiding Type 1 Errors (no false alarms)?

or

Do we need to focus more on Type 2 Errors (not overlooking warning signs)?



"want to happen"
"should happen"

Voros, 2003, 2012

Dator, 2009;
Bengtson, 2018

What Data and Kr

A LIFETIME OF PLASTIC

The first plastics made from fossil fuels are just over a century old. They came into widespread use after World War II and are found today in everything from cars to medical devices to food packaging. Their useful lifetime varies. Once disposed of, they break down into smaller fragments that linger for centuries.

**LIFETIMES:
100 to 5000 years**

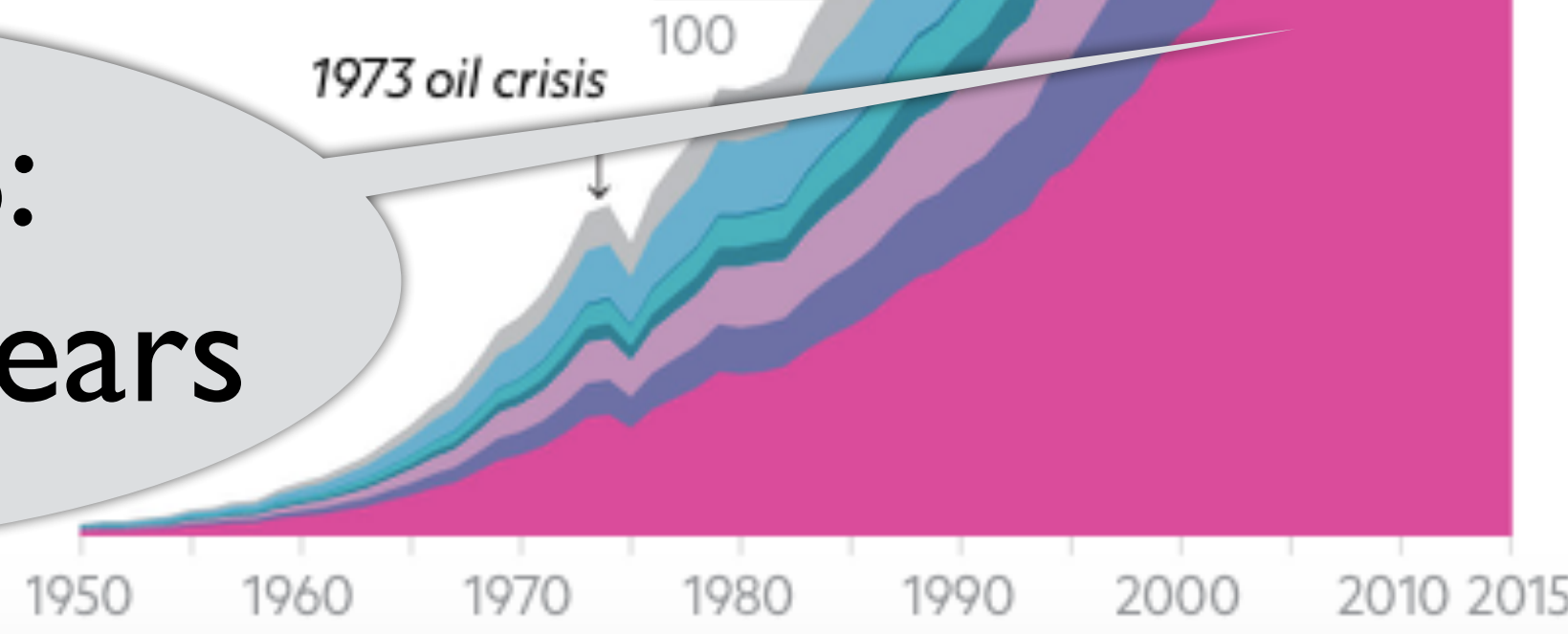
400 million tons (Mt)

grew, consumer products—and plastics. Half the world's plastics are made there, 29 percent in China.

Production contributes as much CO₂ emission as 40 million cars

Global plastic production by industry in millions of tons

Legacy of World War II
Shortages of natural materials during the war led to a search for synthetic alternatives—and to an exponential surge in plastic production that continues today.



Total
448 million tons produced in 2015

Other
52 million
includes health care and agriculture

5 years ◀ The average time plastics are used before they're discarded.

Building and construction
72 million
35 years

Transportation
30 million
13 years

Electrical
19 million
8 years

Textiles
65 million
5 years

Consumer products
46 million
3 years

Packaging
161 million
Less than six

The largest market for plastics today is for packaging materials. That trash now accounts for nearly half of all plastic waste generated globally; most of it never gets recycled or incinerated.

448 Mt in 2015

Average usetime:
5 years

Build.+Const.:	72 Mt, 35 yrs
Industrial mach.:	3 Mt, 20 yrs
Transportation:	30 Mt, 13 yrs
Electrical:	19 Mt, 8 yrs
Textiles:	65 Mt, 5 yrs
Consum. prod.:	46 Mt, 3 yrs
Packaging:	161 Mt, <0.5 yrs

161Mt < 6 months

What Data and Kr

2% annual increase in production:

2025: 550 Mt

2035: 670 Mt

2045: 817 Mt

Total production:

2015: 7 Bt

2045: 26 Bt

1% in the ocean: 260 Mt

In coastal built environment prone to

disasters:

1.7 Bt

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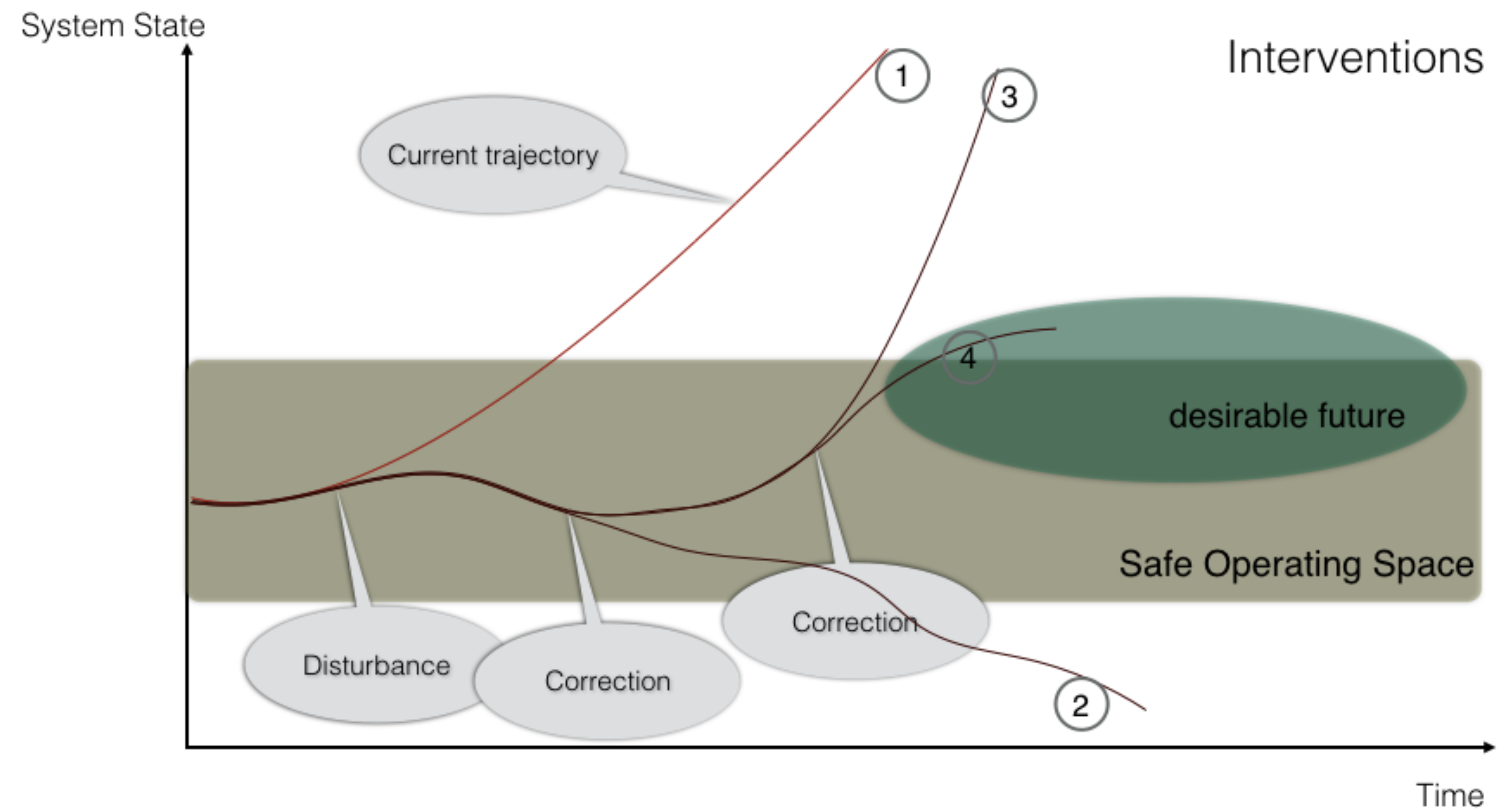
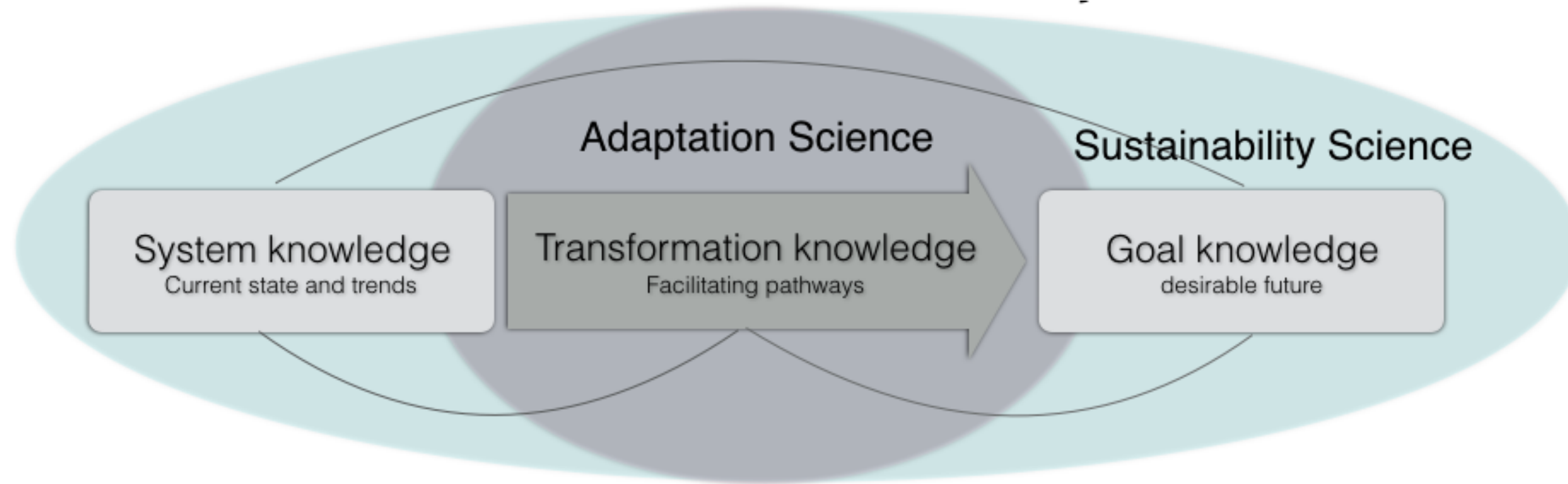
Plastics in the planetary physiology will
impact the 500 Billion to
1 trillions of people to come during the
next 5,000 years.

Does the plastics crisis violate the
rights of those not yet born?

Does science have an ethical
obligation to create the knowledge
society needs to assess and address
the risk?

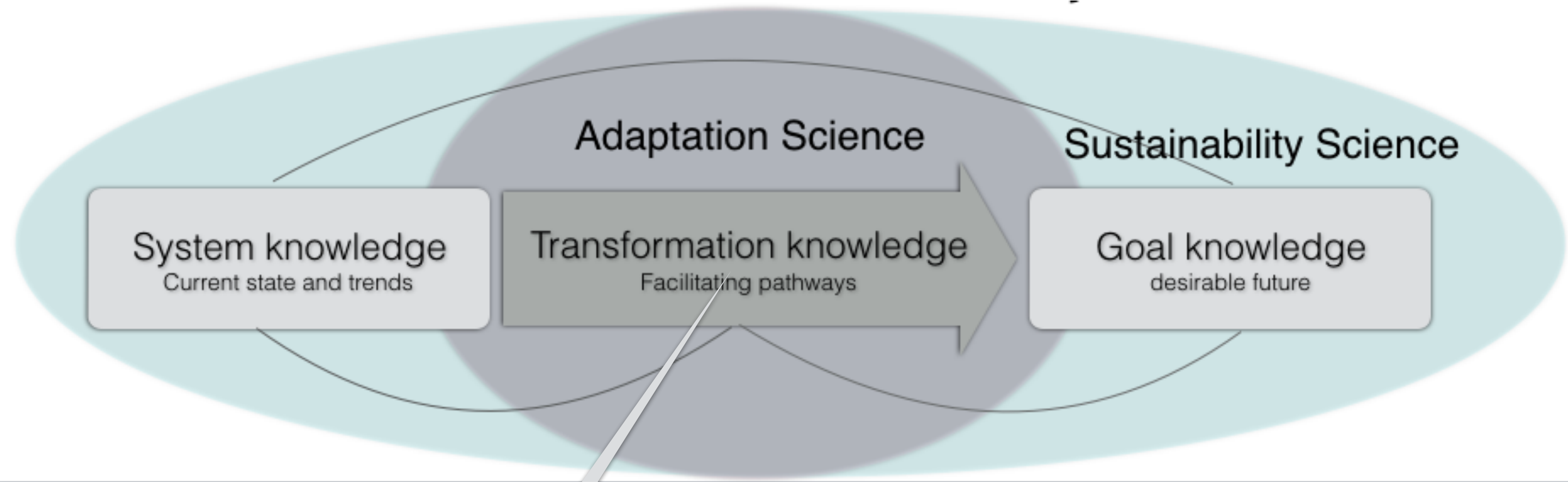
What Data and Knowledge are Needed?

Efforts to reach a desirable future

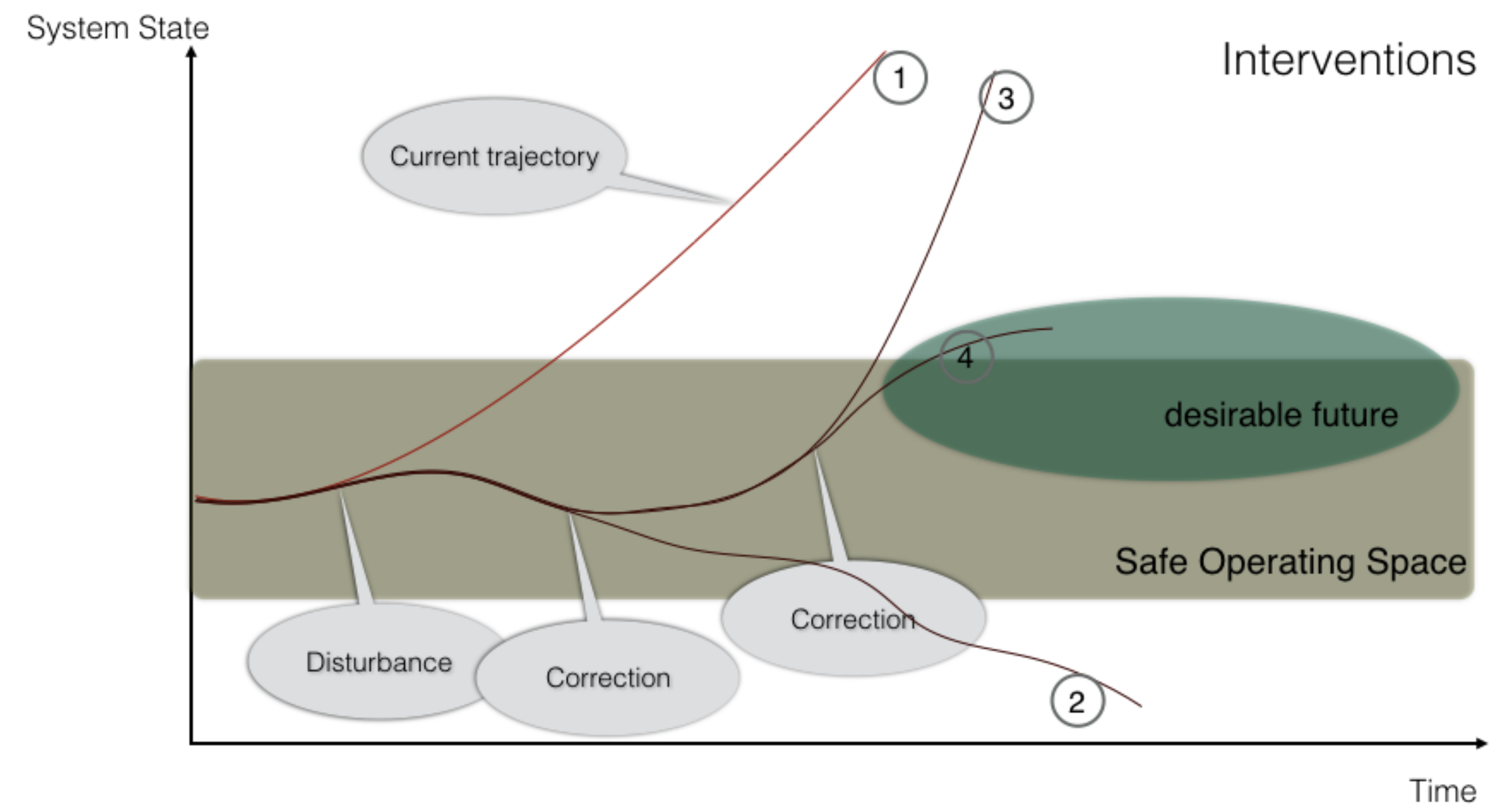


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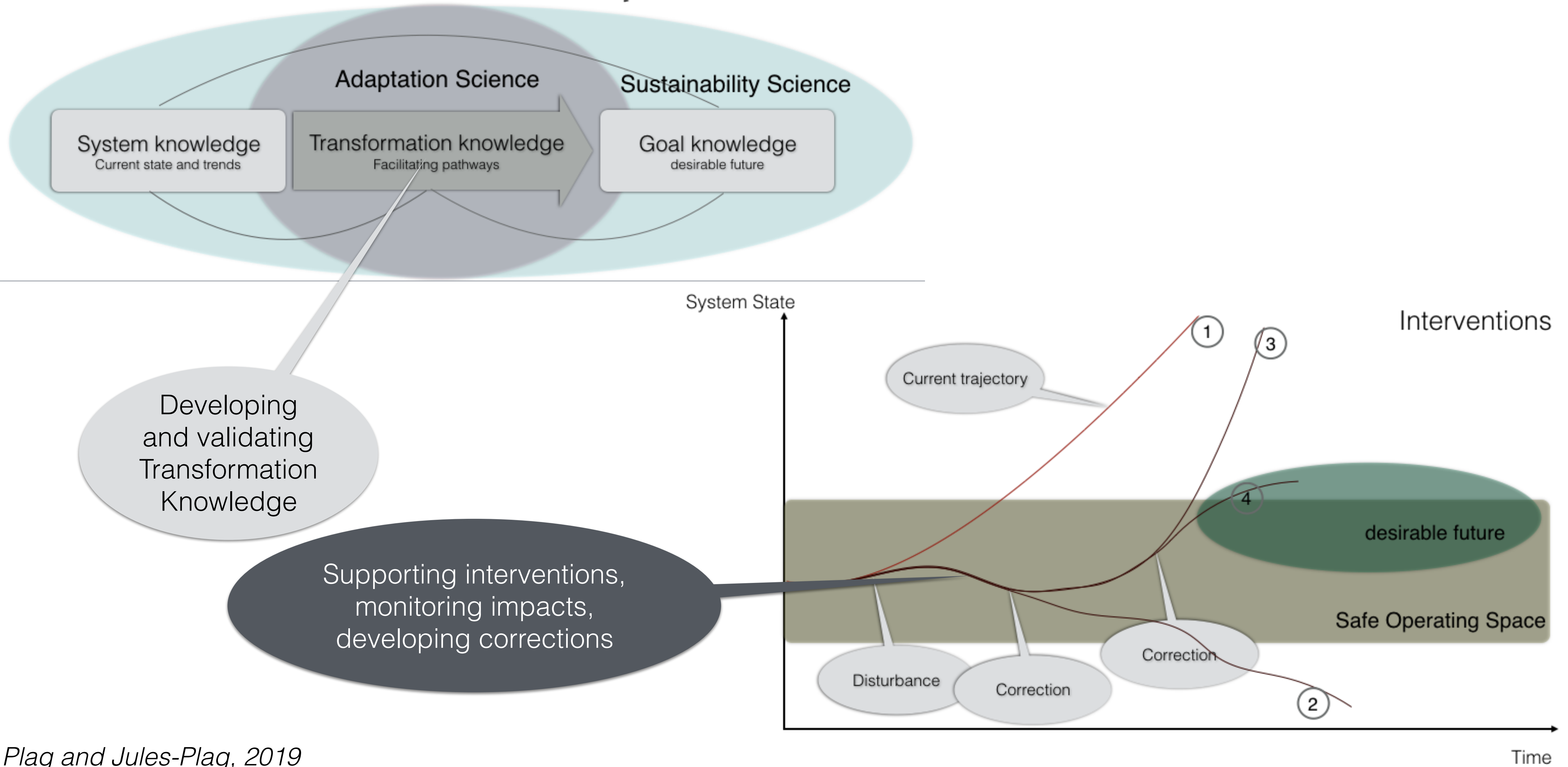


Developing and validating Transformation Knowledge



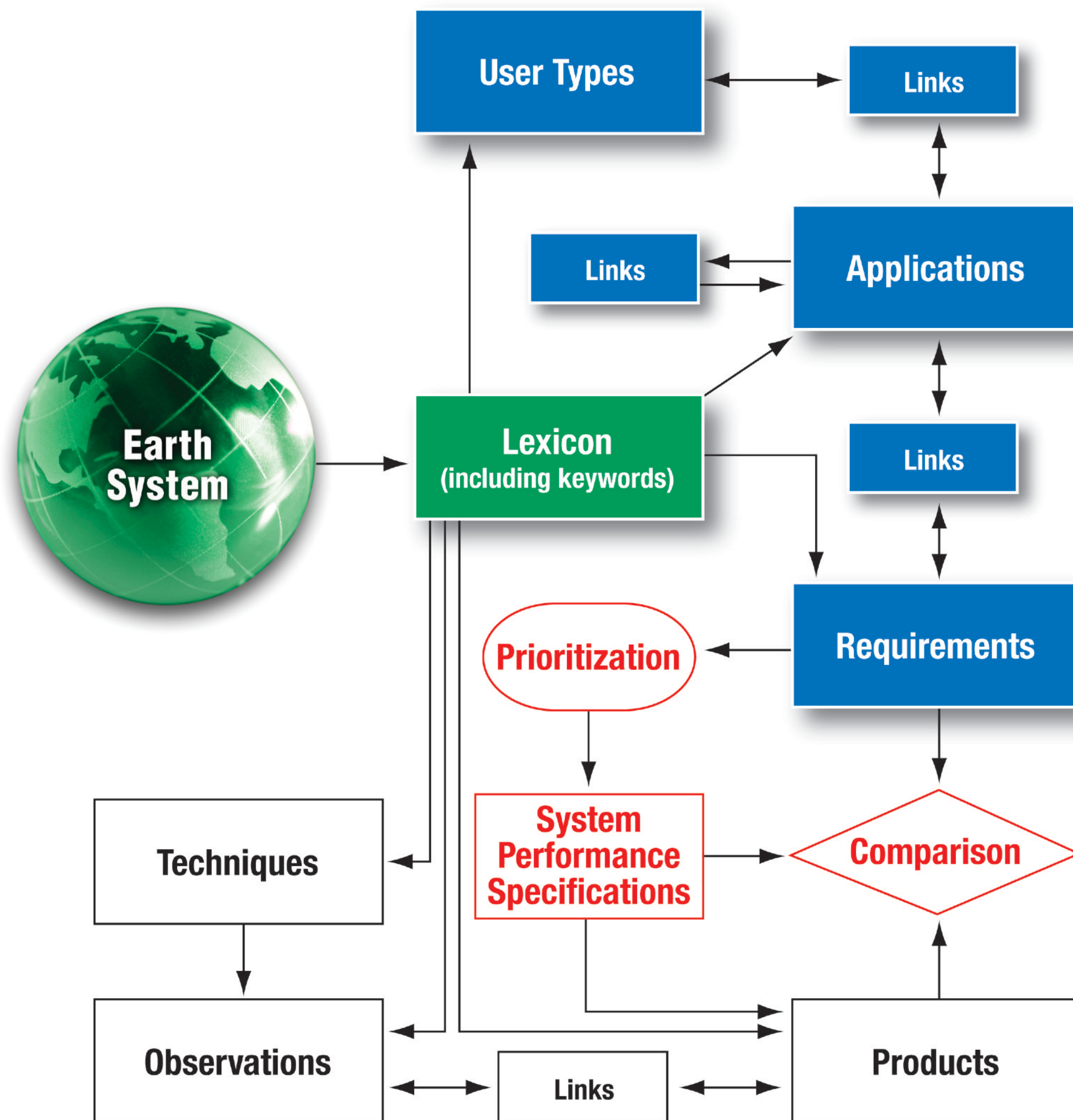
What Data and Knowledge are Needed?

Efforts to reach a desirable future



What Data and Knowledge are Needed?

Methodologies for Gap Analysis

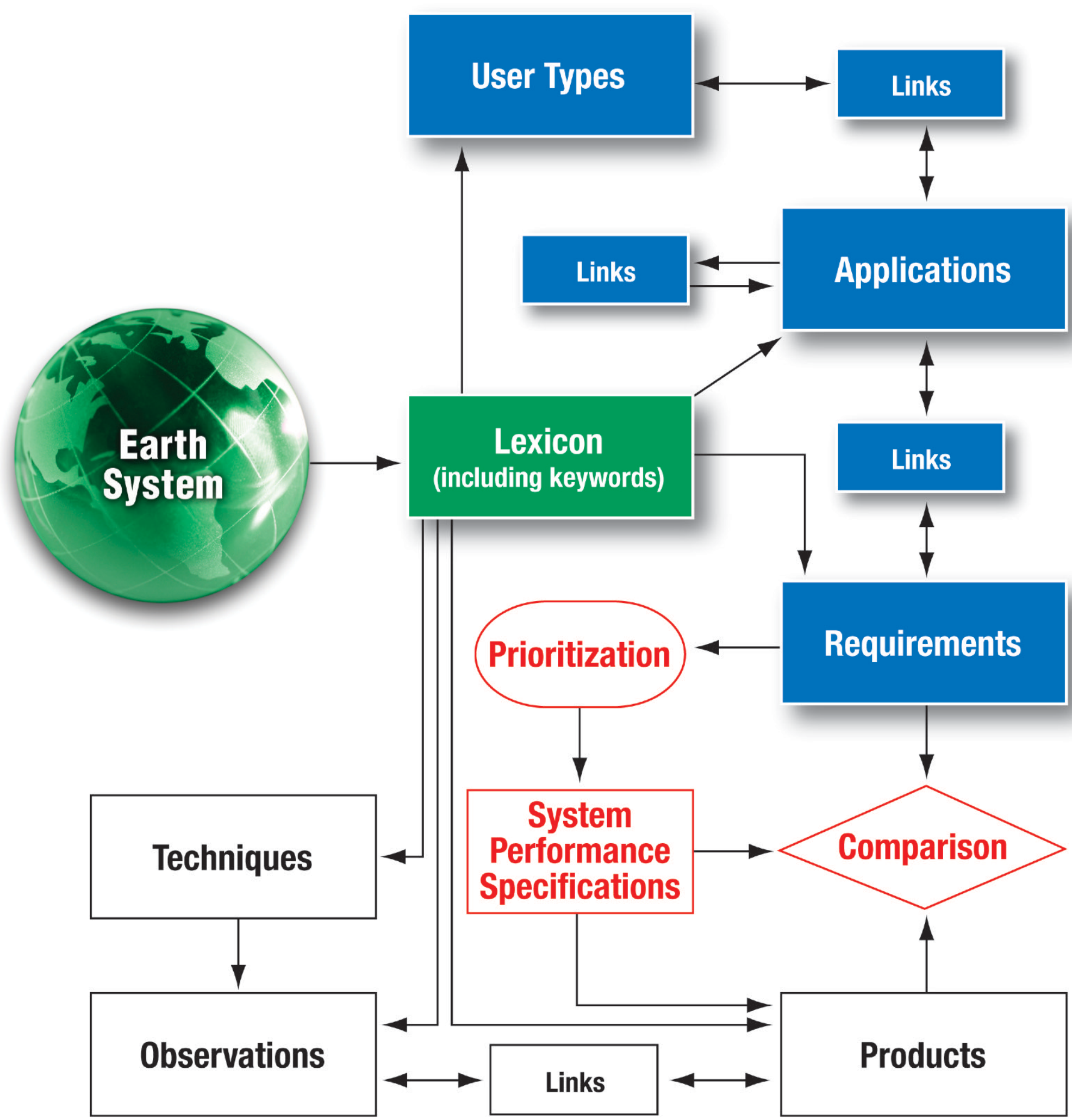


For example:
GEOSS User requirement Registry

Plag et al., 2018

What Data and Knowledge are Needed?

Methodologies for Gap Analysis



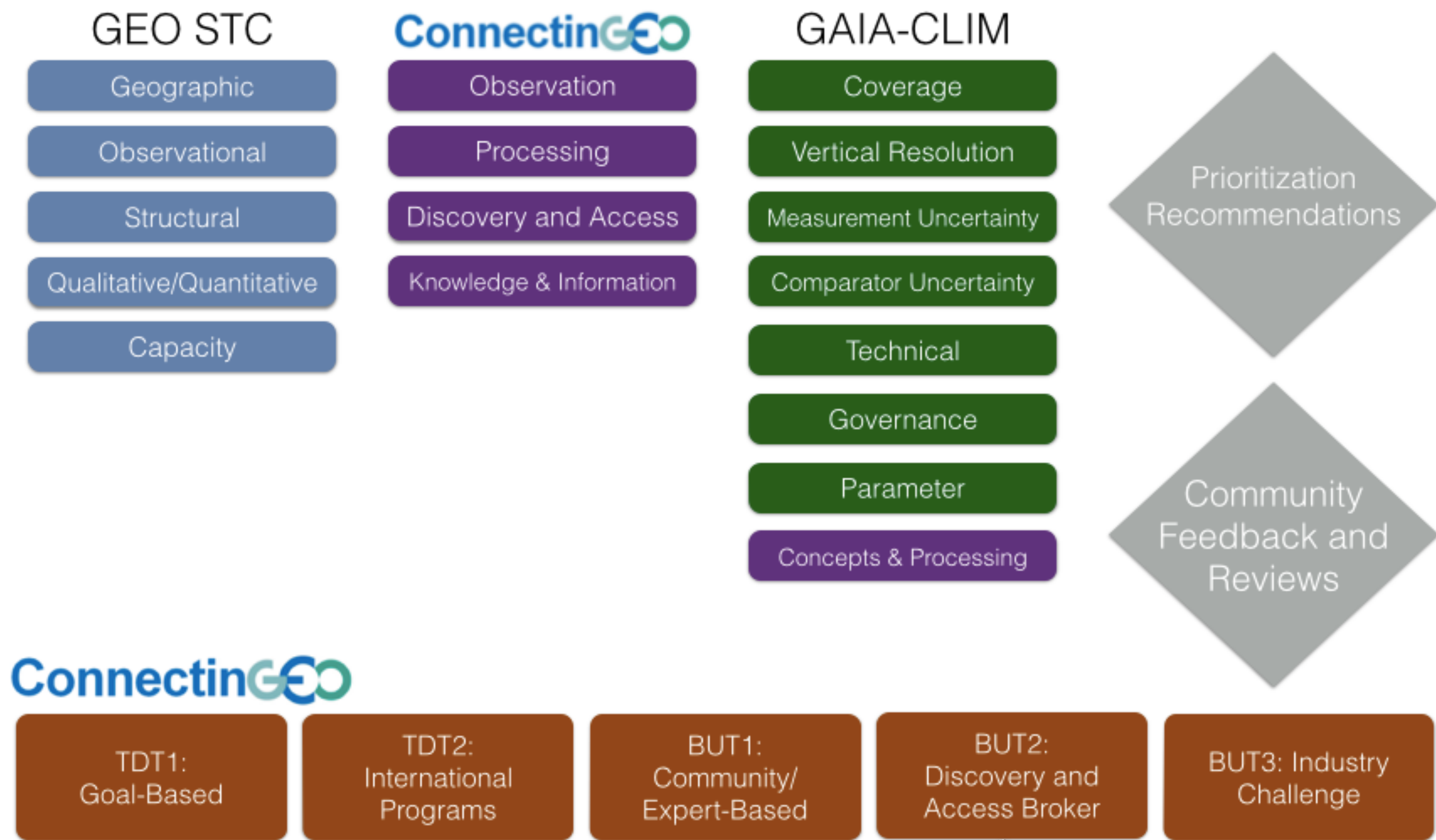
1. *Top-Down thread 1:* Identification of a collection of observation requirements and specifications from generic goals for sustainability of the global civilization as expressed in the GEOSS Strategic Targets, the SDGs, and the adherence to the planetary boundaries.

For example:
GEOSS User requirement Registry

Plag et al., 2018

What Data and Knowledge are Needed?

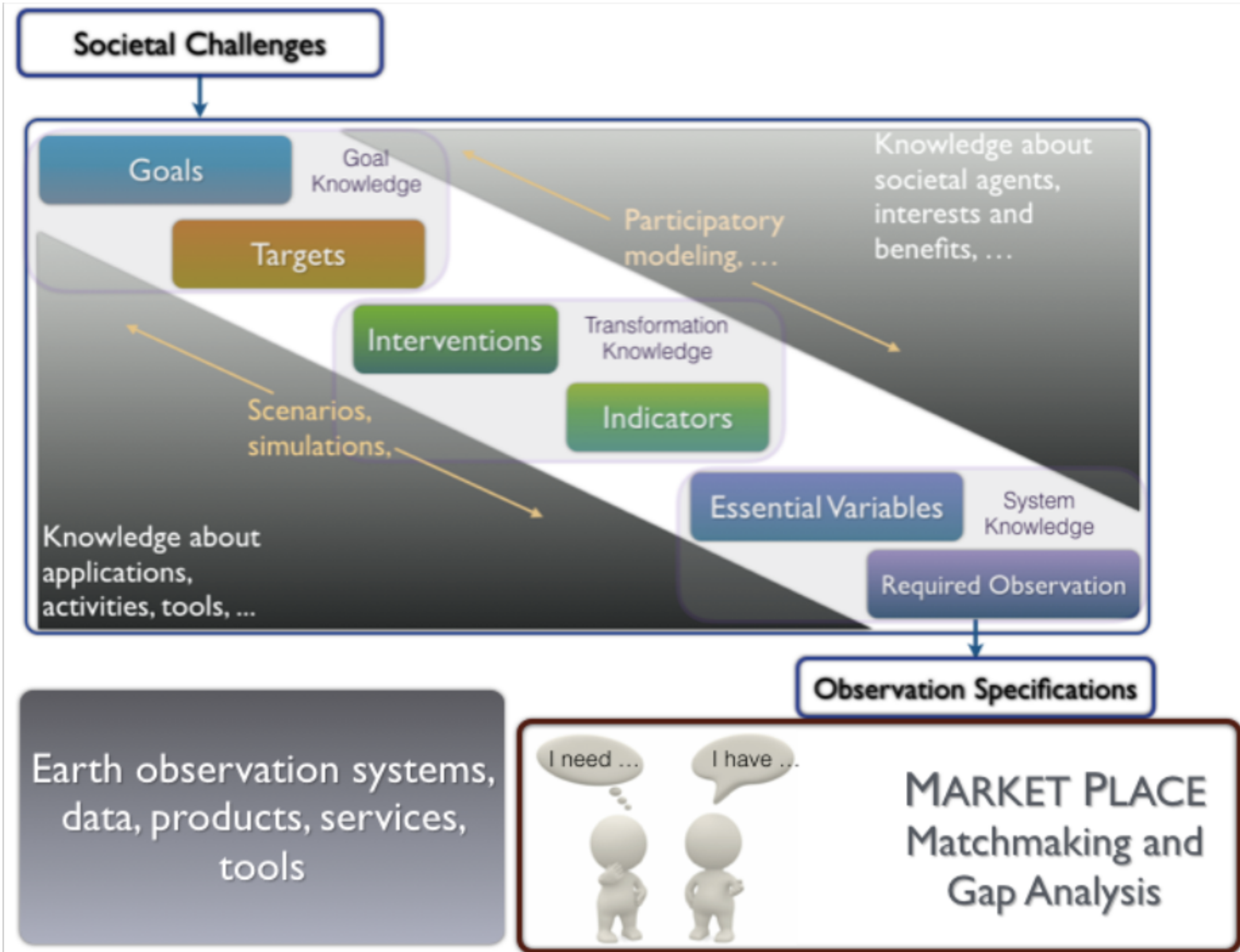
Spectrum of Methodologies for Gap Analysis



Plag, 2016

What Data and Knowledge are Needed?

Goal-Based Gap Analysis



SMART gap formulation

- **Specific** Specific proposed action to remedy
- **Measurable** Outcome for success of the remedy
- **Achievable** Indicative cost estimate
- **Relevance** User impact if not remedied
- **Time bounded** Action on short-, mid- or long-term

- **Risks** Risk register for non-resolution
(+impact, +probability)



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 640276.

www.gaia-clim.eu

Prioritization of Gaps

Utilizing Graph Data Linking Requirements and Applications

For SEE-IN KB entries:

$$\hat{r}^{\text{glob}}(A) = \sum_{i=1}^{L_A} w_i \cdot \hat{r}_i^{\text{glob}}, \quad (6)$$

L_A : number of entries E_i that are targets in the links with entry A being the source;

w_i : weight of the link between A and E_i ;

r_i^{glob} : global relevance of E_i .

For external datasets or products:

$$r^{\text{glob}}(B) = \sum_{i=1}^{K_B} \hat{r}_i^{\text{glob}}, \quad (7)$$

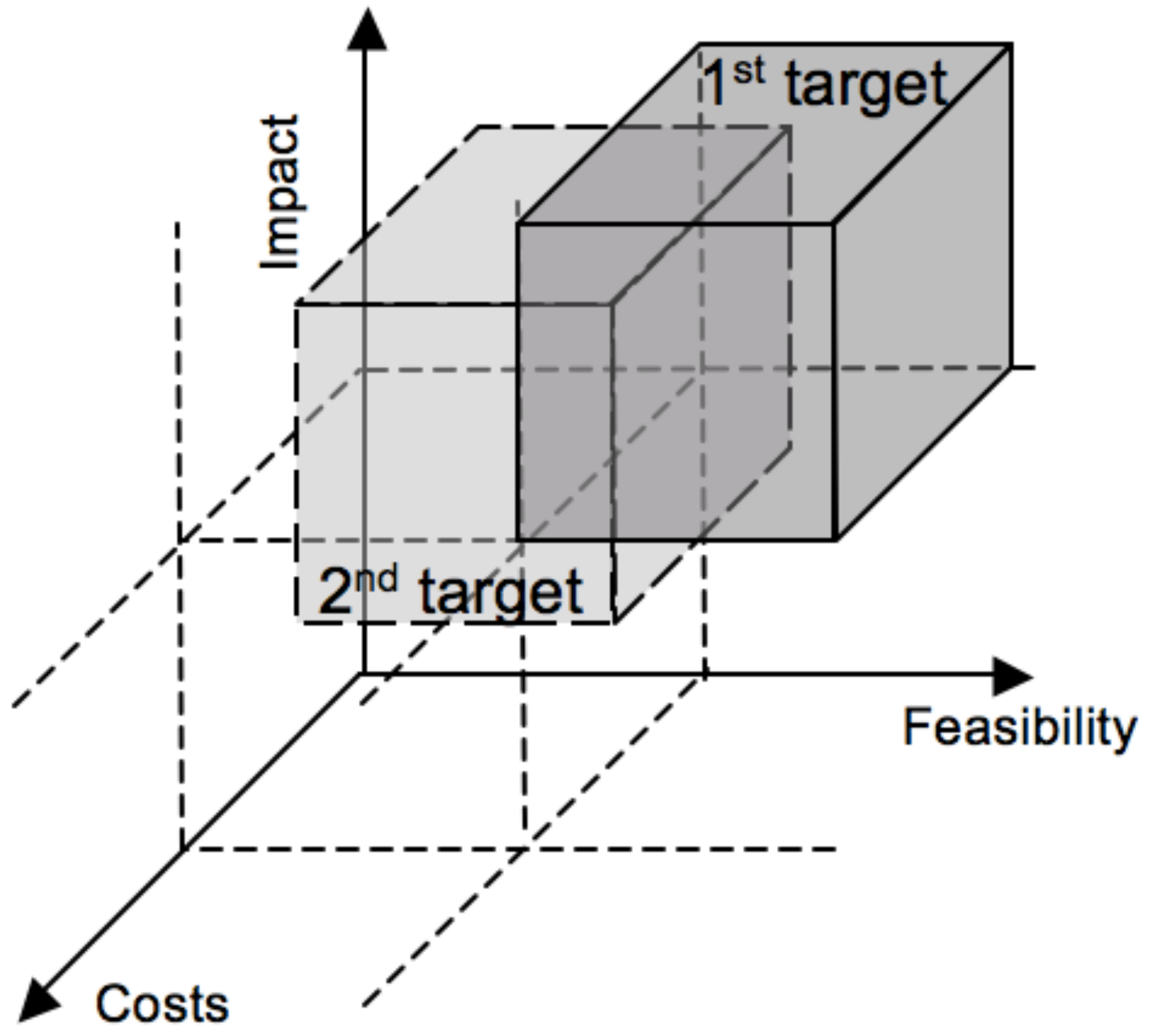
K_B : number of requirement entries R_i that are met by dataset or product B ;

r_i^{glob} : global relevance of requirements R_i .

What Data and Knowledge are Needed?

Prioritization of Gaps

Feasibility and impact versus cost and time needed



$$p = \frac{f * i}{c * t}$$

p : priority

f : feasibility

i : impact

c : cost

t : time needed

Discussions on:

1) **What data and knowledge are needed?** Best practices in gap analyses, identification and prioritizing of knowledge needs, including life cycle analyses and impact assessments;

What approaches to knowledge gap analyses and knowledge need prioritization?

What (best) Practices are available?

How can we decide on what is BEST?

Discussions on:

(2) **Co-creation of research agendas and knowledge**: best practices in engaging with stakeholders, including participatory modeling;

Goal: Create Knowledge Used by Societal Agents

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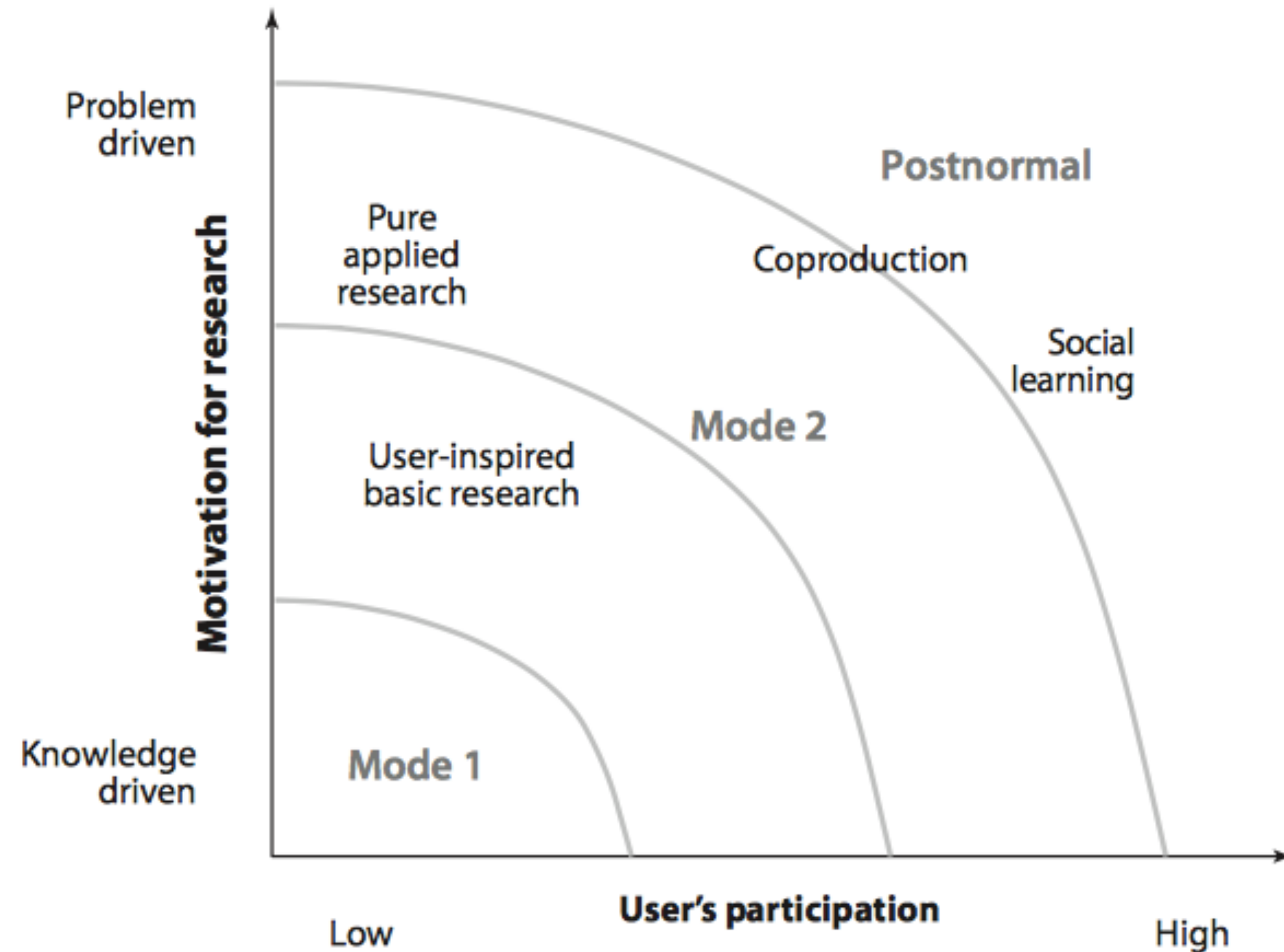
Believe (and use) requires trust in knowledge creation

Co-Creation of Research Agendas and Knowledge

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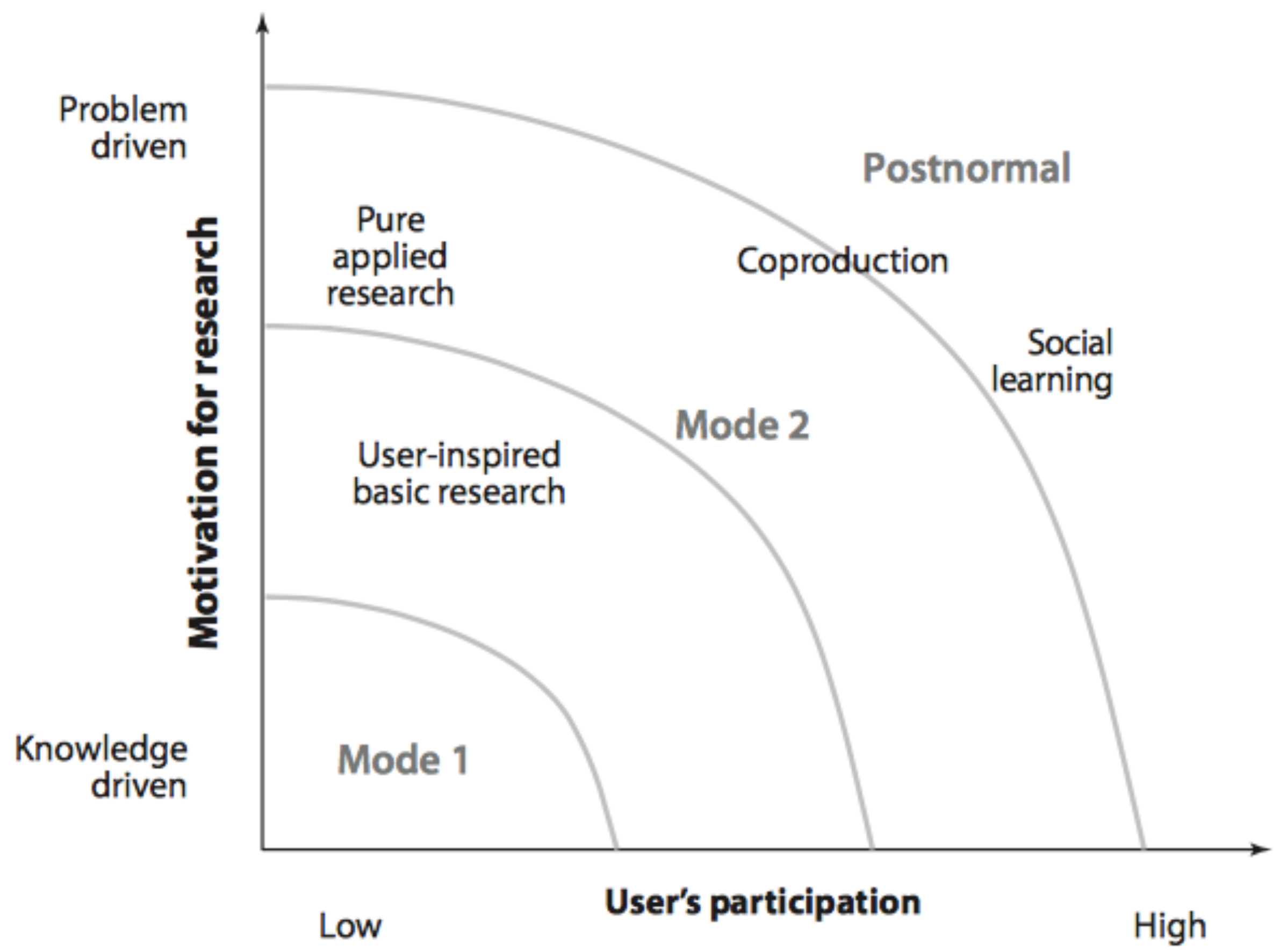


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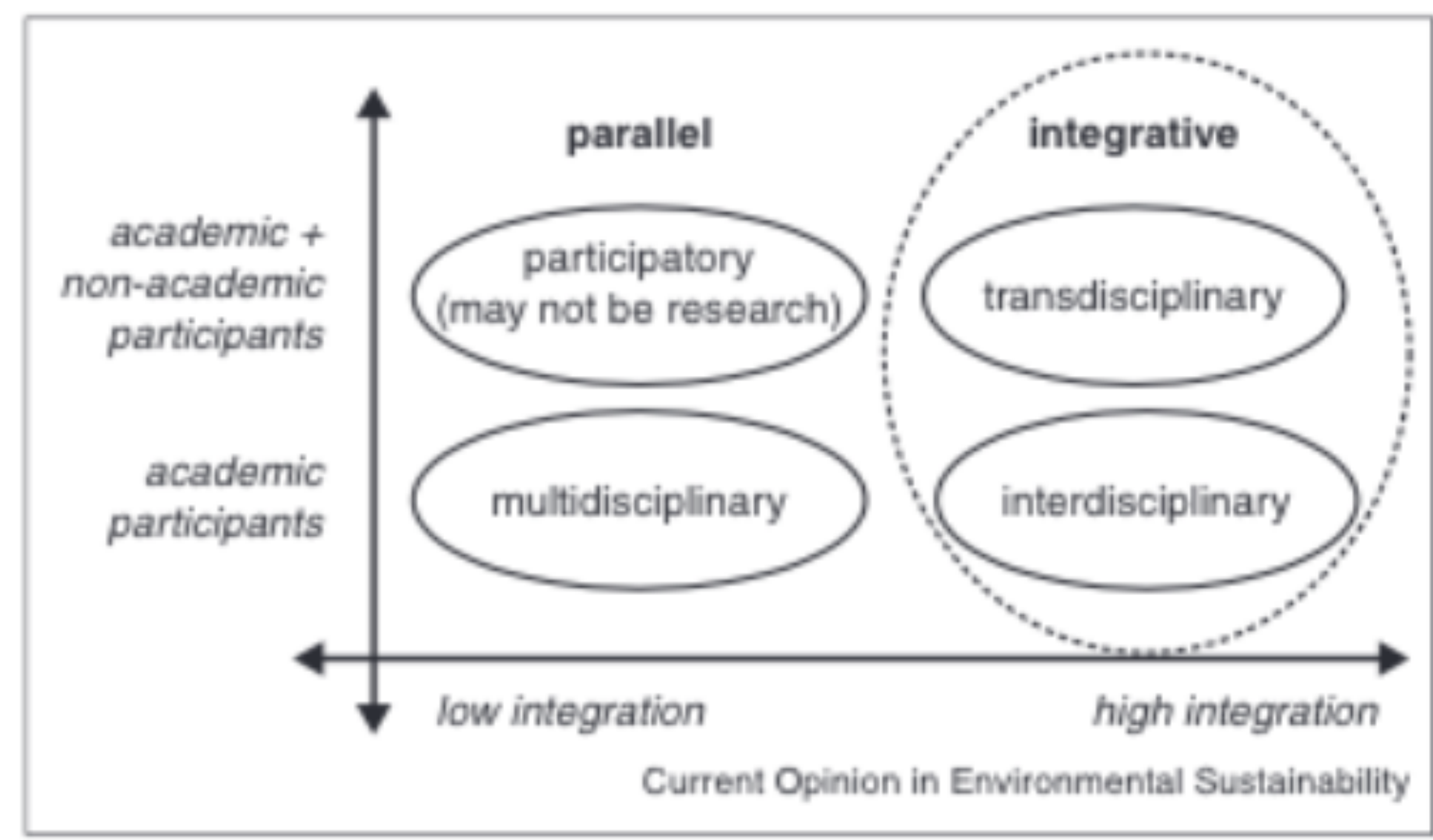
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Kirchhoff et al., 2013



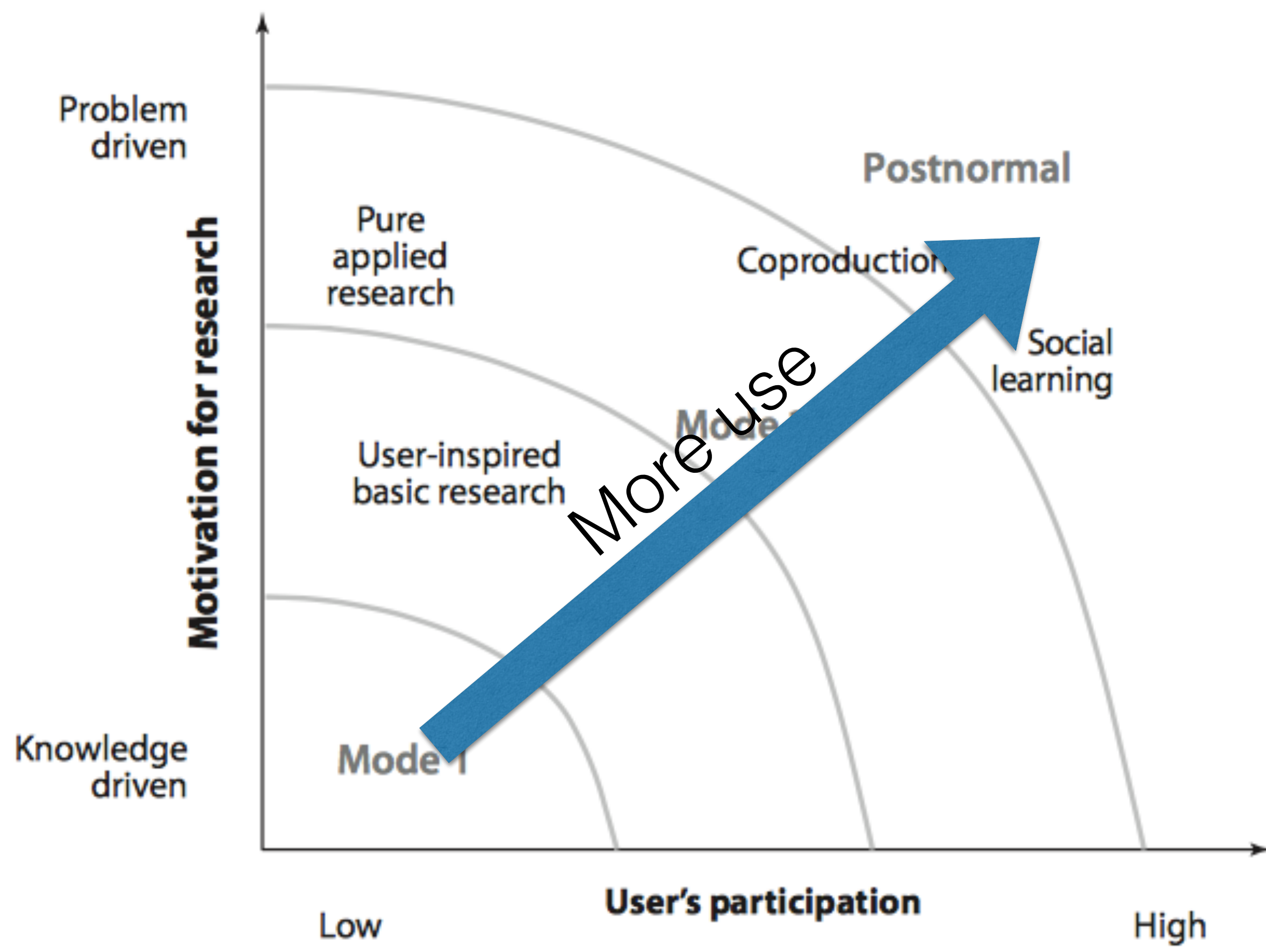
Mausser et al., 2013

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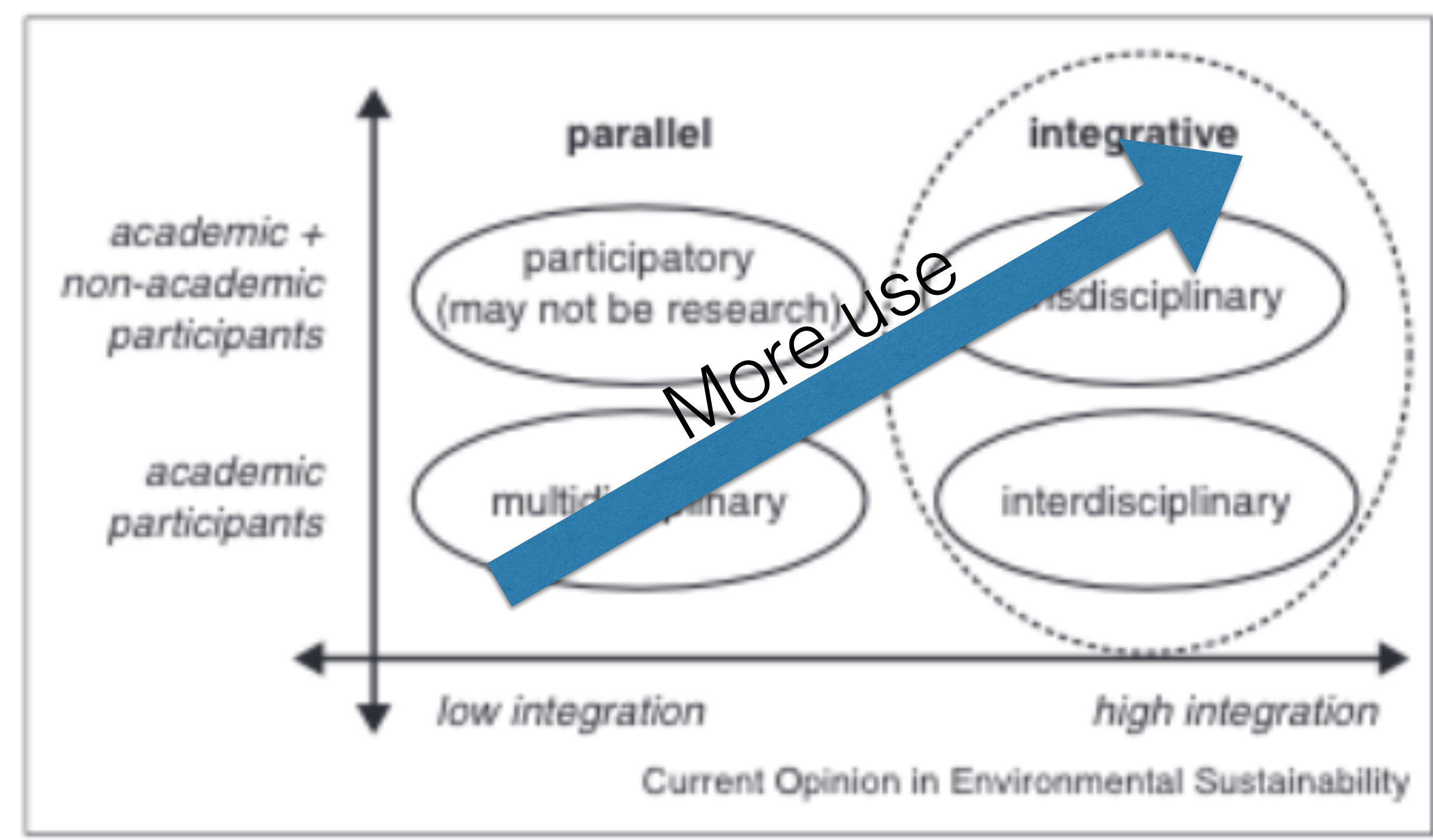
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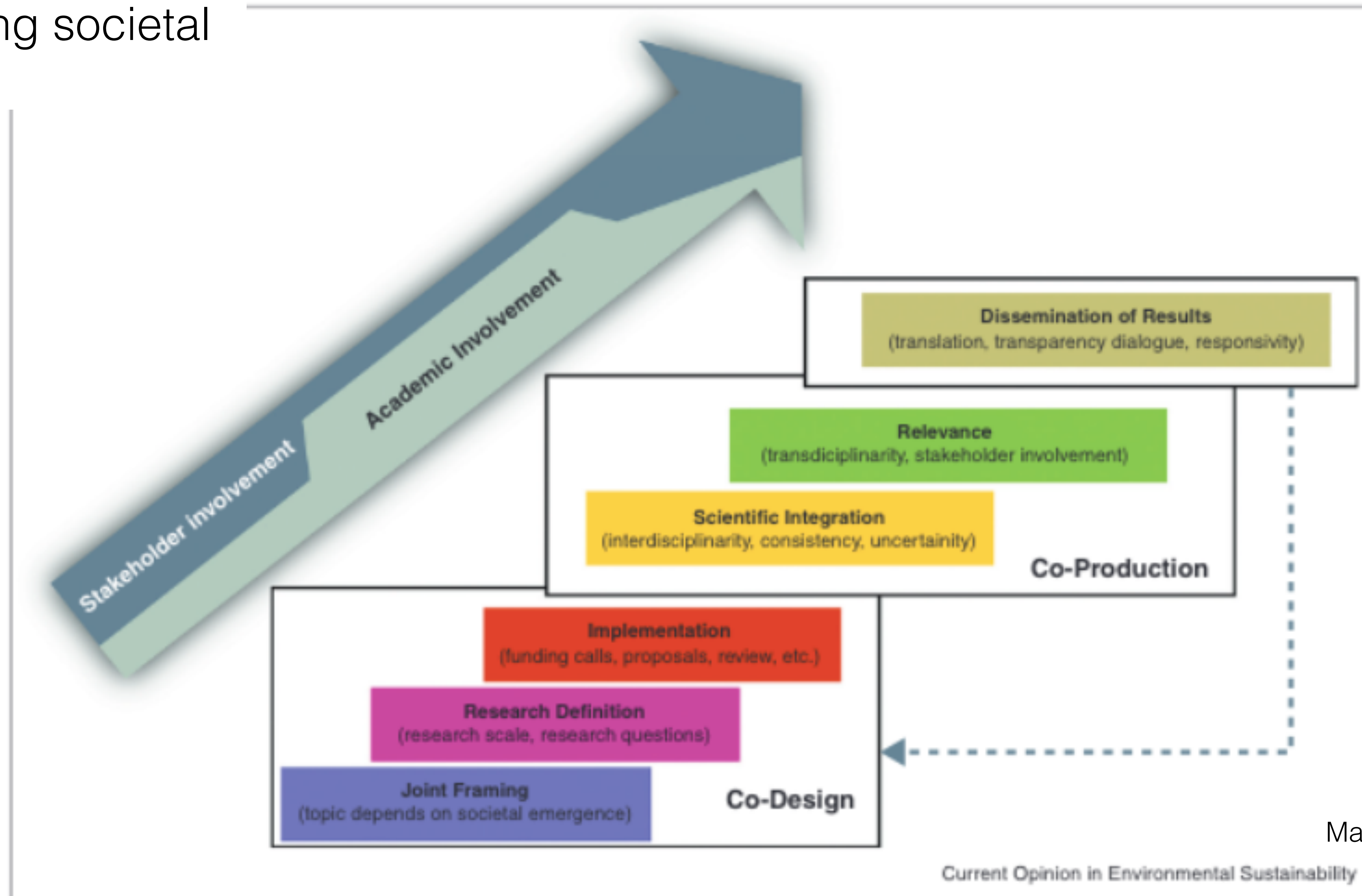
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Co-Creation of Research Agendas and Knowledge

Engaging societal agents

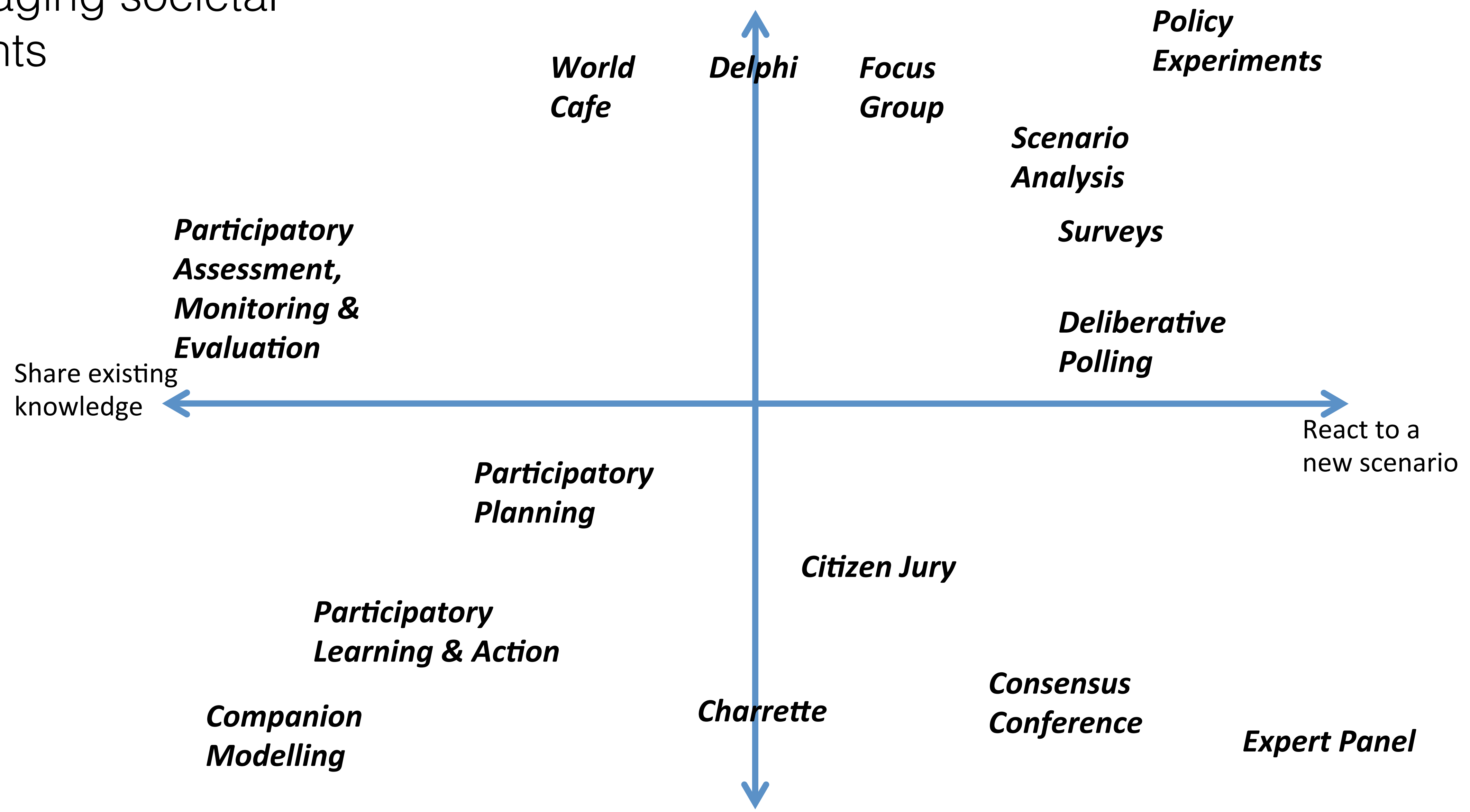


Mausser et al., 2013

Co-Creation of Research Agendas and Knowledge

Engaging societal agents

Maintain a diversity of points of views



Participatory Assessment, Monitoring & Evaluation

World Cafe

Delphi

Focus Group

Scenario Analysis

Surveys

Deliberative Polling

Policy Experiments

Share existing knowledge

Participatory Planning

Participatory Learning & Action

Companion Modelling

Charrette

Citizen Jury

Consensus Conference

Expert Panel

React to a new scenario

Converge towards a shared representation

Adapted from Van Asselt (2001)

Discussions on:

(2) **Co-creation of research agendas and knowledge**: best practices in engaging with stakeholders, including participatory modeling;

What approaches to co-creation of research agenda and co-creation of knowledge?

What (best) Practices are available?

How can we decide on what is BEST?

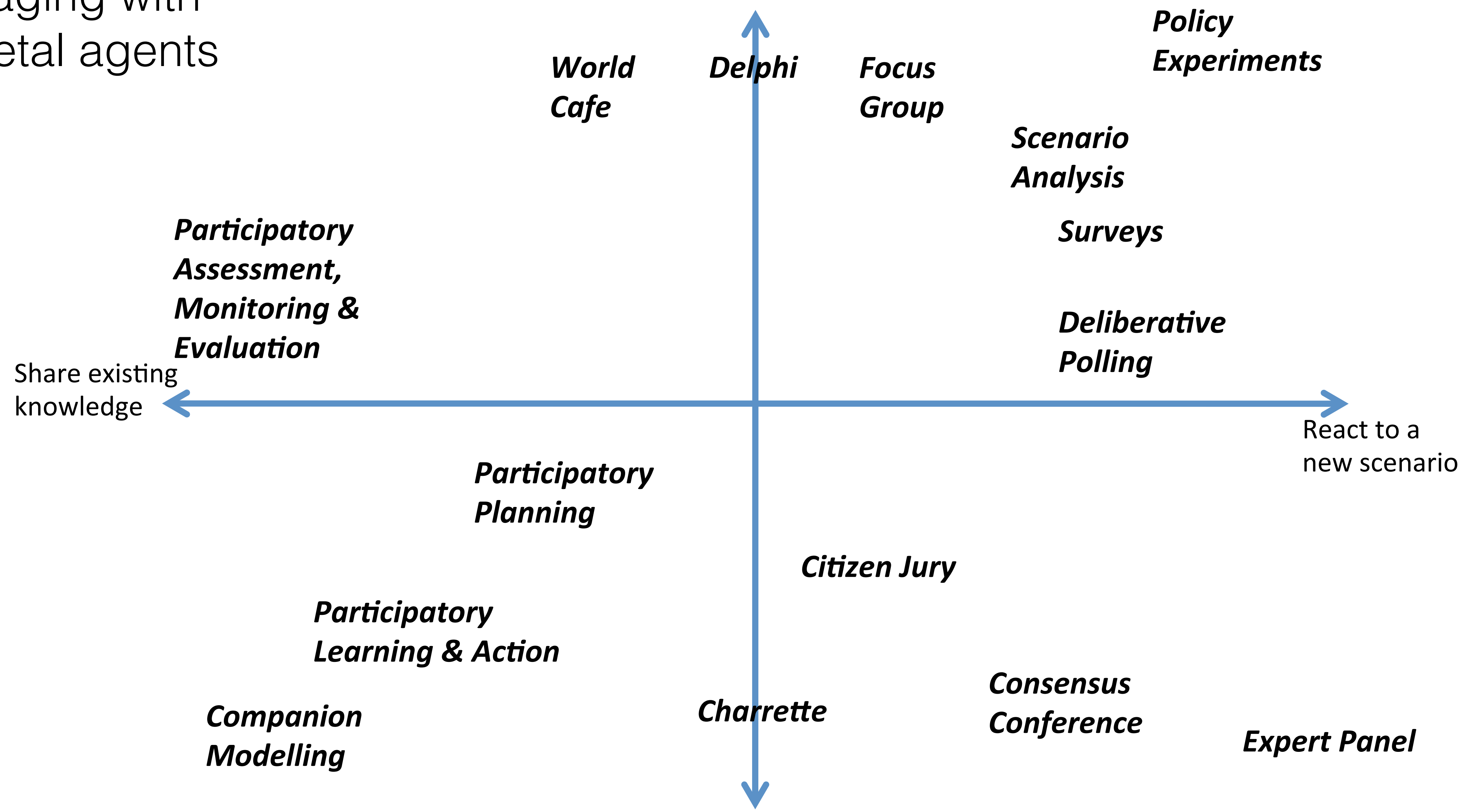
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Co-Usage of Knowledge

Engaging with societal agents

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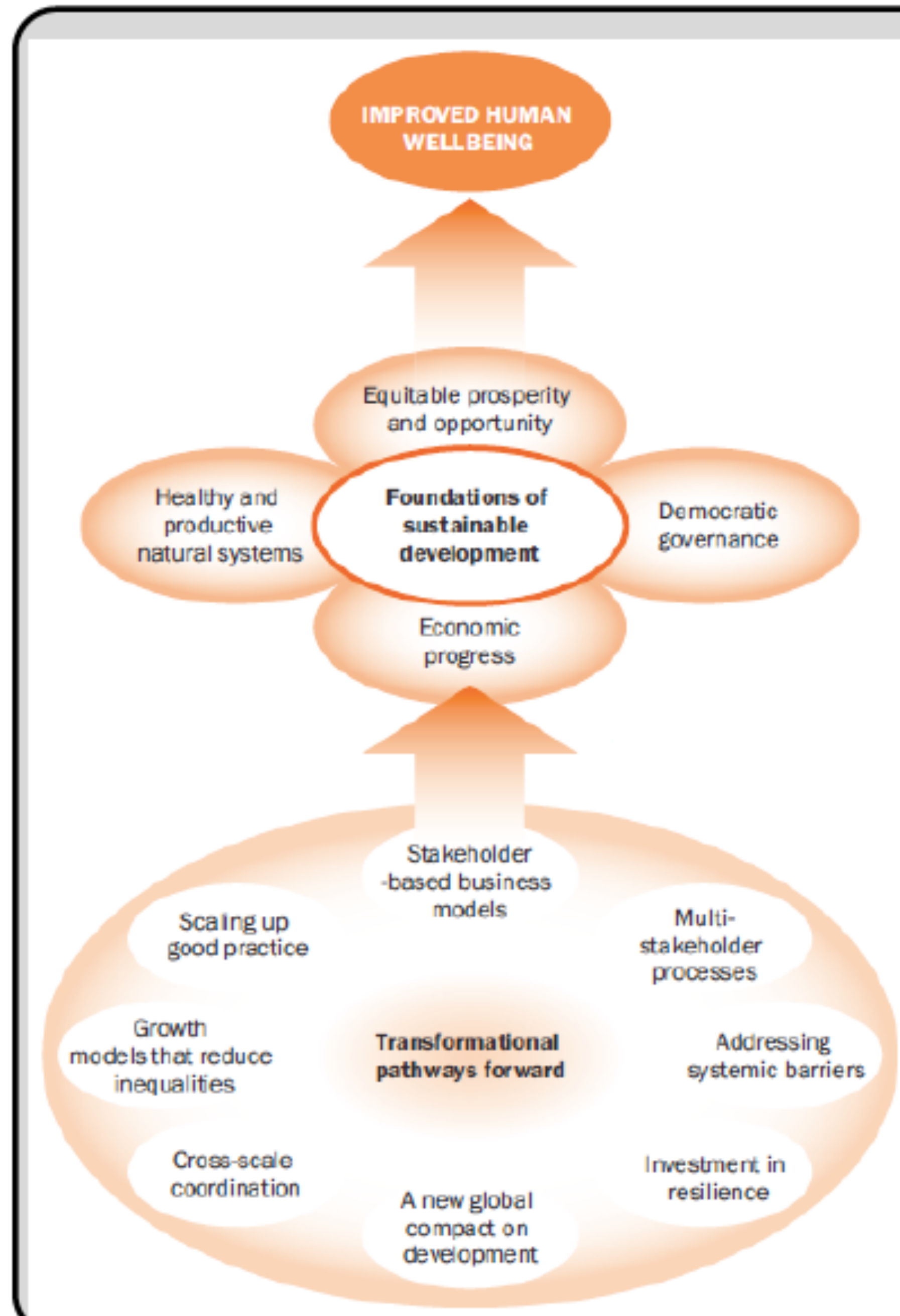


Converge towards a shared representation

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Co-Usage of Knowledge

Using Knowledge for pathways to sustainable development

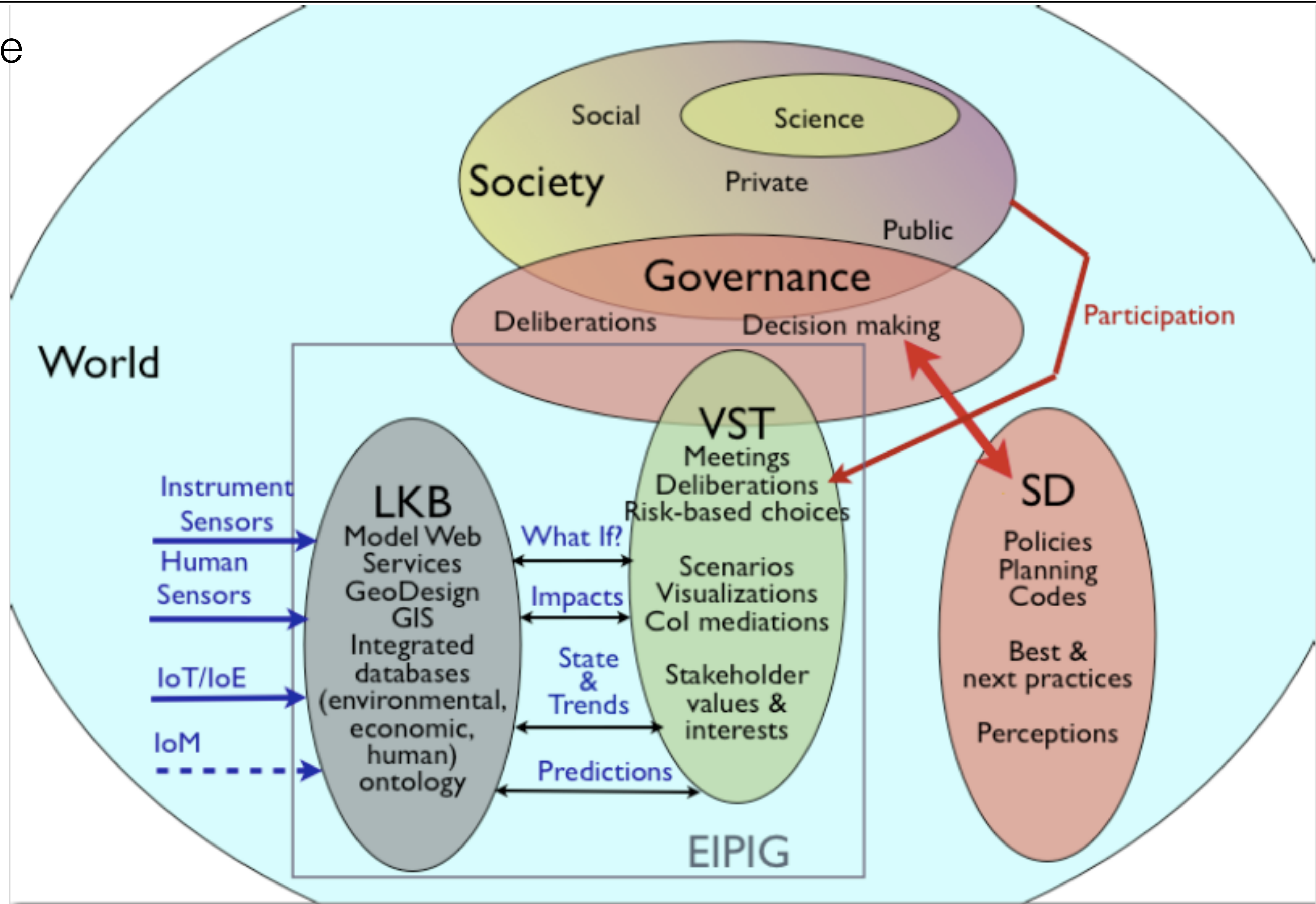


From		To
Development assistance	➔	A universal global compact
Top-down decision making	➔	Multi-stakeholder decision-making processes
Growth models that increase inequality and risk	➔	Growth models that decrease inequality and risk
Shareholder value business models	➔	Stakeholder value business models
Mooting "easy" development targets	➔	Tackling systemic barriers to progress
Damage control	➔	Investing in resilience
Concepts and testing	➔	Scaled up interventions
Multiple discrete actions	➔	Cross-scale coordination

Fig. 1: Sustainable development requires transformational pathways forward to a sound foundation of sustainable development. Most of the transformations depend on access to comprehensive knowledge bases and participation of stakeholders in the creation of knowledge and the processes that lead to decisions. Multi-stakeholder processes are crucial for democratic governance. From IRF2015 (2013).

Co-Usage of Knowledge

Integrating science into society



Transforming society



Virtual Community Center

VCC Concept

WELCOME

The Virtual Community Center is a pilot project that explores new ways for the public to improve literacy and to learn about activities of governmental and non-governmental organizations and to interact with these organizations. Here you can:

- **Exhibition:** Take a walk through the exhibition with information on the participating organizations and their activities. You may also take virtual tours organized by them.
- **Class Room:** participate in courses that give you detailed knowledge and skills related to the activities of the participating organizations or your community.
- **Meet Experts:** participate in scheduled virtual meetings with experts in different topics and get to communicate with these experts.
- **EnviGym:** exercise your knowlegde about your environment and the environmental science background and acquire new knowledge and skill in individual exercises.
- **Citizen Science:** become a citizen sceintists and participate in citizen science projects.
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Transforming society



EXHIBITION

CLASSROOM

MEET EXPERTS

ENVIGYM

CITIZEN SCIENCE

CHAT ROOMS

A space to meet experts, talk to them, learn from them, ...

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Discussions on:

What ways do we (experts/researchers) have to support the societal use of knowledge?

What (best) Practices are available?

How can we decide on what is BEST?

(3) **Co-usage of knowledge**: best practices for the delivery of knowledge to decision and policy makers and for the engagement of scientists and researchers in policy making, including ethical considerations.

