THALES

SYSTEMS ENGINEERING & SEMD MULTIDISCIPLINARY DESIGN

UNIVERSITY OF TWENTE.

Faculty of Engineering Technology / Systems Engineering and Multidisciplinary Design (SEMD) group

ALIGNING TECHNICAL AND PROJECT MANAGEMENT THROUGH PARTICIPATORY APPROACHES:

AN INDUSTRIAL CASE STUDY

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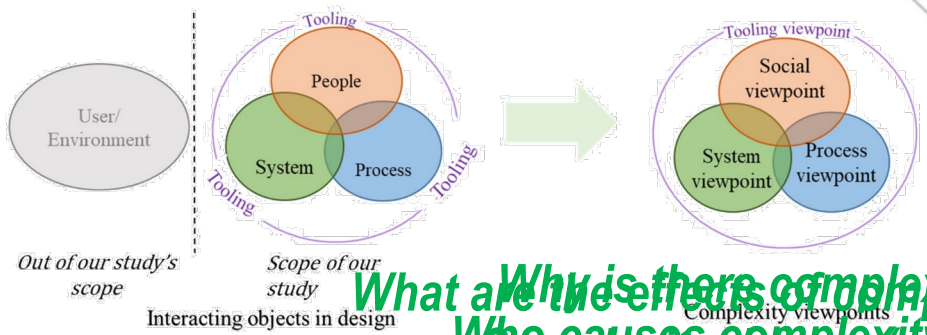
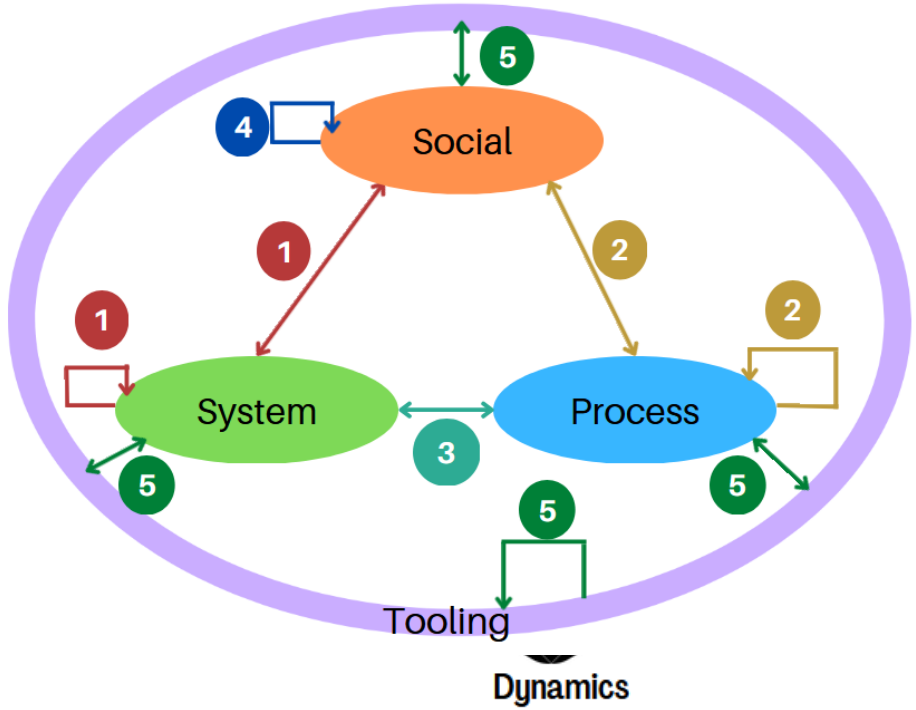
BACKGROUND

- In previous works, we proposed a multifaceted framework to characterize *complexity in engineering design*, called **System-Social-Process-Tool (SSPT) Framework.**

Complexity viewpoints



What are the effects of complexity?
Why is there complexity?
Who causes complexity?
Generalized complexity challenges
Complexity viewpoints

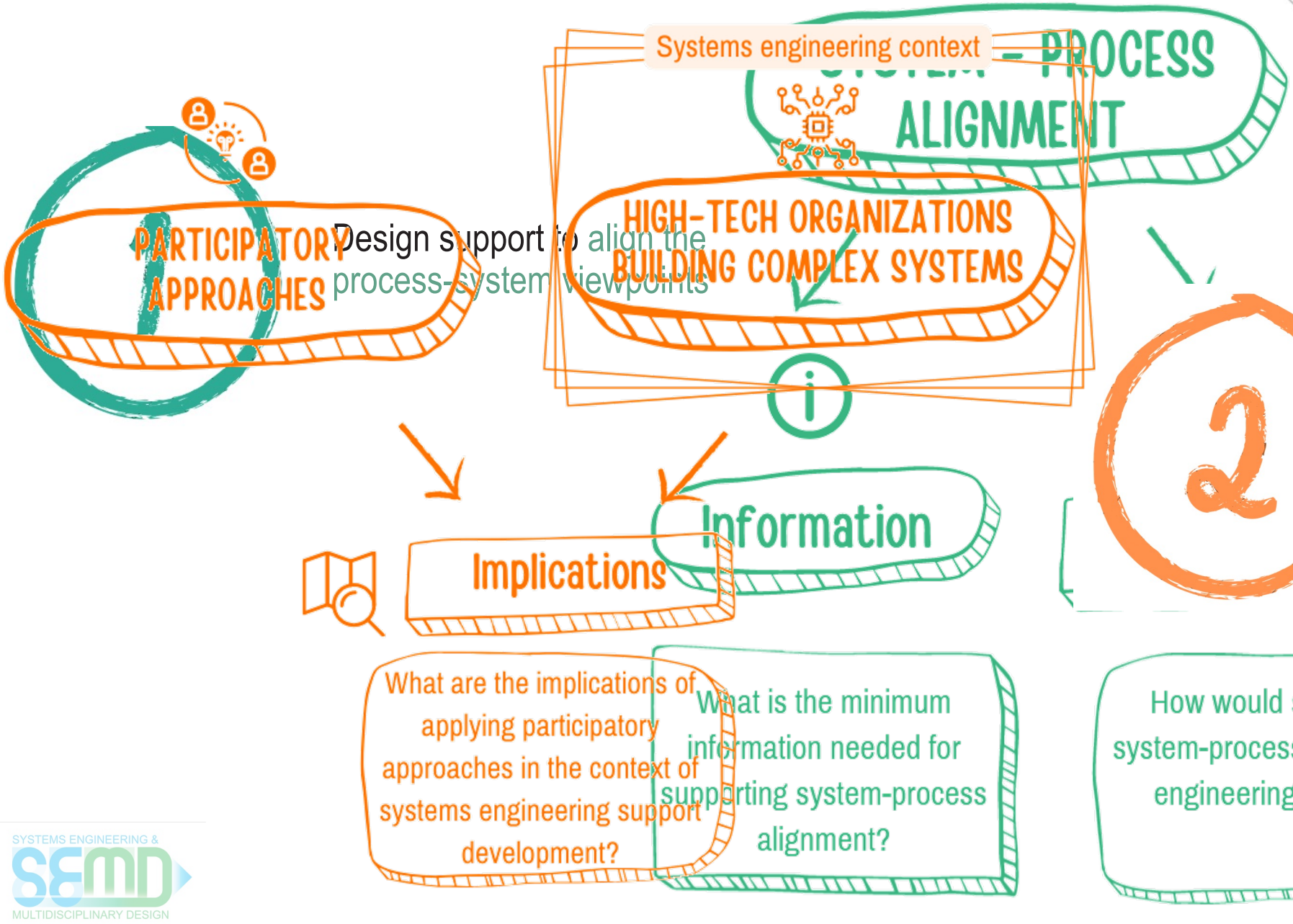


3 Alignment of the *system* and the *process* viewpoints

After mapping the literature using the framework, we found that the *System-Process* relationship was understudied.

(Generalized) Complexity challenges

RESEARCH OBJECTIVES



Reflect on the implications of using participatory approaches [based on Human Centered Design (HCD) and Action Research (AR) principles] as **methodology** to create *systems engineering support*

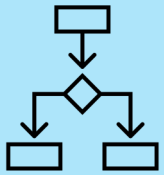
THE SYSTEM AND THE PROCESS VIEWPOINTS

We focus on these two complexity viewpoints:

THE SYSTEM

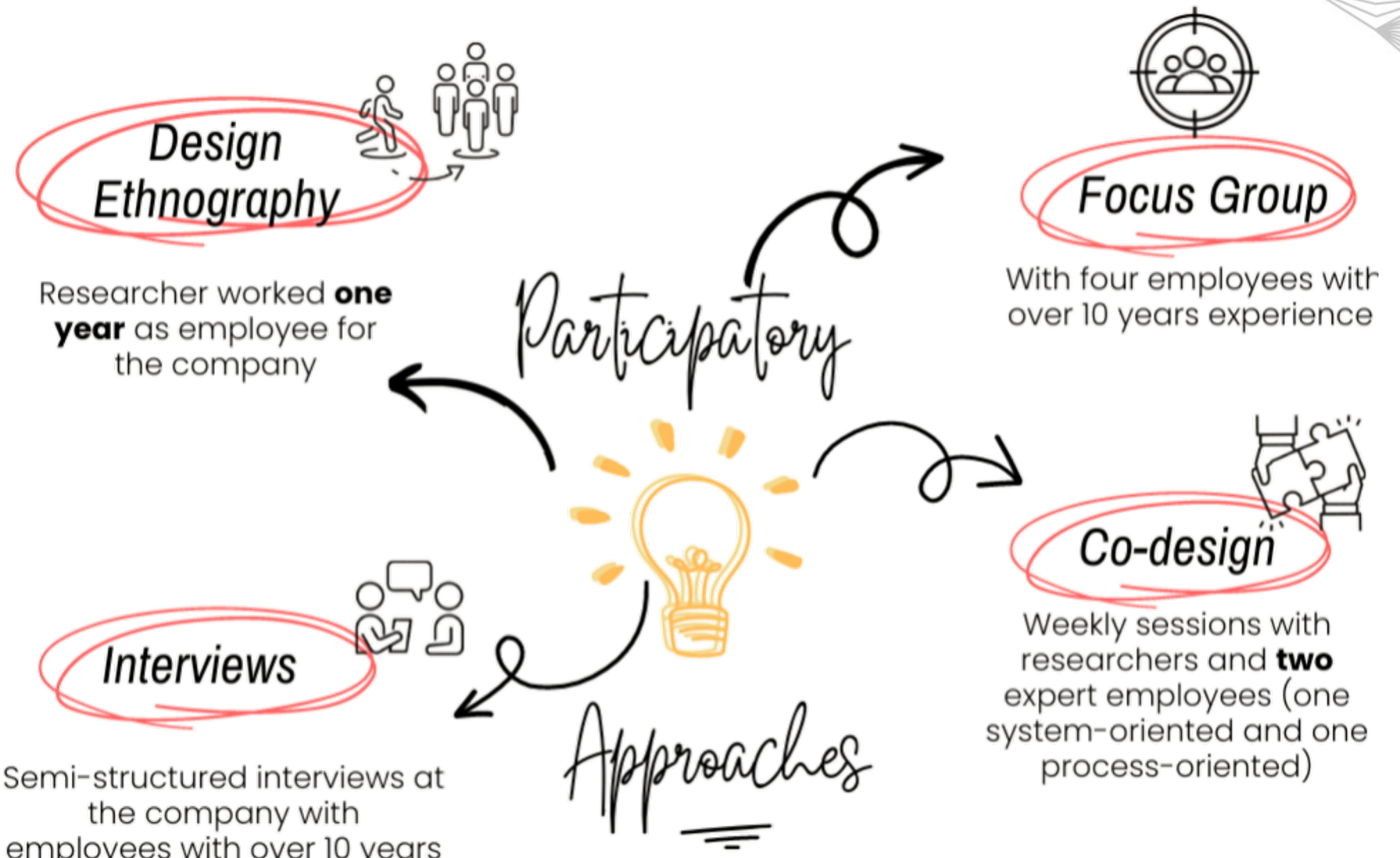
- Object to be created and operated to satisfy the stakeholder needs
- Continuant
- Has both an enduring cyber/physical presence and a functionality; it is something and can do something.
- ***What*** needs to be developed, tested, and delivered?

THE PROCESS

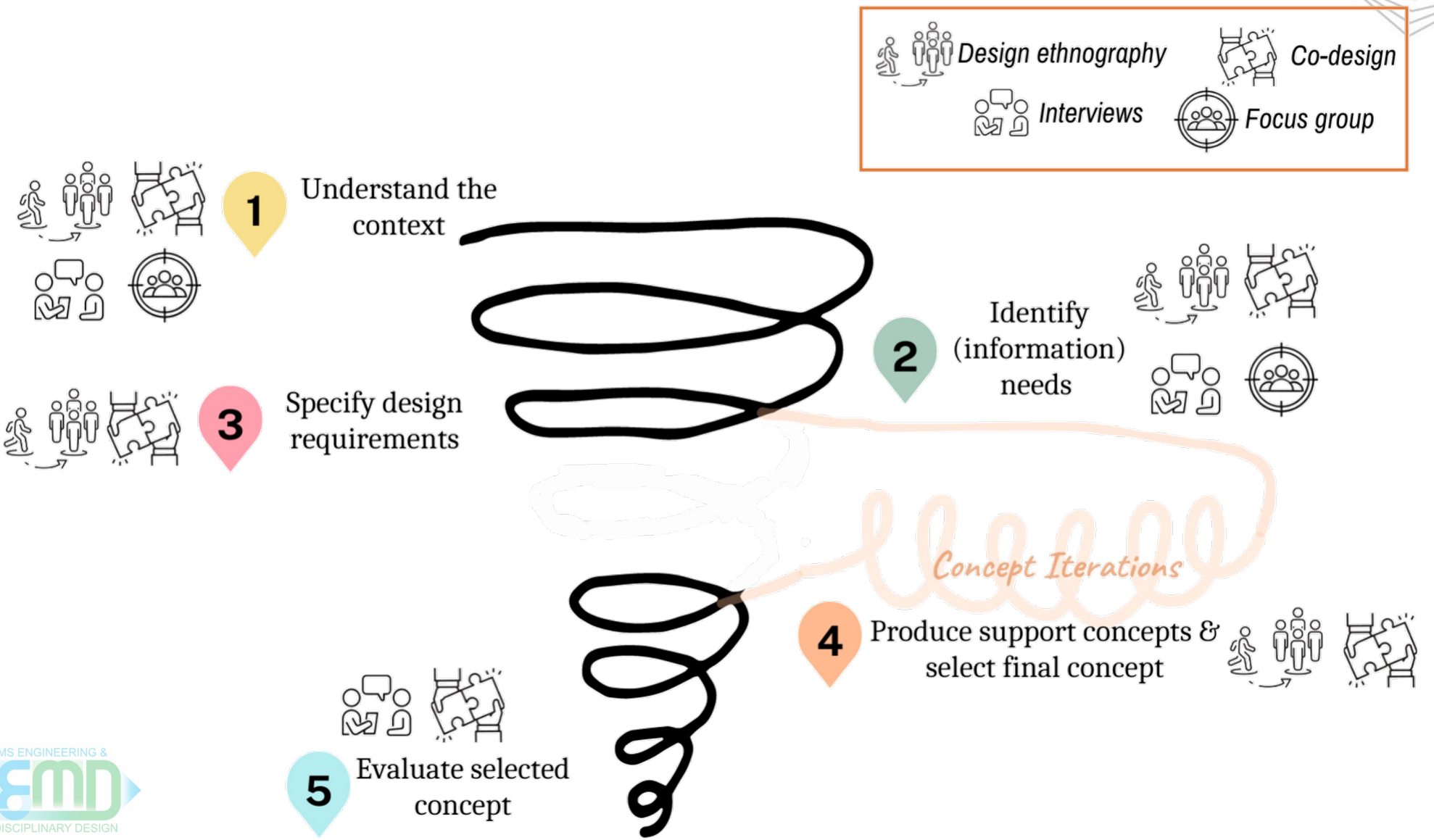


- The body of work required to create the object
- Occurrent
- Defined in terms of what it does (no substance, nothing exists when no work is being done).
- ***When*** each component, subsystem, and the final system should and can be developed and tested?

SELECTED PARTICIPATORY APPROACHES



STEPS AND APPROACHES APPLIED IN OUR METHODOLOGY

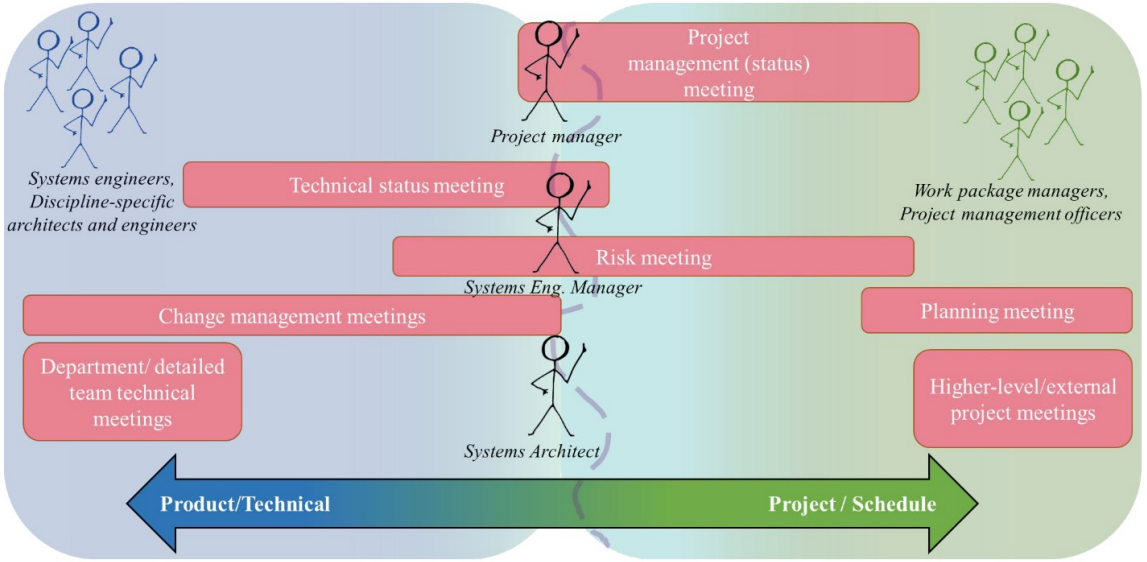


1 Understand the context

Applied participatory approaches

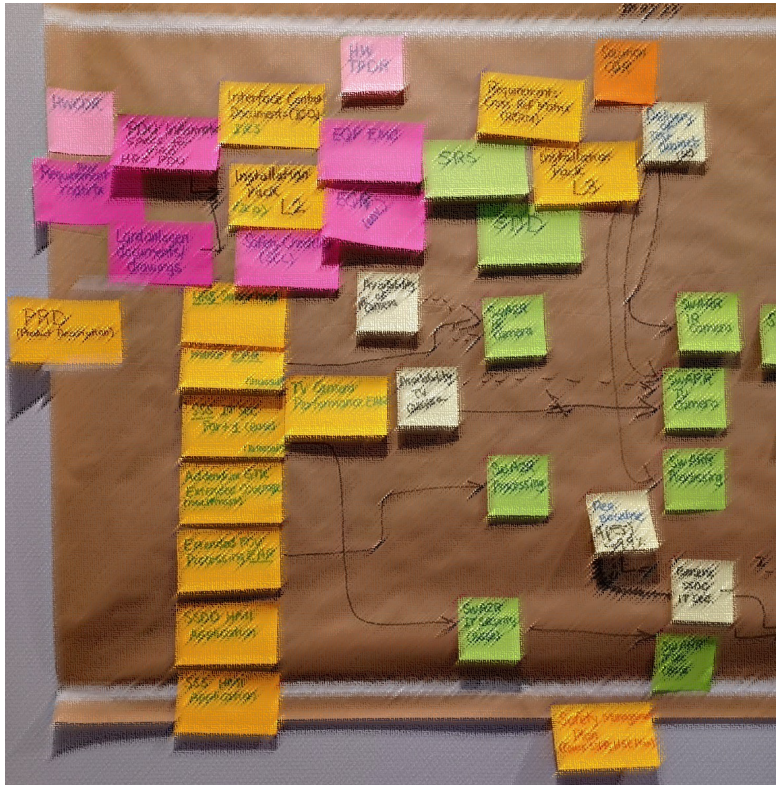
- Design ethnography
- Co-design
- Interviews
- Focus group

Barrier 1: Separation between technical- and process-oriented information flows.



The observed meeting landscape indicated that the technical and process meetings were sharply divided

Barrier 2: Instability and dynamics of the project environment



2 Identify (information) needs

Applied participatory approaches


Design ethnography


Co-design


Interviews


Focus group

PRIORITIZED LIST FOR THE SUPPORT DEVELOPMENT

Decisions

Qualification status

Process KPIs

Risks

Changes

Technical Effort Status

raints

Lessons Learned

Issues

Constraints

Team expertise

3 Specify design requirements

Applied participatory approaches

- Design ethnography
- Co-design
- Interviews
- Focus group

Support REQUIREMENTS

Performance / Functionality
- Shared view
- Right info / Right time
- Information through time
- Identify issues, risks, status

Practicality
- Small overhead
- Work for uncertain/incomplete
- Flexible formality
- Flexible hierarchy abstraction

Understandability
- Essential info
- Simple notation
- Easy to use/read
- Quick insights

Communication / Cohesion
- For technical & non-technical
- Cohesive information
- Project history
- Lessons & knowledge reuse

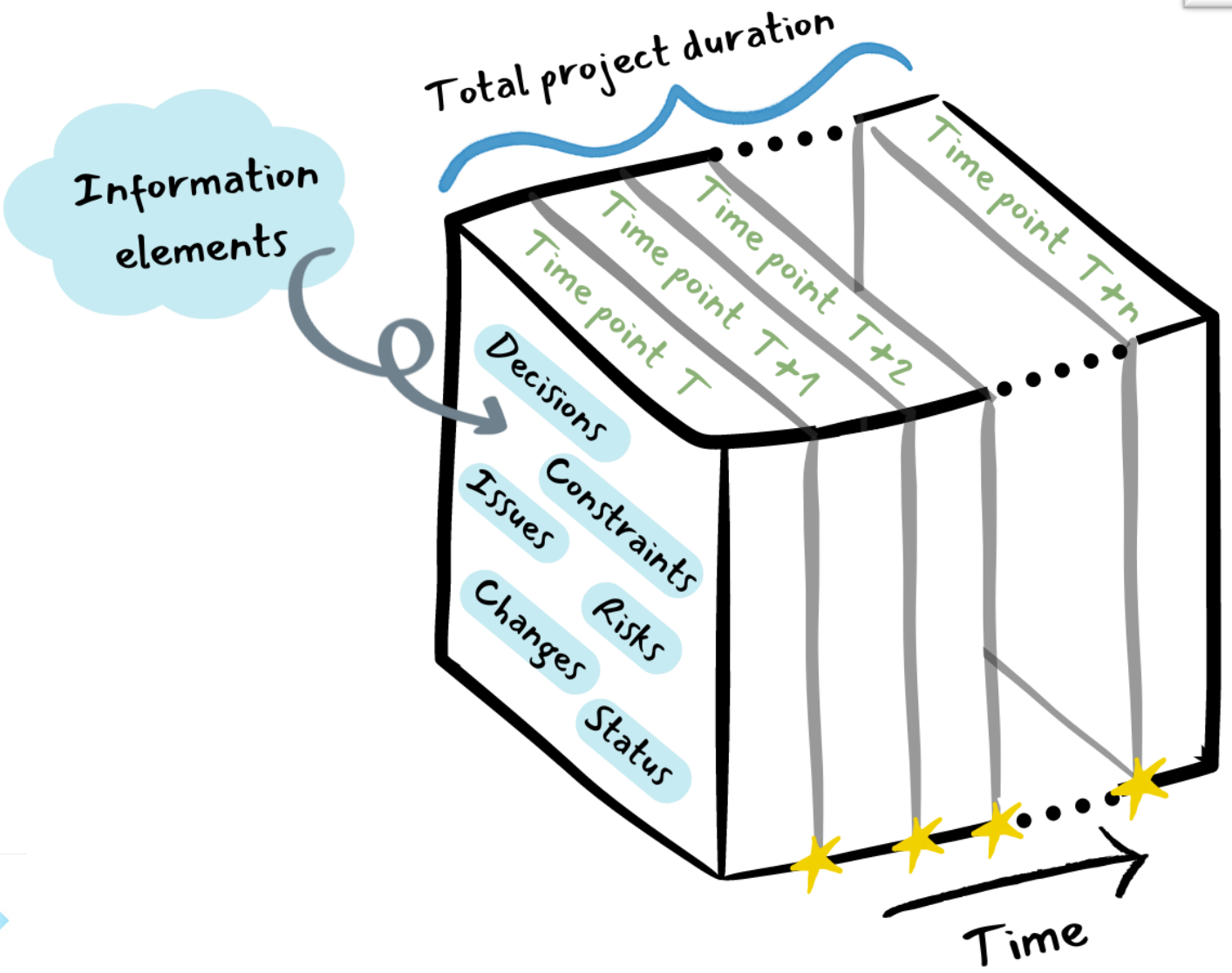
SYSTEMS ENGINEERING & MULTIDISCIPLINARY DESIGN

4 Produce support concepts & select final concept

Applied participatory approaches

Design ethnography | Co-design

GENERAL DRIVING CONCEPT



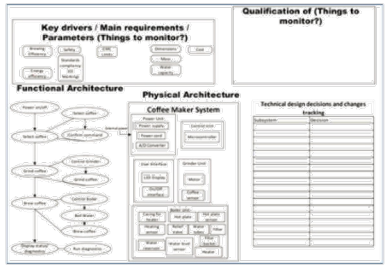
4 Produce support concepts & select final concept

Applied participatory approaches

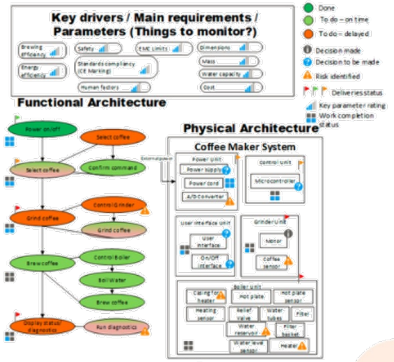
Design ethnography

Co-design

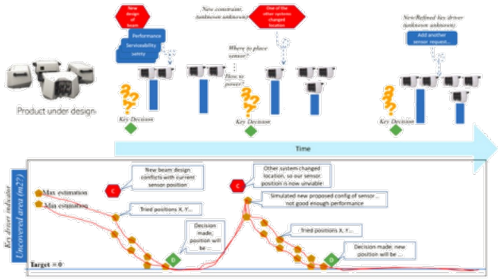
(1) Dashboard



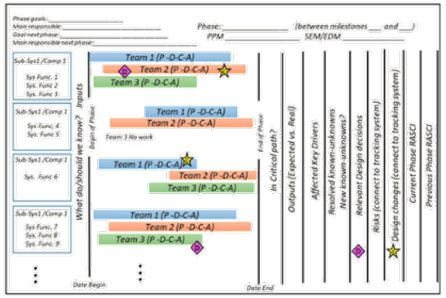
(3) Key drivers & A3AO



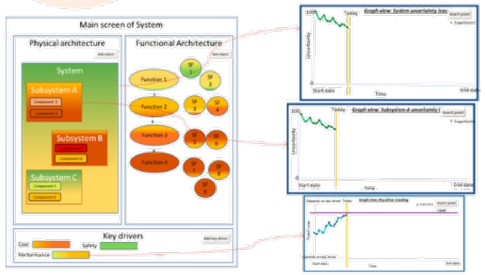
(5) MOEs, TPMs, Key drivers, & Storytelling



Concept Iterations



(2) A3AO (Architecture Overviews) based



(4) Perceived uncertainty

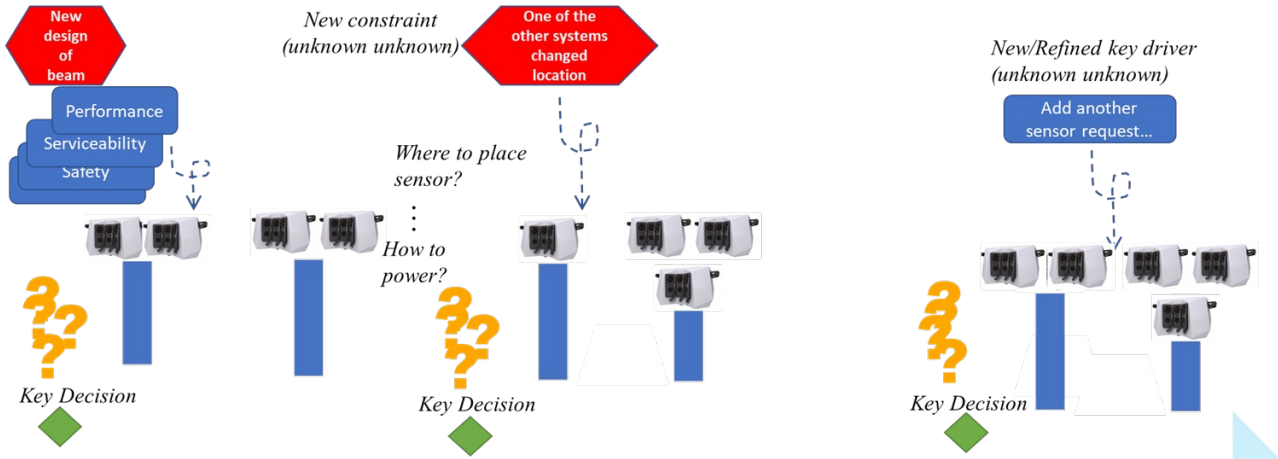
4 Produce support concepts & select final concept

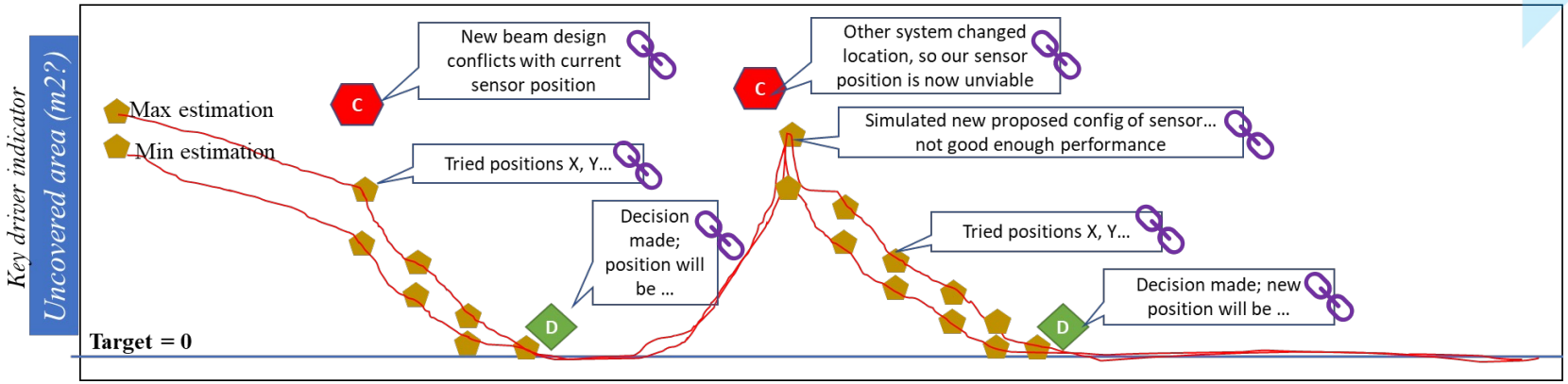
Applied participatory approaches

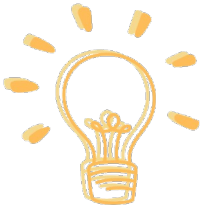
Design ethnography | Co-design

CONCEPT # 5 (FINAL ITERATION)

Product under design







Measures of effectiveness (MOEs)

Technical Performance Measures (TPMs)

Key drivers

Quick "big picture" + linking

Documenting & indexing project history

Irregularities & solutions quickly findable → lessons learned

Dependency on identifying key drivers

Many indicators might be needed

Effort to quantify, capture and link info

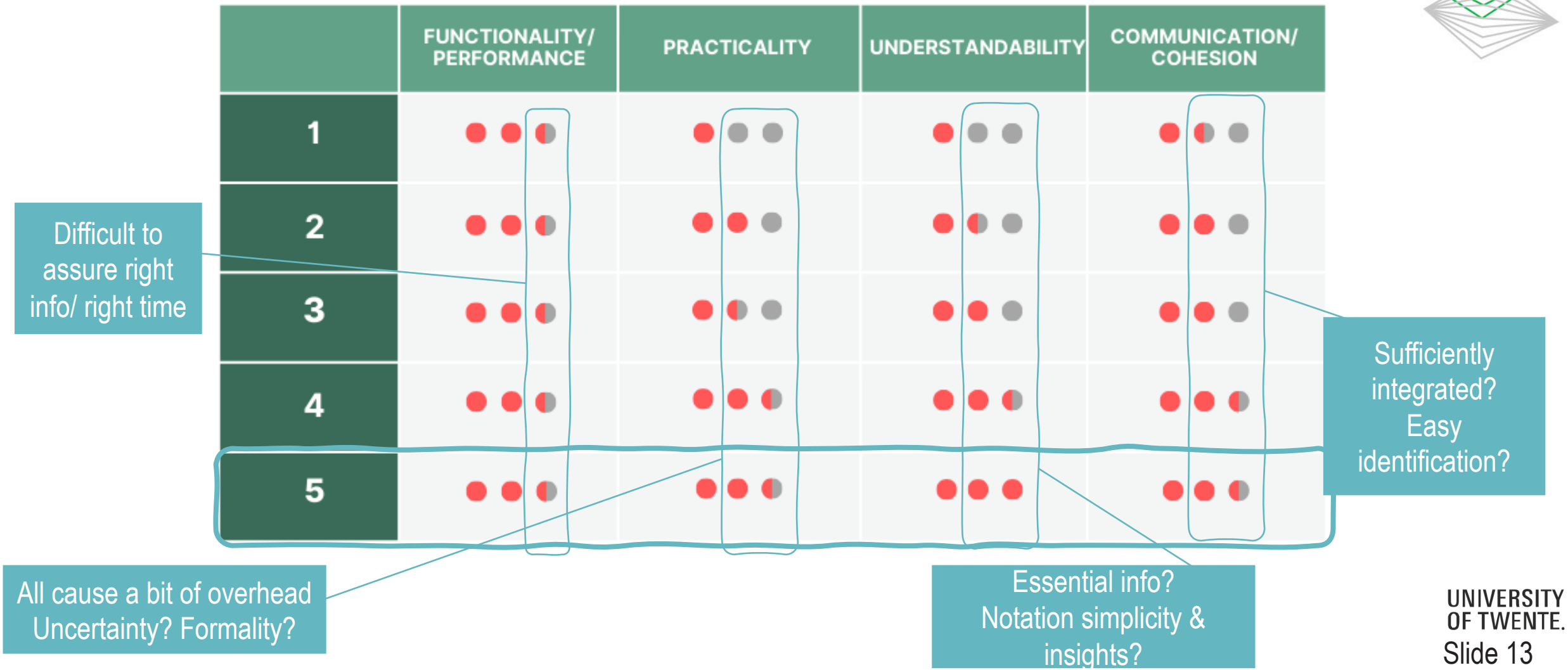
4 Produce support concepts & select final concept

Applied participatory approaches

Design ethnography

Co-design

CONCEPT COMPARISON

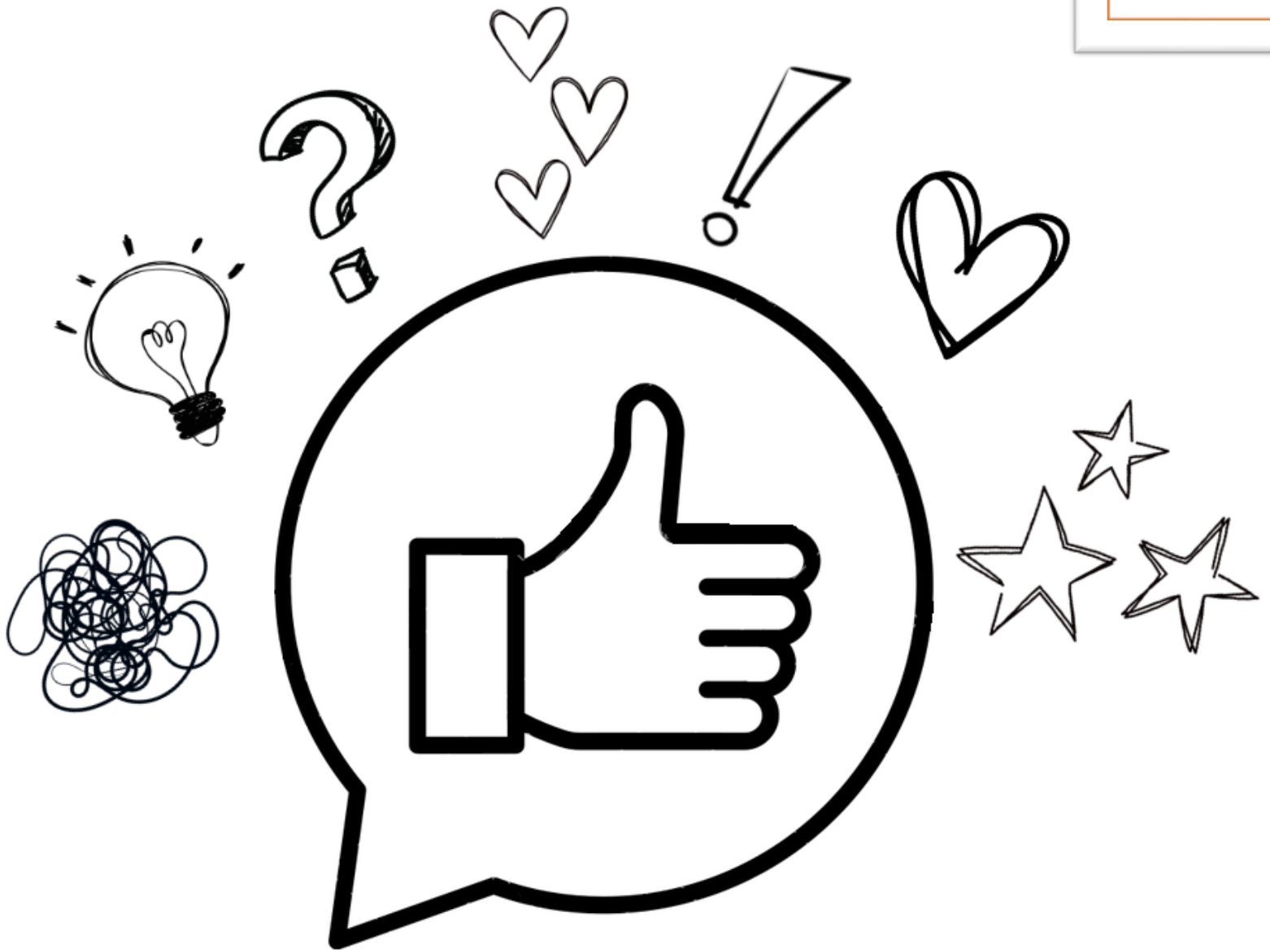


5 Evaluate selected concept

Applied participatory approaches

Interviews

Co-design



DISCUSSION

ALIGNMENT OF PROCESS AND SYSTEM VIEWPOINTS

Value

Effort / overhead

Information overload

DWG Sharing format

Human aspects

Abstraction

Sharing medium

Us vs. Them

DISCUSSION

ALIGNMENT OF PROCESS AND SYSTEM VIEWPOINTS

Complexity demands a new relationship between systems engineers and project managers.

Project Management Institute

INCOSE
International Council on Systems Engineering

DISCUSSION

ALIGNMENT OF PROCESS AND SYSTEM VIEWPOINTS

Relationship to other integrative efforts in systems engineering

	MODEL-BASED	TOOLING-BASED	KNOWLEDGE-BASED	PROCESS-BASED
General concept	Structured "Model-of-everything" suffers from high information density	Can simplify sharing by interoperability Difficult tailoring and long-term sustainability	Support information and knowledge flow Hindered by cognitive, social and technological factors	Formal and flexible procedures and process logic Hindered by changes, uncertainty, and variation
Our concept	Low information density Identifies system-relevant information Graph could link to model-based sources	Tool-agnostic Graph could link to specific tooling environments	Also focused on knolwedge and information management Being lightweight and tool-agnostic might help with barriers	Capture process logic without prescribing it Reflect on decision sequences, highlight uncertainty and changes.

DISCUSSION

IMPLICATIONS OF PARTICIPATORY APPROACHES

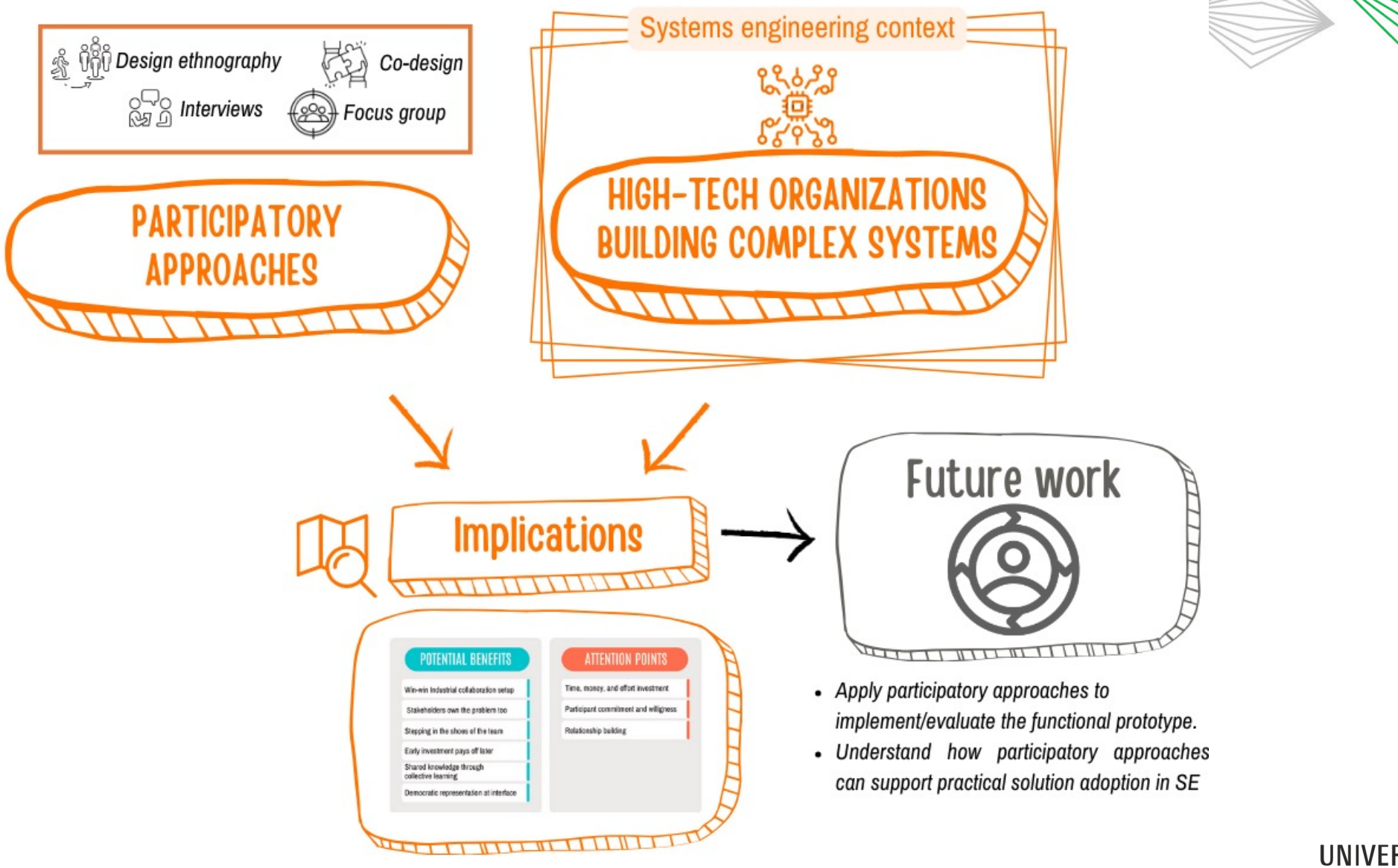
POTENTIAL BENEFITS

- Win-win Industrial collaboration setup
- Stakeholders own the problem too
- Stepping in the shoes of the team
- Early investment pays off later
- Shared knowledge through collective learning
- Democratic representation at interface

ATTENTION POINTS

- Time, money, and effort investment
- Participant commitment and willingness
- Relationship building

CONCLUSIONS AND FUTURE WORK



- *Apply participatory approaches to implement/evaluate the functional prototype.*
- *Understand how participatory approaches can support practical solution adoption in SE*