

LECTURE

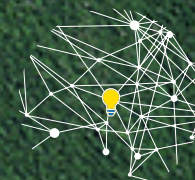
# SYSTEMIC FORESIGHT

*for Planetary Health and  
Human Wellbeing*

*by Jairo da Costa, PhD  
University of Twente*

UNIVERSITY  
OF TWENTE.

IxD



SYSTEMS  
DESIGN  
APPROACH

*Image: Rondonia, Brazil, Deforestation Satellite Imagery  
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Growing Systems Innovation | **2025**



INTRODUCTION

# ABOUT THE LECTURER

**INDUSTRIAL DESIGNER, SYSTEMS THINKER  
& SOCIAL SCIENTIST**

PhD in Sustainable Design Engineering (TU Delft)

**ASSISTANT PROFESSOR**

The Impact of Systems Thinking in Design

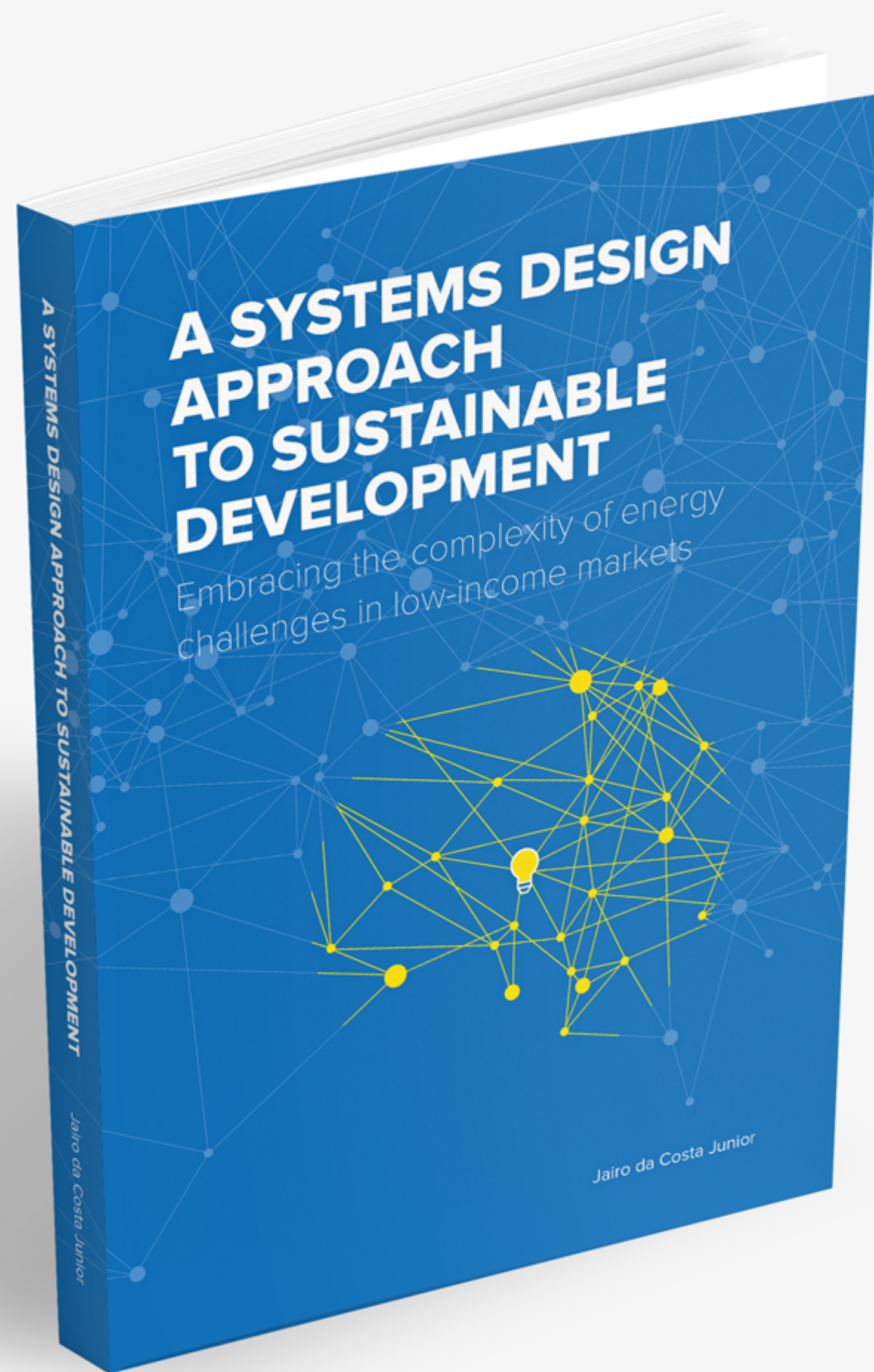
University of Twente

**ADJUNCT SENIOR LECTURER, CO-FOUNDER & ADVISOR**

University of Western Australia, UWA School of Design

Bio-based Materials Design Lab (Co-founder)





DOCTORAL RESEARCH

# SYSTEMS DESIGN APPROACH

The growing complexity of societal-technical and socio-ecological problems in low-income markets calls for a paradigm shift in understanding and addressing these issues.

This research suggests that embracing complexity rather than simplifying problems represents a critical shift from traditional design methods to a systems design approach for sustainable development.



**DOWNLOAD THE BOOK**

<https://systemsdesignapproach.com>



## Design Science

### A framework for a systems design approach to complex societal problems

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DS, <http://orcid.org/0000-0002-6678-9281>

#### Abstract

Societal problems concern the complexity of technical, organisational, social, and political issues. The enormous negative impacts of these problems and the inability of problem solvers to deal with high levels of complexity cannot be overcome without a paradigm shift in how we understand and engage with such issues. Two domains have been helpful in bringing about such a shift: Systems Thinking and Design. Although these domains express mutual interest in social-technical systems and complex problem solving, in the literature there are few attempts of bringing the compatibility between them to the attention of designers. This paper aims to contribute to this endeavour by uncovering the role of integrating systems thinking for design, and by providing an overview of the emerging field of systems-oriented design approaches. An extensive literature review outlines significant aspects underlying systems thinking to support its use and further development in design. This paper provides a conceptual framework structured in five clusters: mindset, methodology set, knowledge set, skill set and tool set. The framework is meant to assist designers in integrating systems thinking into design and thereby enable them to better handle complex societal problems.

**Key words:** systems design approach, complex societal problem, systems thinking, design research, sustainable development

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<https://doi.org/10.1017/dsj.2018.16> Published online by Cambridge University Press

#### 1. Introduction

Complex societal problems that underlie challenges such as sustainability call for solutions that are entangled in a manifold of social and technological processes. The processes involved in these problem situations profoundly influence each other in a network of institutions, organisations, phenomena, and stakeholders (DeTombe 2015a). In addition, the complexity of societal problems may be dependent on an observer's knowledge and capacity to act (Murthy 2000). To handle societal problems more effectively, problem solvers from different disciplinary domains have rethought how to employ scientific methods for studying and responding to complexity (Murthy 2000; Espinosa, Harnden & Walker 2008; Stjepandić, Wognum & Verhagen 2015). Despite these efforts, the

1/32

## FURTHER READING

# SYSTEMIC DESIGN FRAMEWORK

Societal problems are complex and require a paradigm shift in our understanding and approach.

This paper explores the integration of systems thinking into design, presenting a conceptual framework that supports designers and engineers in tackling complex issues through five key clusters: mindset, methodology set, knowledge set, skill set, and tool set.



## DOWNLOAD THE ARTICLE

<https://doi.org/10.1017/dsj.2018.16>



INTRODUCTION

# INTERACTION DESIGN LAB

*"We like to design stuff that  
improves people's lives."*

A diverse group of creative teachers and researchers come together in the Interaction Design Lab (IxD). We are committed to understanding and improving networks and ecosystems of people and technology.

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OF TWENTE.

IxD



SYSTEMS  
DESIGN  
APPROACH

# UNIVERSITY OF TWENTE.





<https://youtu.be/8V4CrKsLsIQ>



## INTRODUCTION

# SYSTEMS DESIGN APPROACH

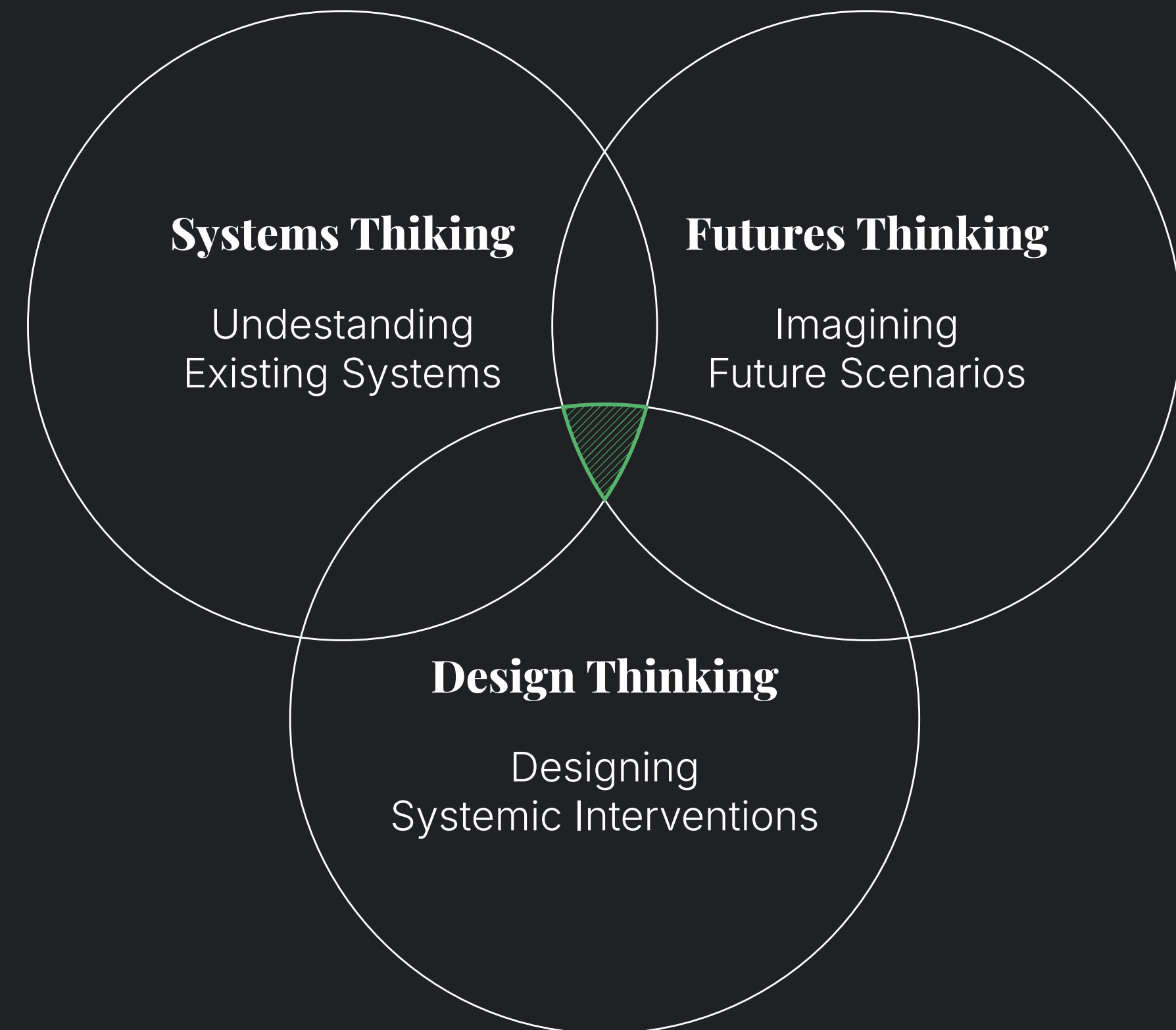
The Systems Design Approach (SDA) theme at the IxD Lab explores new ways of being, knowing, and designing. We develop methods, tools and practical knowledge to improve our understanding of complex societal problems, drive system change, and design systemic interventions.

We focus on three emerging topics:

**Planetary Health**

**Sustainability Transitions**

**Systemic Behaviour Change**



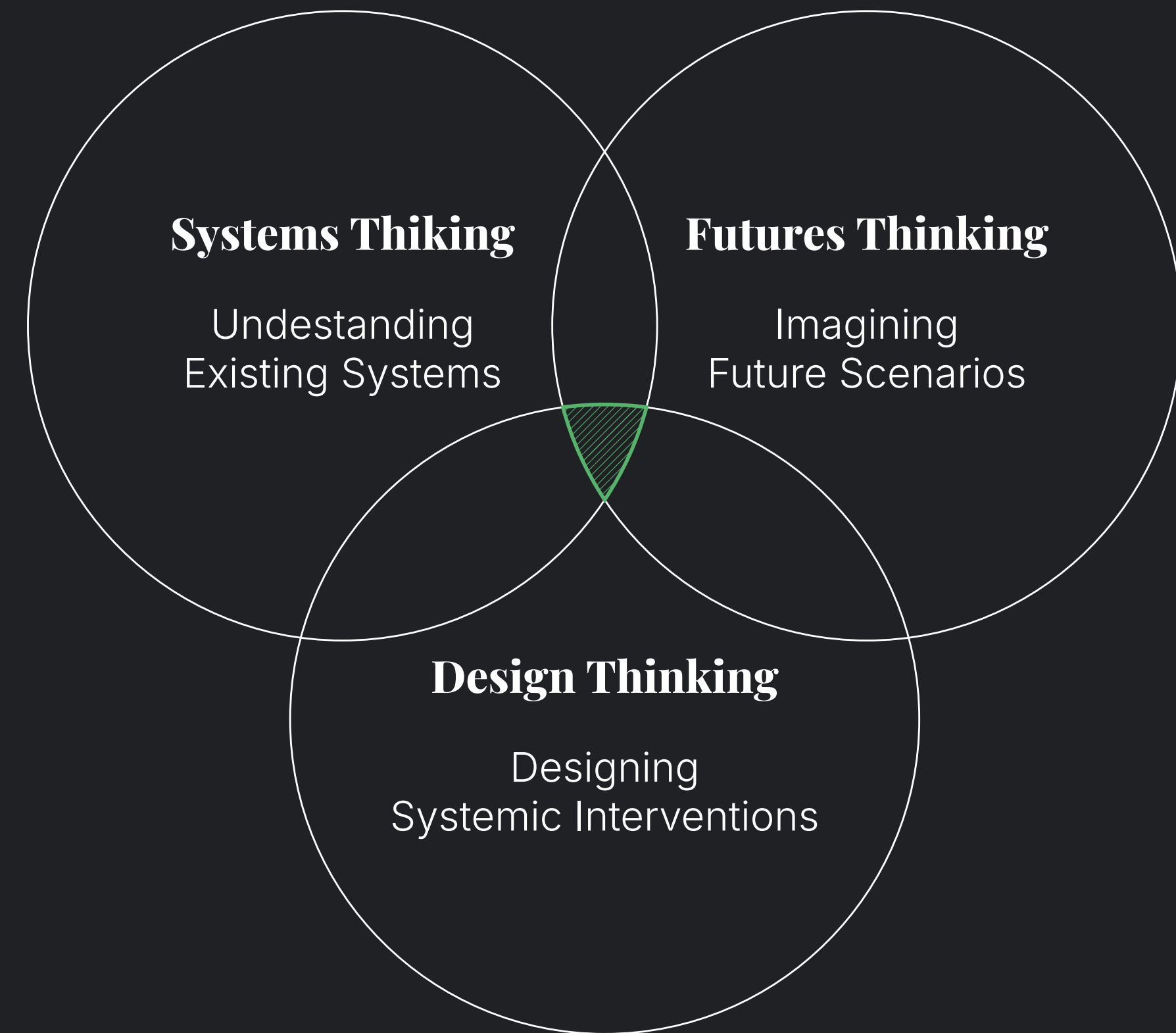


INTRODUCTION

# SYSTEMS DESIGN APPROACH TO PH

Systems Design Approach to **Planetary Health** aims to develop methodological tools and systemic solutions (products, services, and systems) that address the complex and interconnected relationships between environmental change and human health.

**Research & Education**





RESEARCH

# [SYSTEMIC] DESIGN METHODOLOGY & TOOLS

*AI-Driven Systemic Design Methodologies  
for Planetary Health Actions - 2024-2028*

In this project, led by PhD candidate **Dulaj Perera**, design acts as a bridge between theory and practice, integrating systems science with design and engineering to develop innovative methodologies and tools.

This research examines the potential of AI-assisted participatory modelling tools to address planetary health challenges.

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OF TWENTE.

IXD



SYSTEMS  
DESIGN  
APPROACH

[j.dacosta@utwente.nl](mailto:j.dacosta@utwente.nl)





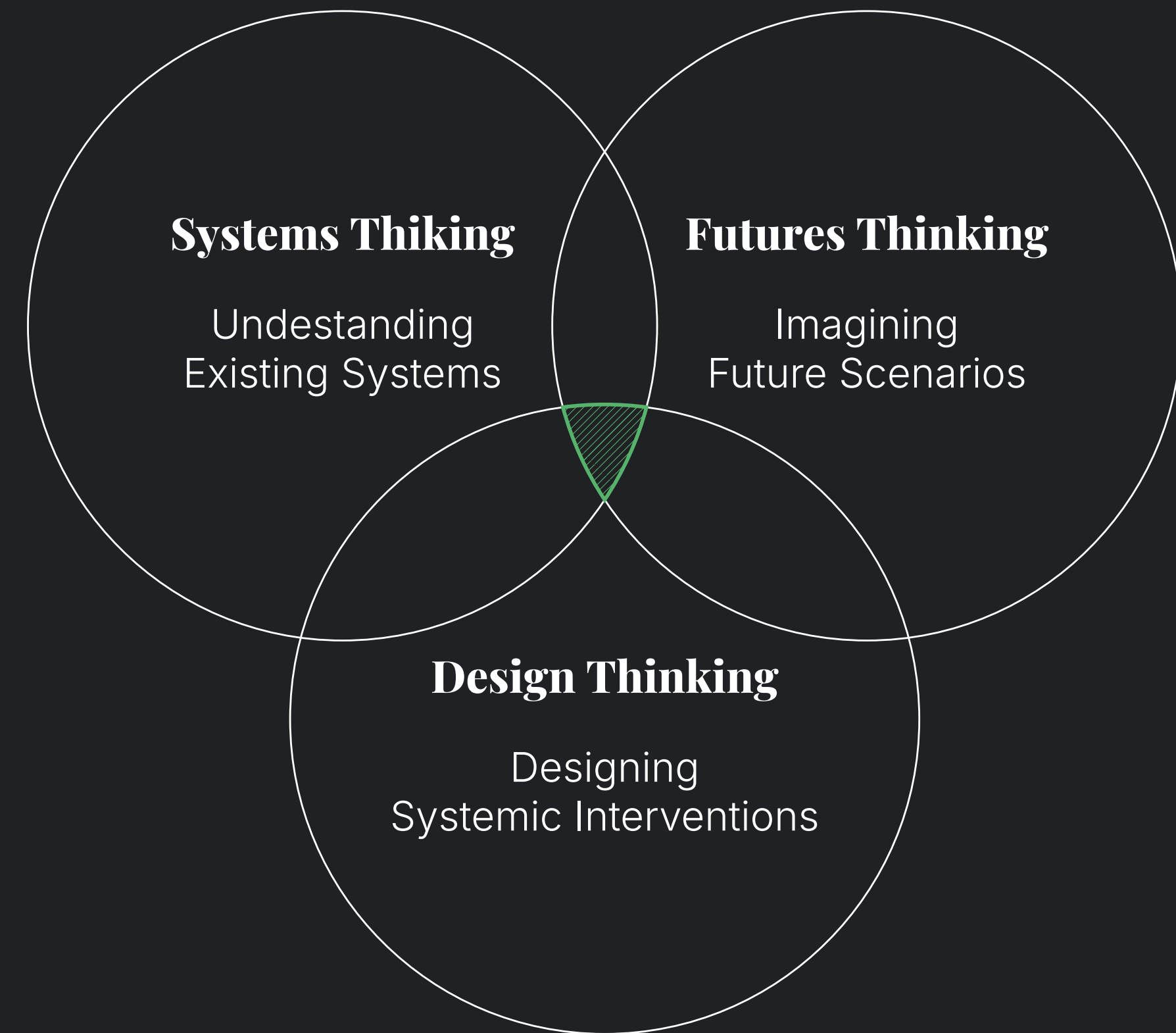
# EDUCATION RESEARCH [SYSTEMIC] DESIGN METHODOLOGY & TOOLS

## *Planetary Health Futures – 2024–2025*

This study explores the use of systems thinking in engineering education, focusing on how industrial design engineering students address the health-environment relationships through a structured six-step approach.

It aims to outline how a systemic design methodology aids in creating future scenarios and designing systemic interventions that promote Planetary Health Futures.

*This project was reviewed and approved by the Natural Sciences & Engineering Sciences (NES) Ethical Committee from the University of Twente under application number 240650.*



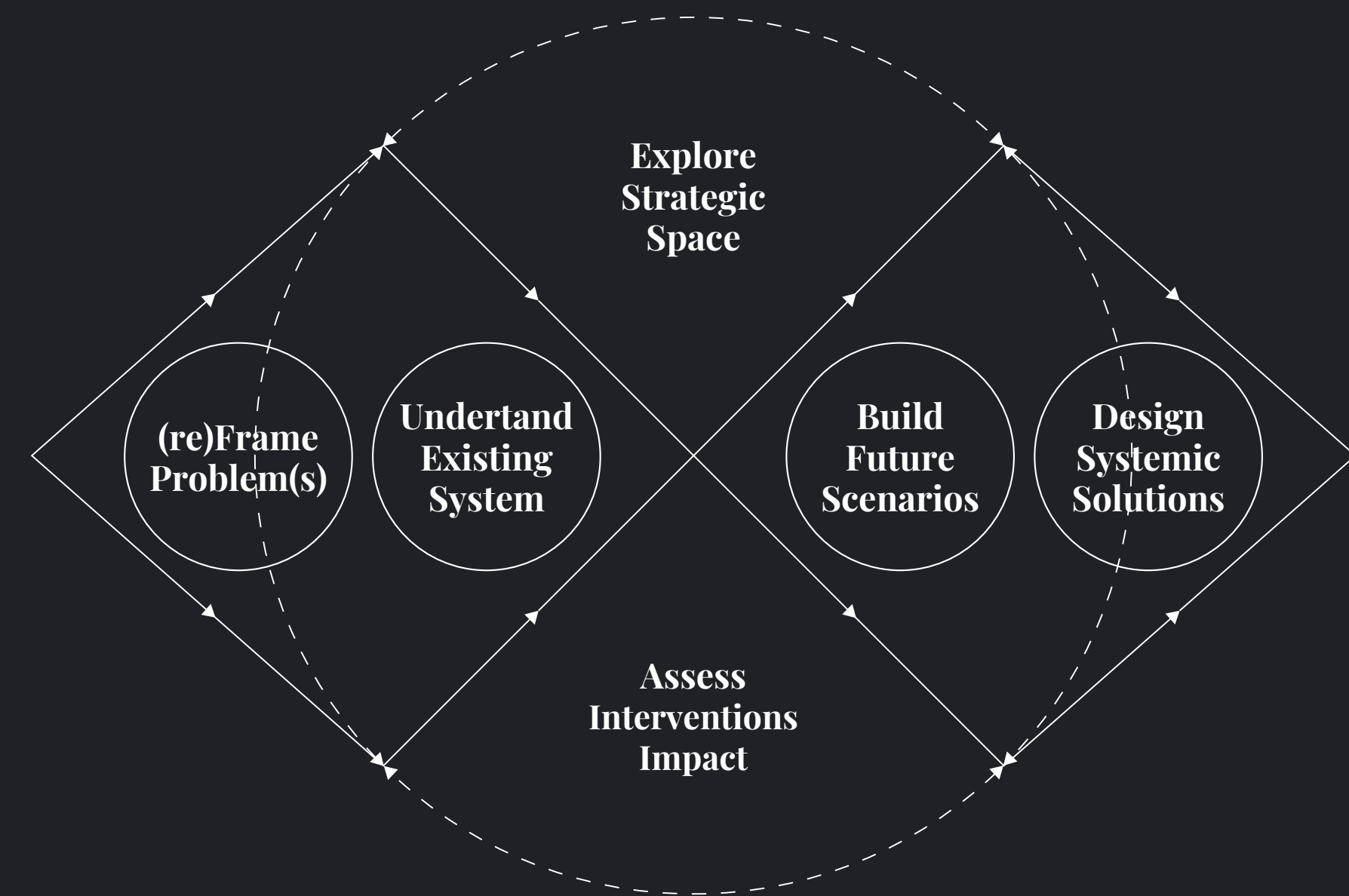


# EDUCATION RESEARCH [SYSTEMIC] DESIGN METHODOLOGY & TOOLS

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EDUCATION

# [SYSTEMIC] DESIGN METHODOLOGY & TOOLS

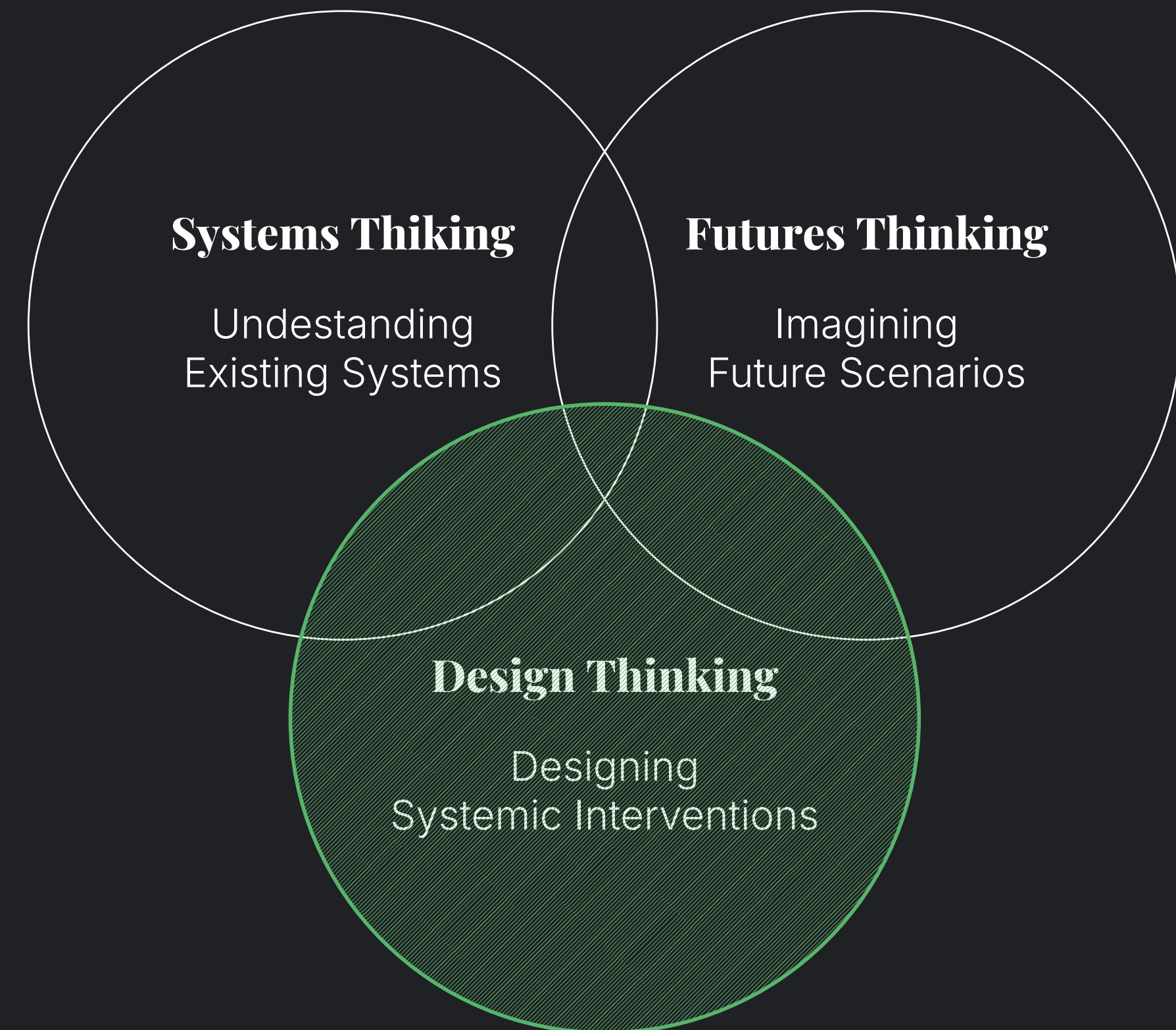
*Industrial Design Engineering*

*Human-centred Design*

*Constructive Technology Assessment*

*Product Impact Tool*

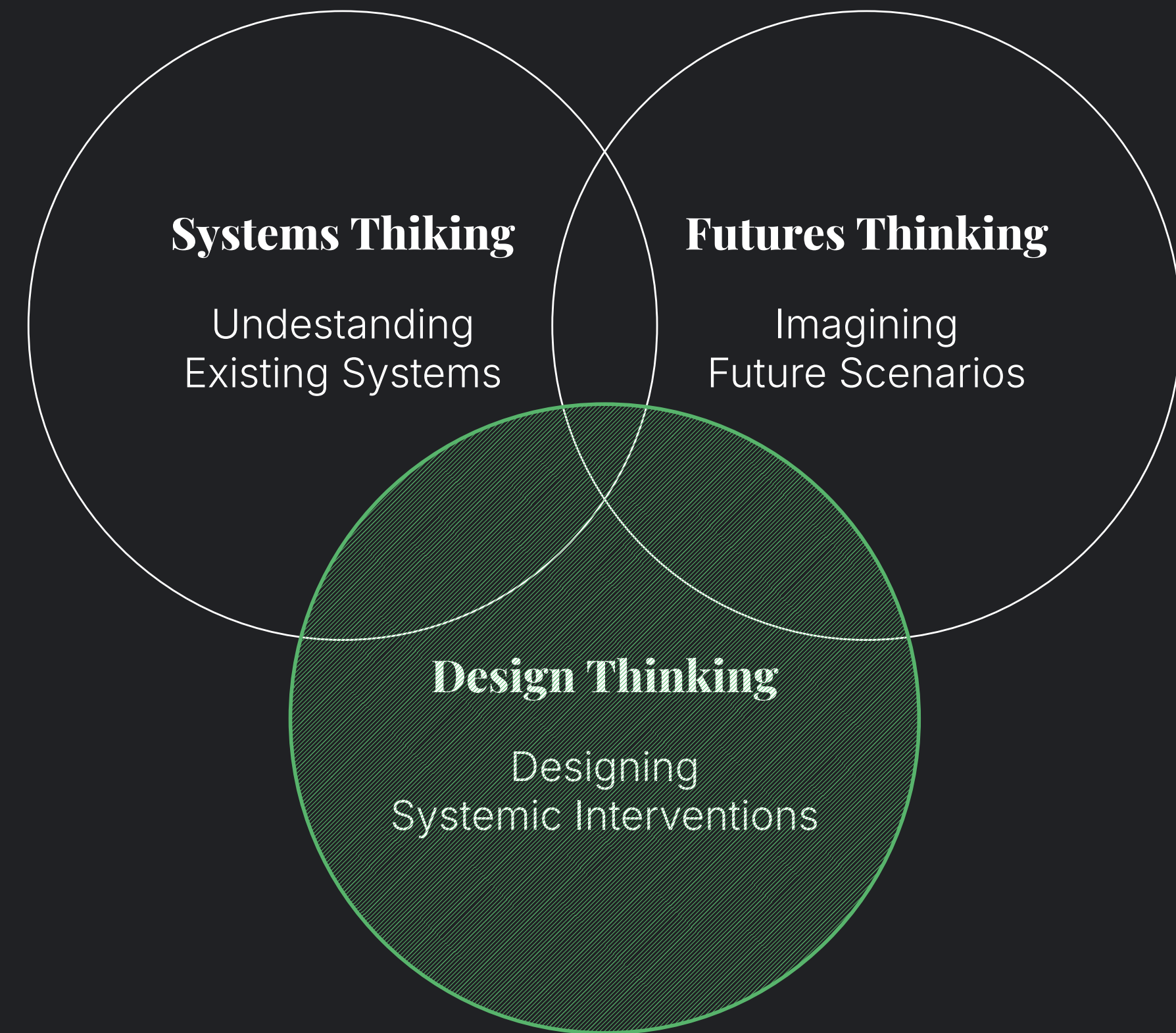
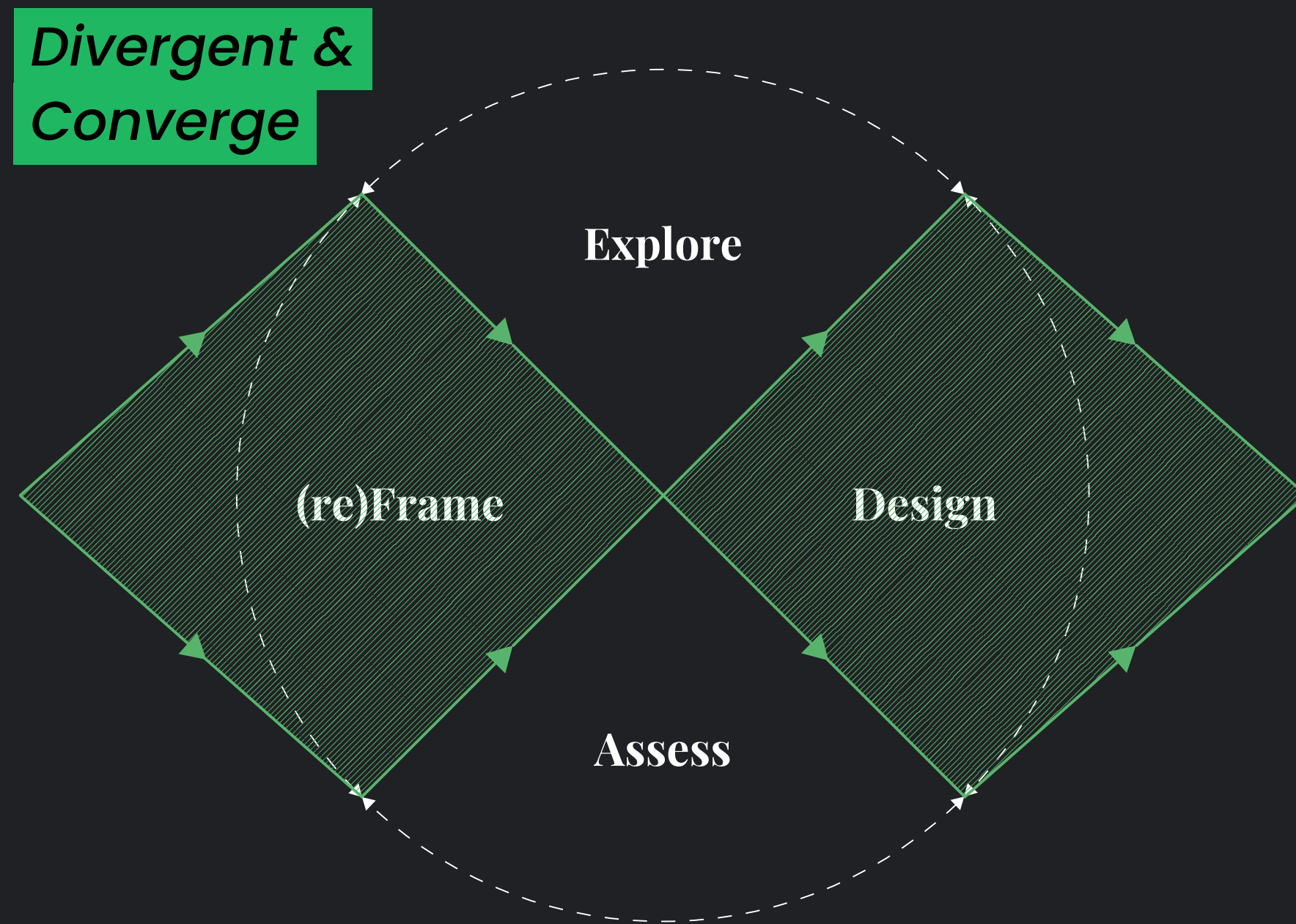
*Multilevel Design Model*





EDUCATION

# [SYSTEMIC] DESIGN METHODOLOGY & TOOLS

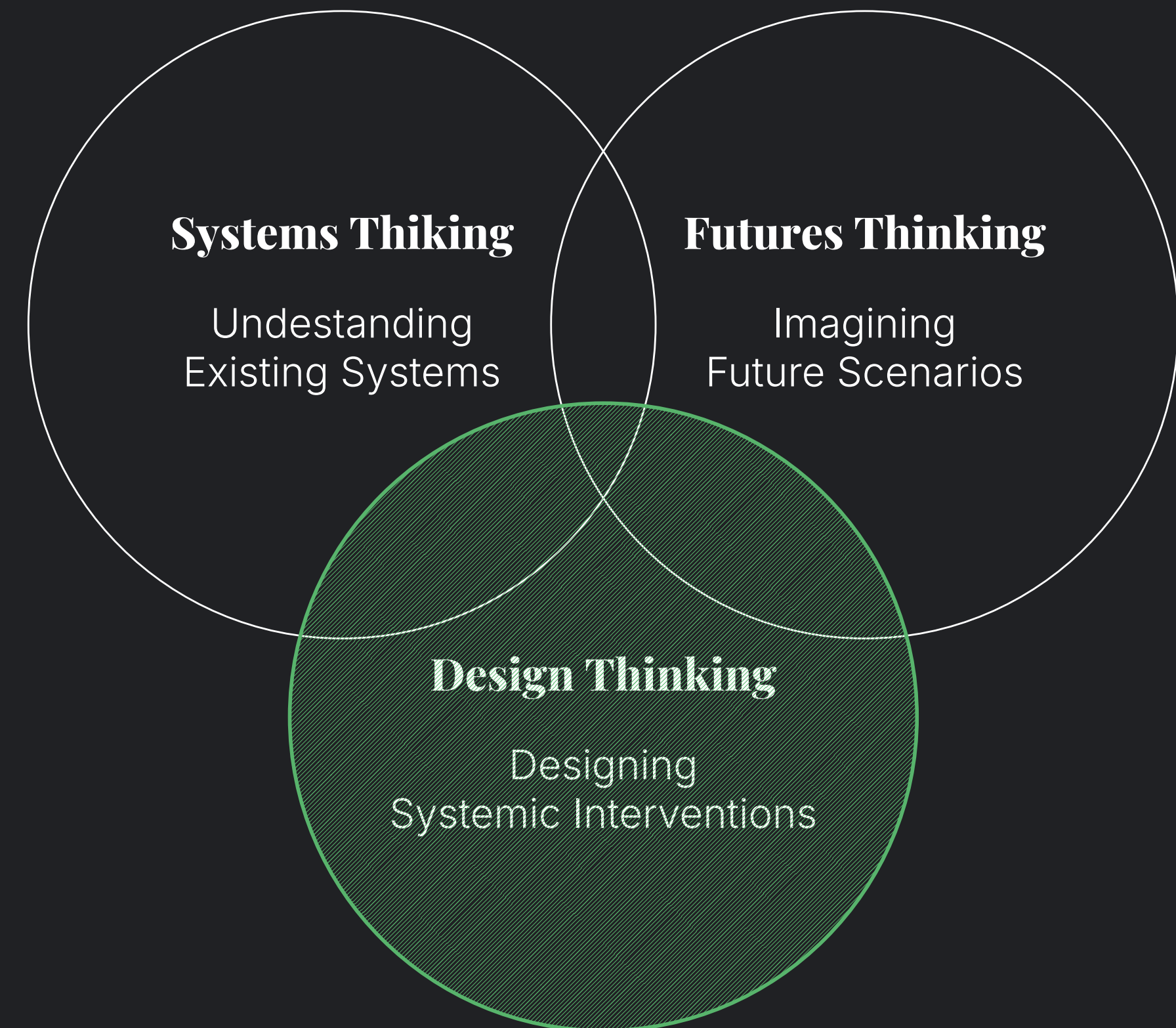
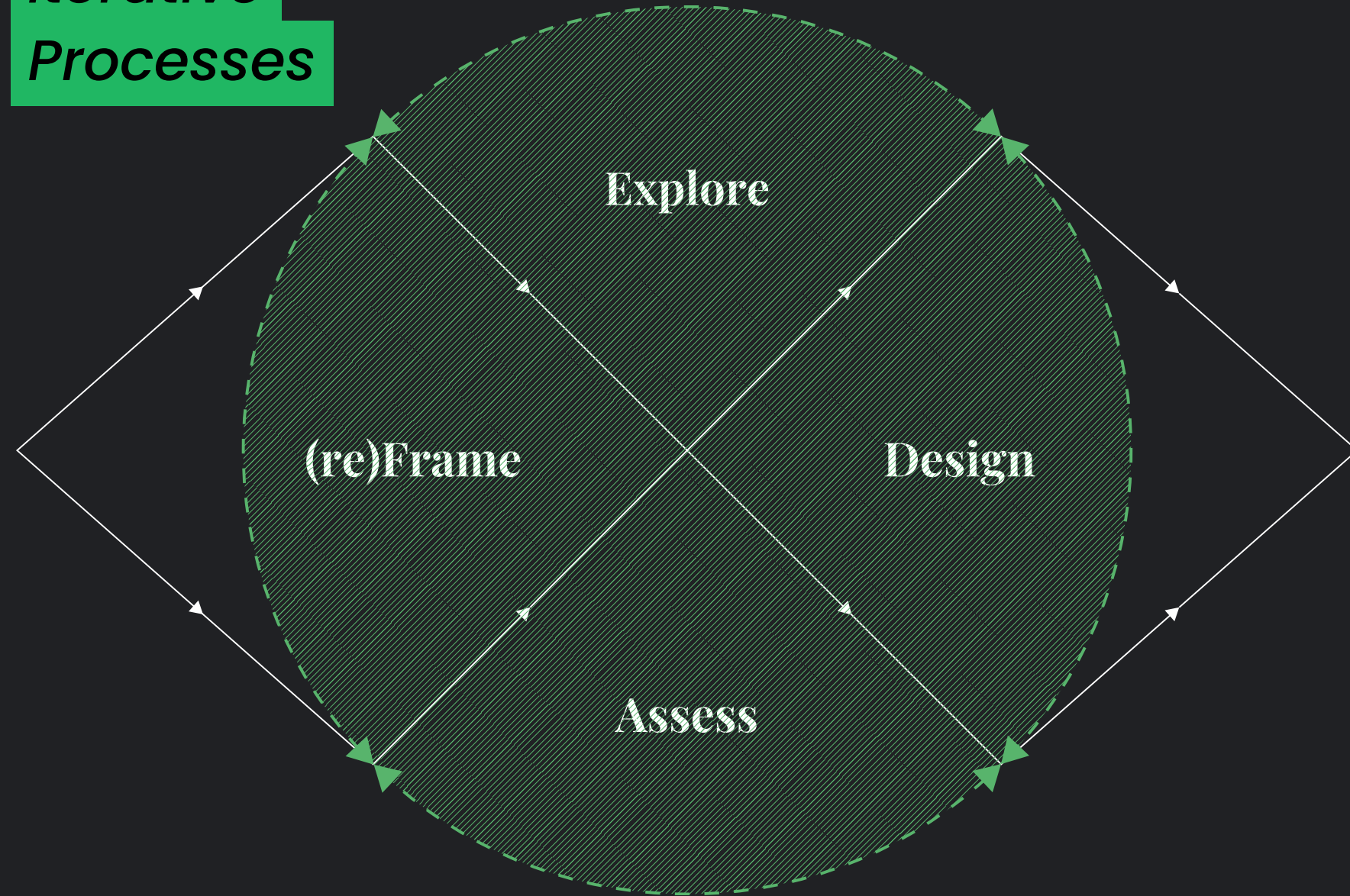




EDUCATION

# [SYSTEMIC] DESIGN METHODOLOGY & TOOLS

**Iterative  
Processes**





EDUCATION

# [SYSTEMIC] DESIGN METHODOLOGY & TOOLS

*Horizon & Environmental Scanning*

*Weak Signals Scanning*

*Trend Analysis*

*Driver Mapping*

*Scenario development*

*Uncertainties Analysis*

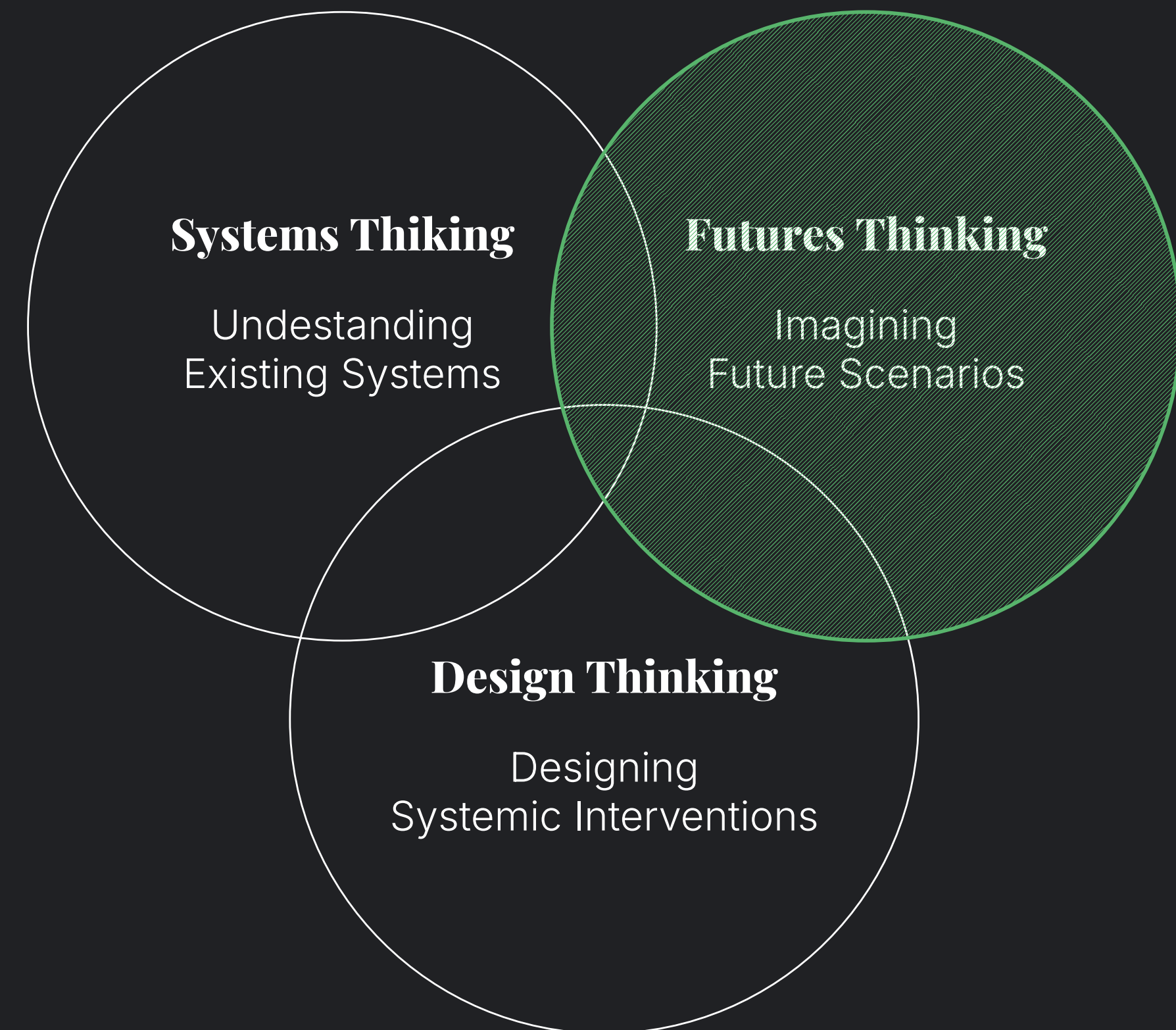
*Strategic Space Exploration*

*Three Horizons*

*Futures Wheels*

*Backcasting*

*Futures Archetypes*

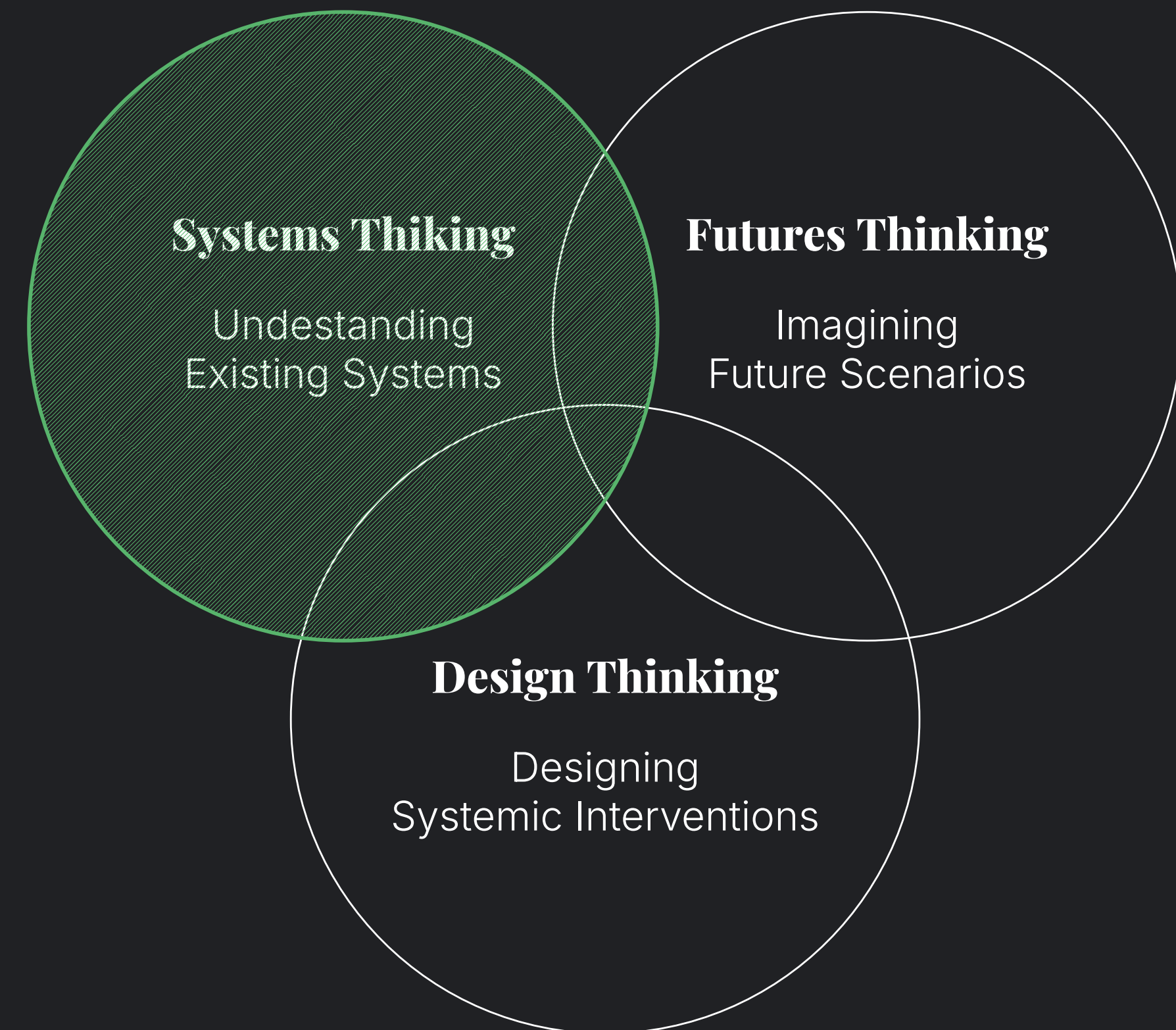




EDUCATION

# [SYSTEMIC] DESIGN METHODOLOGY & TOOLS

*Stakeholders Mapping*  
*System Mapping*  
*Causal Loop Diagram*  
*Enablers / Inhibitors*  
*Multilevel Perspective*  
*Theory of Change*





# IA. PROBLEM (RE)FRAMING

Design by: \_\_\_\_\_ Date: \_\_\_\_\_

## INSTRUCTIONS

1. Identify potential driving forces through brainstorming and researching, people, trends, events, norms, beliefs, phenomena, institutions, laws, cultures, and technologies.
2. Define the current and long-term goal context based on the characteristics of the system (scope) you want to analyze.
3. Identify your interests, you are in the context and create a problem statement for the one problem that needs to change to achieve your vision.
4. Formulate the research question(s), why? A. What driving forces influence?
5. Define the boundaries and perspectives of the research based on article aspects (e.g., stakeholders, points of view, trends and which ones you will intentionally leave out.)

**OUT OF SCOPE (FOR NOW)**

**PRIMARY FOCUS (DRIVING FORCES)**

**LONG-TERM GOAL**

**PROBLEM STATEMENT**

**RESEARCH QUESTIONS**



Define your research area for your potential future big. To facilitate your thinking, consider people and/or activities, phenomena, institutions, laws, cultures, and technologies.

Write a concise description of the world you want to create and the problem you want to solve. Be specific about the scope of the problem and the system you want to analyze.

What question(s) did you want to answer? Why? A. What driving forces influence?

What question(s) did you want to answer? Why? A. What driving forces influence?

What question(s) did you want to answer? Why? A. What driving forces influence?



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For more results, visit <https://www.researchgate.net/publication/355555555>

| 1B. STEEPV FRAMEWORK   |  | INSTRUCTIONS  |  |
|--|--|---|--|
| Design by: _____ Date: _____   |  | 2. Include a title, description, relevance and source in each post-6.<br>3. Make meaningful and appropriate connections between these factors by drawing related post-6s.   |  |
| <b>SOCIAL</b><br>Explore the social, cultural, demographic, and economic needs of the community. Consider the impact of social structures, values, and norms on the design process.  | <b>TECHNOLOGICAL</b><br>Explore the current and emerging technologies, tools, and materials that can be used to address the design challenge. Consider the impact of technological innovation on the design process.     | <b>ECONOMIC</b><br>Explore the economic context of the design challenge, including the costs, benefits, and potential impacts of the design. Consider the impact of economic factors on the design process.             |  |
|  |  |   |  |
| <b>ENVIRONMENTAL</b><br>Explore the natural and built environment of the design challenge. Consider the impact of environmental factors on the design process, including the availability of resources, the impact of climate change, and the potential for environmental degradation. | <b>POLITICAL</b><br>Explore the political context of the design challenge, including the role of government, the impact of laws and regulations, and the potential for political action to address the design challenge. | <b>VALUE</b><br>Explore the values and beliefs that inform the design challenge. Consider the impact of cultural, social, and economic values on the design process, and the potential for values to inform the design. |  |
|  |  |   |  |

## 2A. STAKEHOLDER MAP

Design by \_\_\_\_\_ Date \_\_\_\_\_

**INSTRUCTIONS**

1. Identify potential stakeholders through brainstorming and research.
2. Describe their interests, needs, and expectations (optional).
3. Map their relationships and level of involvement visually.
4. Connect related stakeholders as nodes in a flow or web.

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## 2B. CASUAL LOOP MAP

Design by: \_\_\_\_\_ Date: \_\_\_\_\_

POTENTIAL

**INSTRUCTIONS**

1. Identify potential stakeholders through brainstorming and research.
2. Describe their interests, needs, and expectations (optional).
3. Map their interdependencies and level of commitment visually.
4. Prioritize stakeholders based on importance and influence by placing them in the appropriate place on the diagram (e.g., core, direct, indirect, potential).
5. Connect related stakeholders as nodes in a flow or web.

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### 3A. UNCERTAINTY / IMPORTANCE MATRIX

### 3B. STRATEGIC SPACE

Design by: \_\_\_\_\_ Date: \_\_\_\_\_

#### INSTRUCTIONS

- Identify and list the most driving forces based on your previous research (e.g., LOI method).
- Categorize the most influential driving forces based on the next of impact and opportunity.
- Consider two different driving forces to generate interesting scenarios or contributions for future developments.
- Then, reveal your own technical design (i.e., actors, regions, elements, technique developments, etc.) based on your previous research in the appropriate quadrant.
- Analyze these factors to identify potential opportunities and challenges, considering their implications and how they might affect the overall system.
- Brainstorm three scenarios plots and arrange them in a "journey" plot to avoid simple options.

Please note that the "Translation" mentioned here is a summary and should not be used only for information purposes.

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## 4A. SCENARIOS PLOTS

Design by \_\_\_\_\_ Date \_\_\_\_\_

### SCENARIO PLOT 2

#### INSTRUCTIONS

1. Start by choosing the focal issue you want to explore.
2. Write down the strategic space map of your project in the adjacent space.
3. Randomize three plot scenarios and arrange them in a triangular shape to avoid order-dependence or order primacy, and then compare plots.
4. Create related scenario plots by describing (imagined) future outcomes based on drivers of change and storylines that reflect previous learnings.
5. Compare scenarios to identify opportunities and challenges and consider scenario implications and impact on your Future Issue (Justification).
6. Choose a scenario plot based on their level of importance and impact.

Note: Focus on a scenario you are inspired and interested in further developing.

#### DESCRIPTION

#### JUSTIFICATION

#### DESCRIPTION


#### JUSTIFICATION


STRATEGIC SPACE

# 4B. THEORY OF CHANGE

by Michael Goodman

Design by \_\_\_\_\_ Date \_\_\_\_\_

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For further results, visit [www.4b.nl](https://www.4b.nl)

## 2. PRODUCT IMPACT

On Product Efficacy and User Outcomes

?

Subject

**Delivering Suggestions**  
How to use this Product Impact Sheet in your Design Process:

**Analysing**  
Take the product or service that you want to analyse to your mind. Then go around the four quadrants of the sheet and write down: 1) How your product or service is unique 2) How it might be distributed effectively (normally, products have multiple effects)

In a second step you can determine which effects have the most influence

**Illustrate & Prioritize**  
First, use your imagination to generate many ideas.

**Categorize** – Take your most interesting ideas and place them in the appropriate category – Choose one idea and try to realize it in its own category

**Transfer** – Try to alter the idea in such a way that its major effects is one of the other quadrants

| above-the-head<br>vision technology<br>dynamic technology<br>abstract reality  | before-the-eye<br>guidance<br>perspective<br>identification  |
|--|--|
| <div style="display: flex; align-items: center; justify-content: center;"> <div style="margin-right: 10px;"> <p>↑</p> <p>↓</p> </div> <div style="font-size: 48px;">+</div> <div style="margin-left: 10px;"> <p>↑</p> <p>↓</p> </div> </div> | <div style="font-size: 48px;">+</div>  |
| <div style="font-size: 48px;">+</div>  | <div style="display: flex; align-items: center; justify-content: center;"> <div style="margin-right: 10px;"> <p>↑</p> <p>↓</p> </div> <div style="font-size: 48px;">+</div> <div style="margin-left: 10px;"> <p>↑</p> <p>↓</p> </div> </div> |

**behind-the-back**  
side effects  
background conditions  
technical determinism

**to-the-hand**  
operation  
mediated conditions  
subliminal effect

Product Impact Sheet - sheet version  
Date: 10/11/2017  
Author: [info@design4impact.com](mailto:info@design4impact.com)  
Source: University of Applied Sciences  
Witten/Herdecke  
Source: University of Applied Sciences  
Witten/Herdecke



## EDUCATION

# PATHWAYS TO PH FUTURES

### Project 4 - Consumerism

This project focused on the excessive consumption of goods and services, which exerts pressure on ecosystems and results in deforestation, water shortages, pollution, and greenhouse gas emissions. These environmental crises have a direct impact on human health.

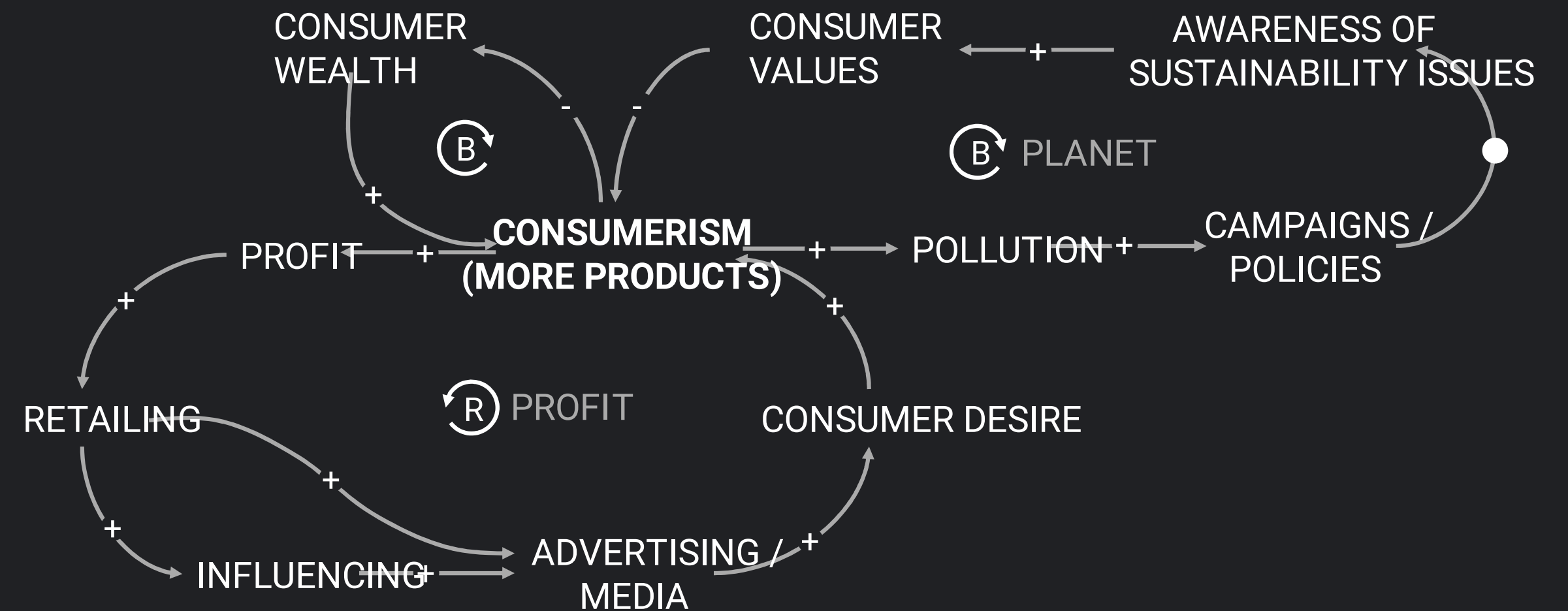


Figure 2. An example of a causal loop diagram. Project 4, by Marin Grinwis, Meliz Klink, Emma Meijer, Simone Pakker, Jitske Rob.



## EDUCATION

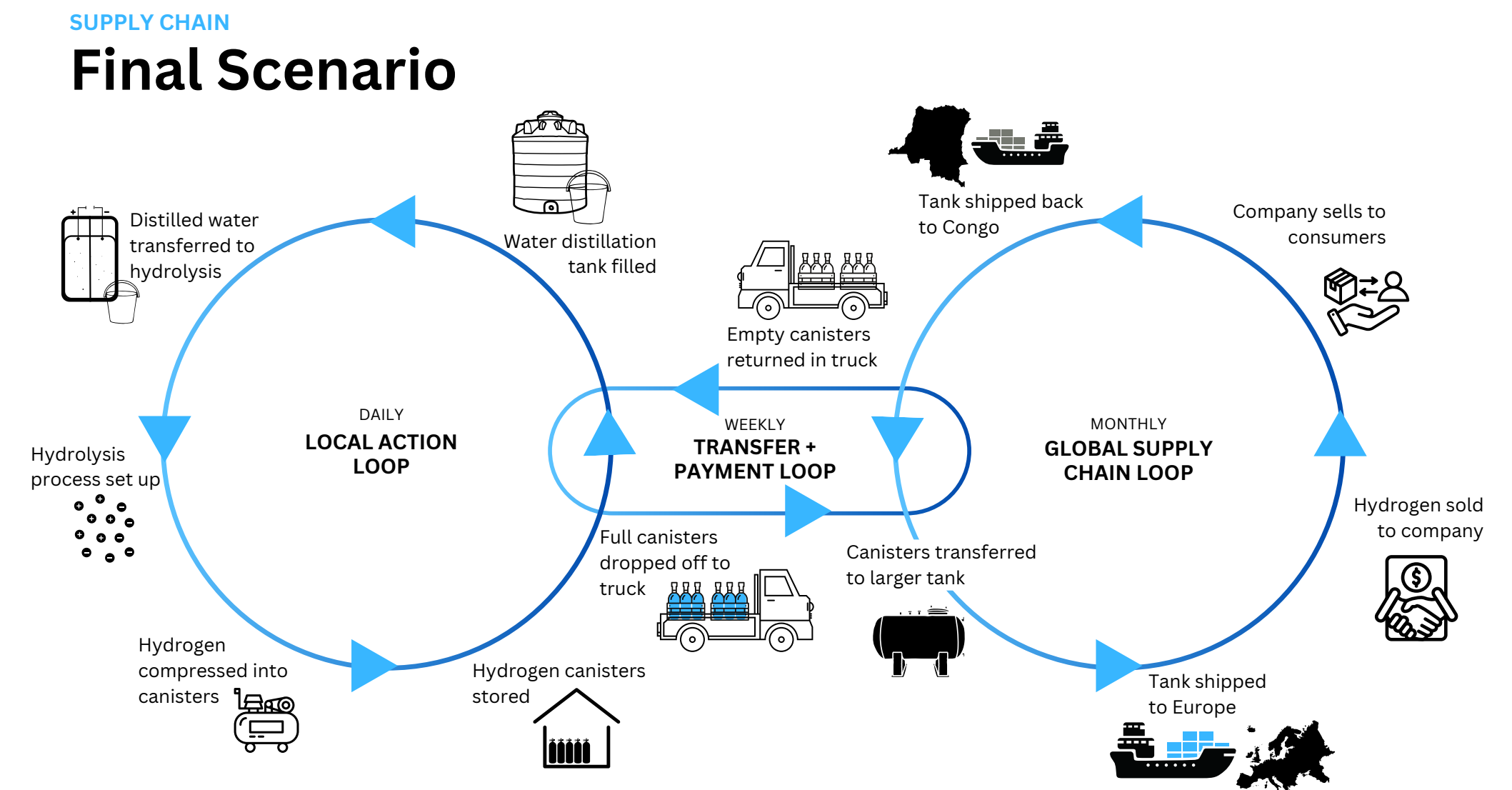
# PATHWAYS TO PH FUTURES

### Project 7 – “DRC Hydrogen-based Future”

This project addresses the environmental impacts, labour inequalities, and social health issues associated with cobalt mining in the Democratic Republic of Congo (DRC).

“By 2050, we will achieve a transformation in cobalt production in Congo that is ecological, sustainable, and ethical, ensuring fair labour practices, safety and financial integrity for all workers, and a commitment to preserving the environment while supporting the global transition to clean energy.”

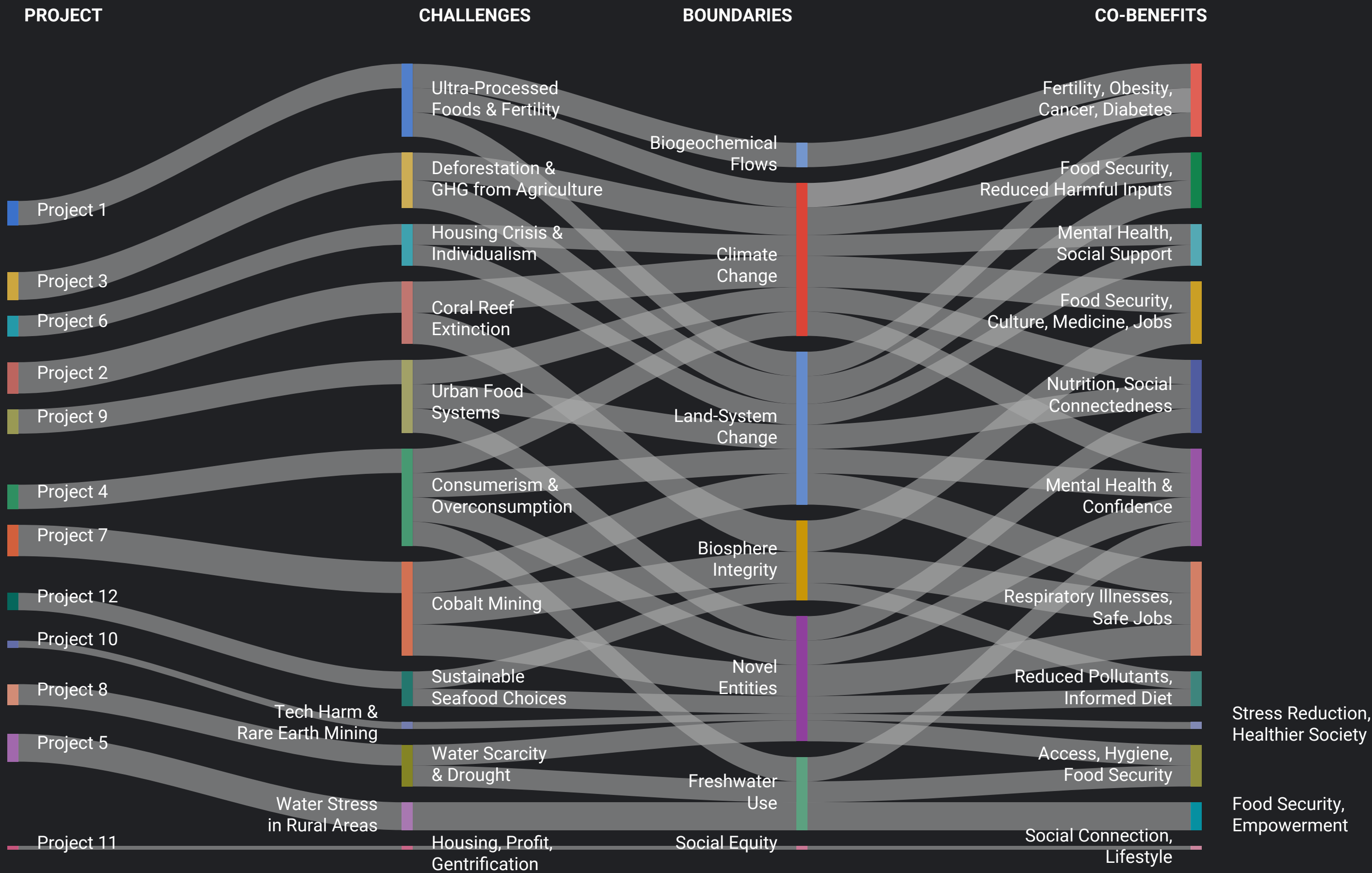
*System overview of the proposed solution for the future of cobalt miners in the Democratic Republic of Congo. Project 7 by Daniel Sanchez Ramirez, Daniela Iamandii, Nikoo Abedian, Rajayogi Nandina, and Ruben Koster.*





EDUCATION

# PATHWAYS TO PH FUTURES





## EDUCATION

# LESSONS LEARNED

- The challenges of **student's participation** and Informed consent.
- Students **value the approach (SDA) and topic (PH)**.
- Students commented on the **density and pace** of the course.
  - Multiple theoretical frameworks, methodological steps, and tools.
- Students struggle to **cope with uncertainty**, ill-defined problems, and a lack of information.
- Students remarked on the need for additional **examples and cases**.
- There was a need for an explicit **connection between the theoretical** underpinnings and the **practical** application.
- **Adopting systemic tools**, particularly the Causal Loop Diagram, presented clear challenges to students.
- Students find it challenging to make the **health co-benefits explicit** in their design interventions.
- A **challenge-based approach** connecting external stakeholders fosters a more enriching learning environment.



EDUCATION

# WHAT'S NEXT?

*NEXTGEN4PH – Alliance VU-UT Spark Grant 2025-2026*

The project "Transdisciplinary Education for Future Social Entrepreneurs and Engineers Tackling Planetary Health" aims to co-design and implement educational resources at VU-UT by integrating systems and futures thinking into the curriculum. It will engage over 400 undergraduate and graduate students in project-based learning to address real-world planetary health challenges while collaboratively creating a **handbook on "A System Design Approach to Planetary Health"** and a **Participatory Modelling Tool** for exploring the relationships between environment and health.



EDUCATION

# WHAT'S NEXT?

*Making Sense of Planetary Health: A Participatory Modelling Tool – 2025–2026*

The project aims to create a **Participatory Modelling Tool** that improves transdisciplinary learning processes by incorporating insights from diverse disciplines and stakeholders. This tool will help analyse complex systems, identify leverage points, and design systemic interventions to promote planetary health.



EDUCATION

# WHAT'S NEXT?

*Systems Design Approach Portal – Sense, Learn, Think & Act 2025–2028*

We are a collective of designers and systems thinkers exploring new ways of being, knowing, and designing. We recognise the complex, interconnected crises facing society as symptoms of deeper root causes that require paradigm shifts in how we sense, learn, think, and act.

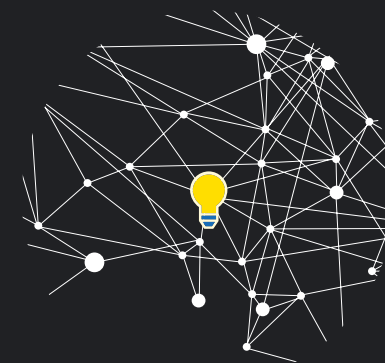
We develop methods, tools and practical knowledge to improve our grasp of widespread and persistent issues, drive system change, support informed decision-making, and design systemic interventions (products, services, and systems) to facilitate transitions.



# THANK YOU!



**Interaction Design Lab**  
[utwente.nl/en/et/dpm/chair/id/](https://utwente.nl/en/et/dpm/chair/id/)



**SYSTEMS  
DESIGN  
APPROACH**

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