

# Capability development at the Embedded Systems Institute

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## Abstract

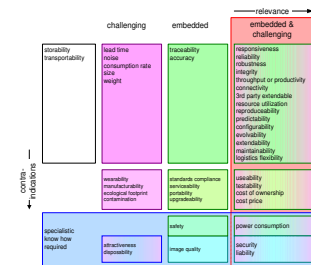
The *systems* discipline is decomposed in views and qualities and complemented with a framework to integrate again. The qualities are taken as starting point to define system design capabilities. These capabilities are analyzed and a set of embedded system capabilities is proposed.

The ESI approach with projects and capabilities is described. The contribution of ESI is explained. Some background is provided about the technology management and research method aspects.

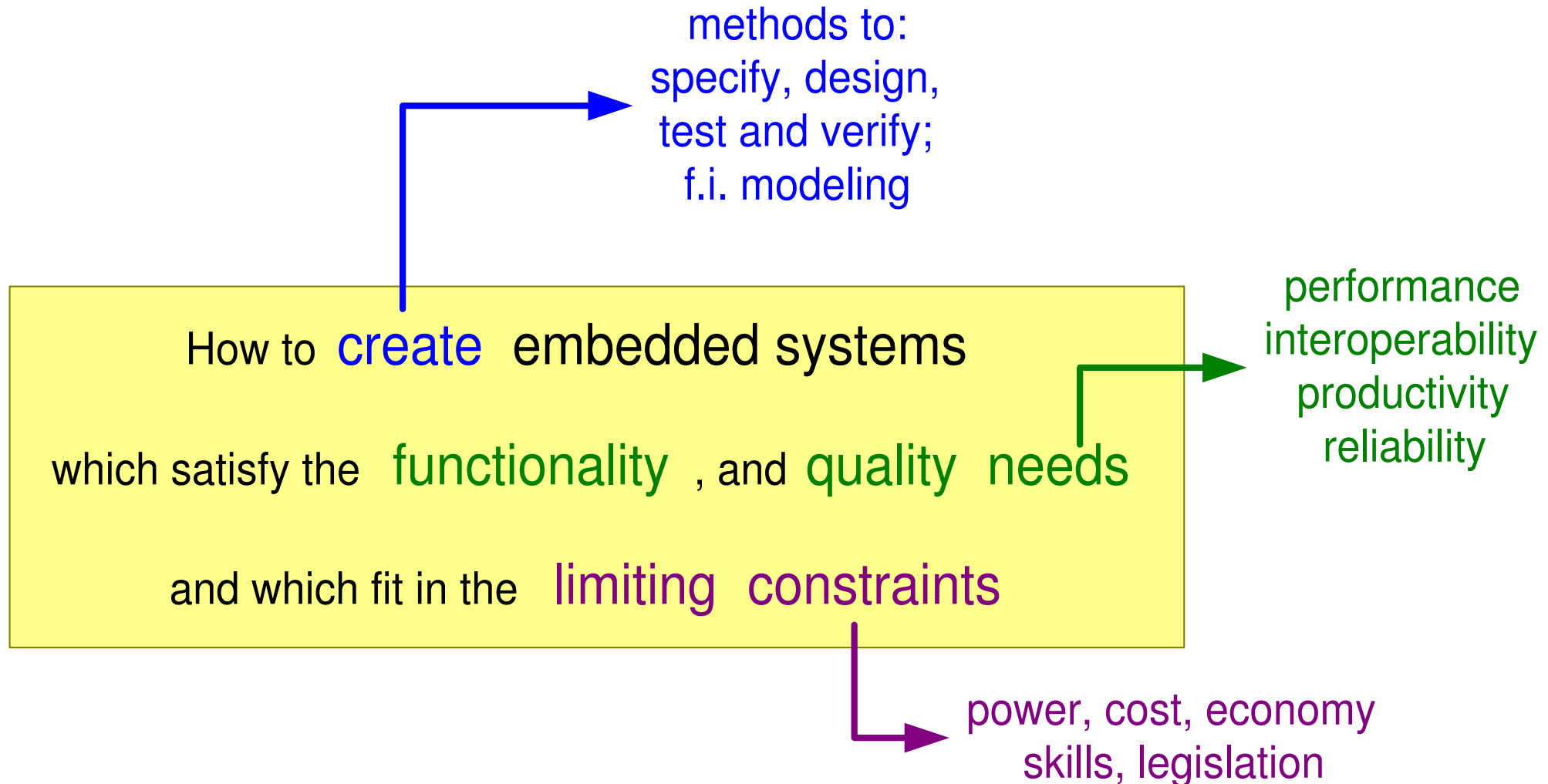
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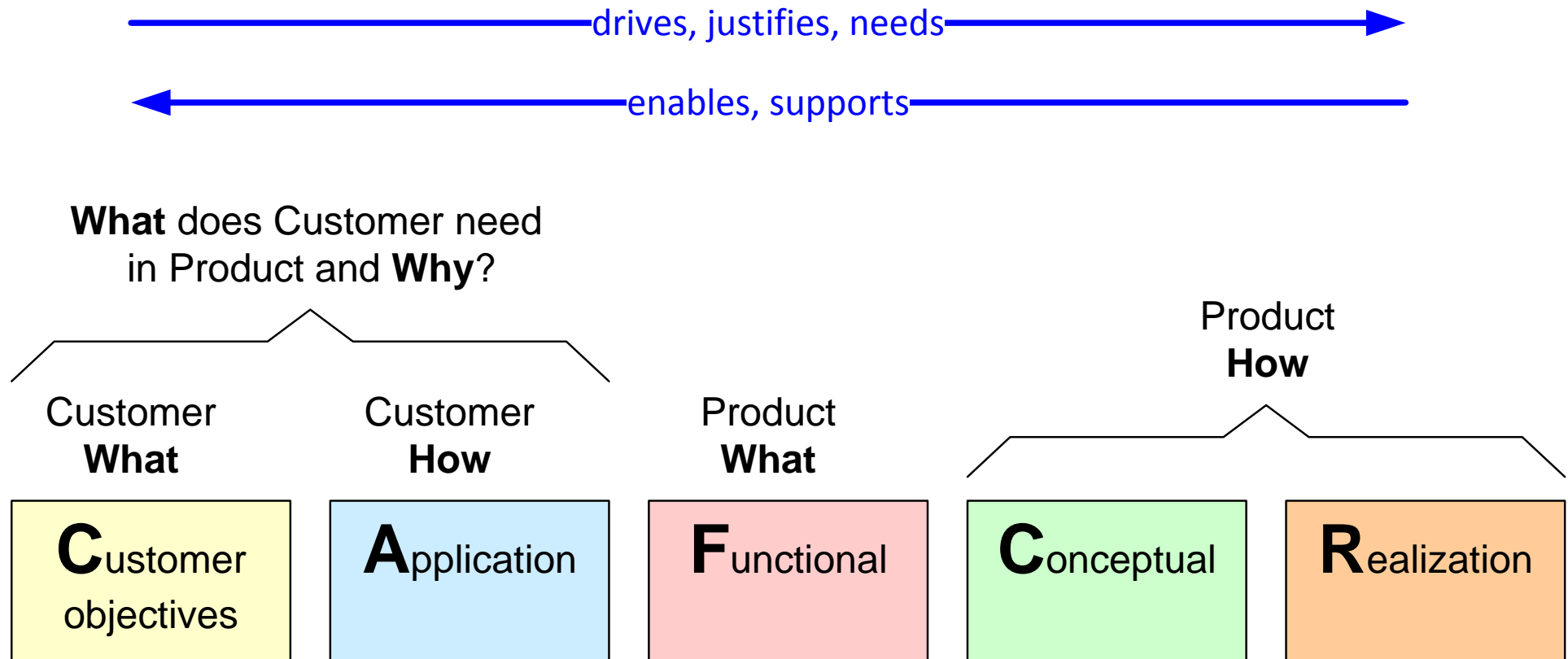
June 5, 2018  
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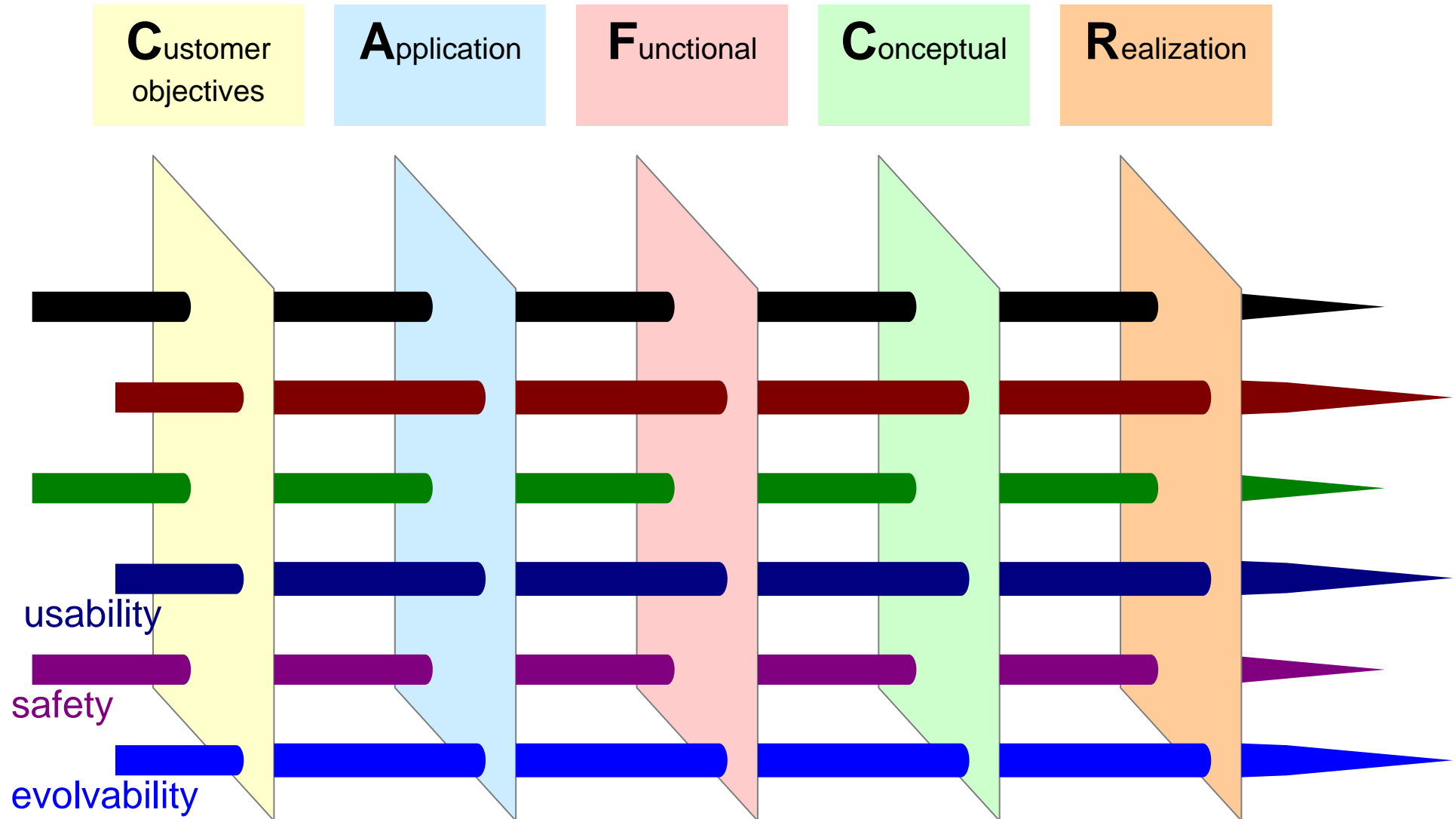
# Role of Embedded Systems Institute ESI



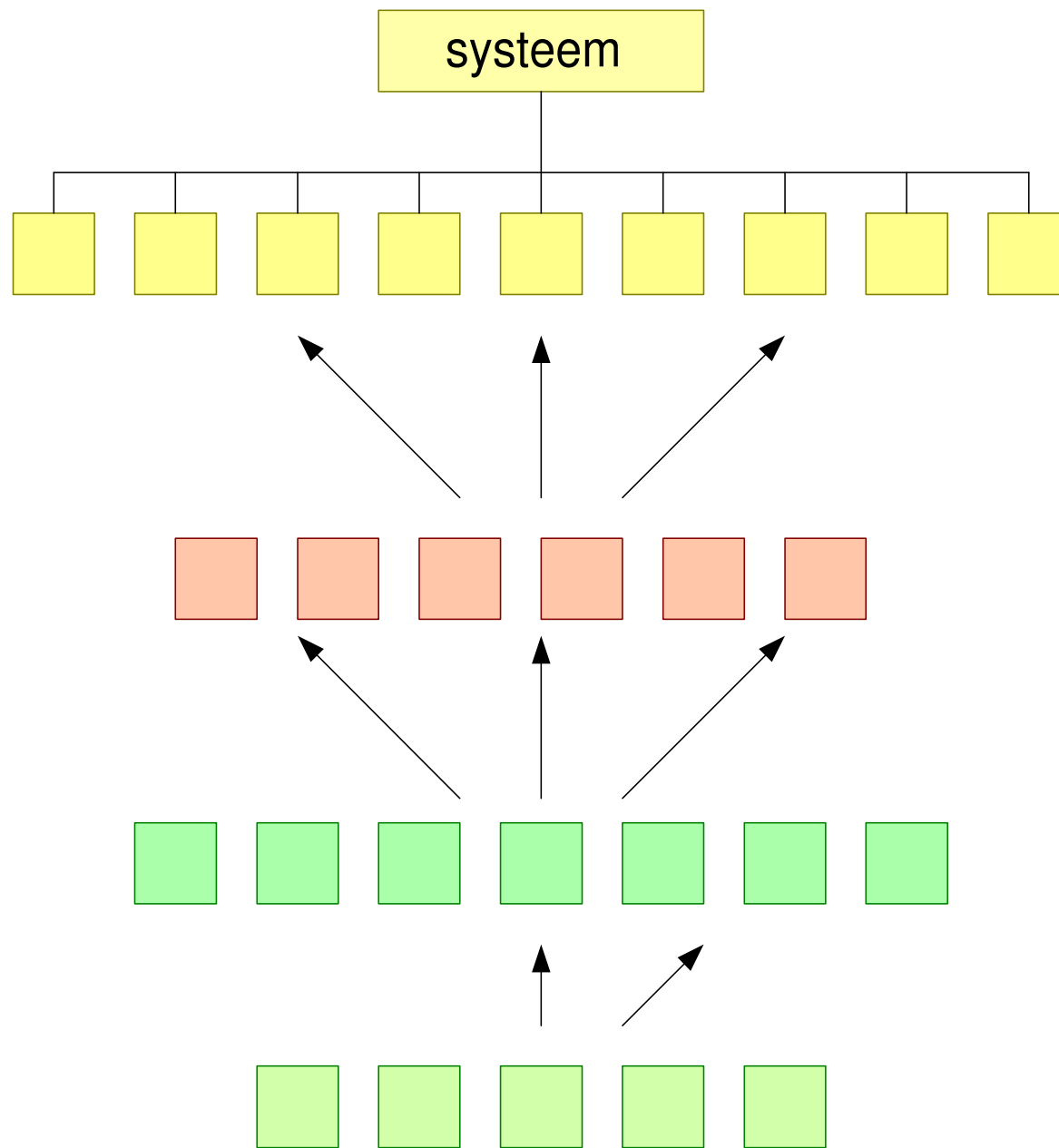
# The "CAFCR" model



# Qualities as basis for capabilities



# Multi Disciplinary Builds on Mono Disciplinary



system

↓ *has attributes*

qualities

↓ *designed by emerging from*

multi disciplinary design methods

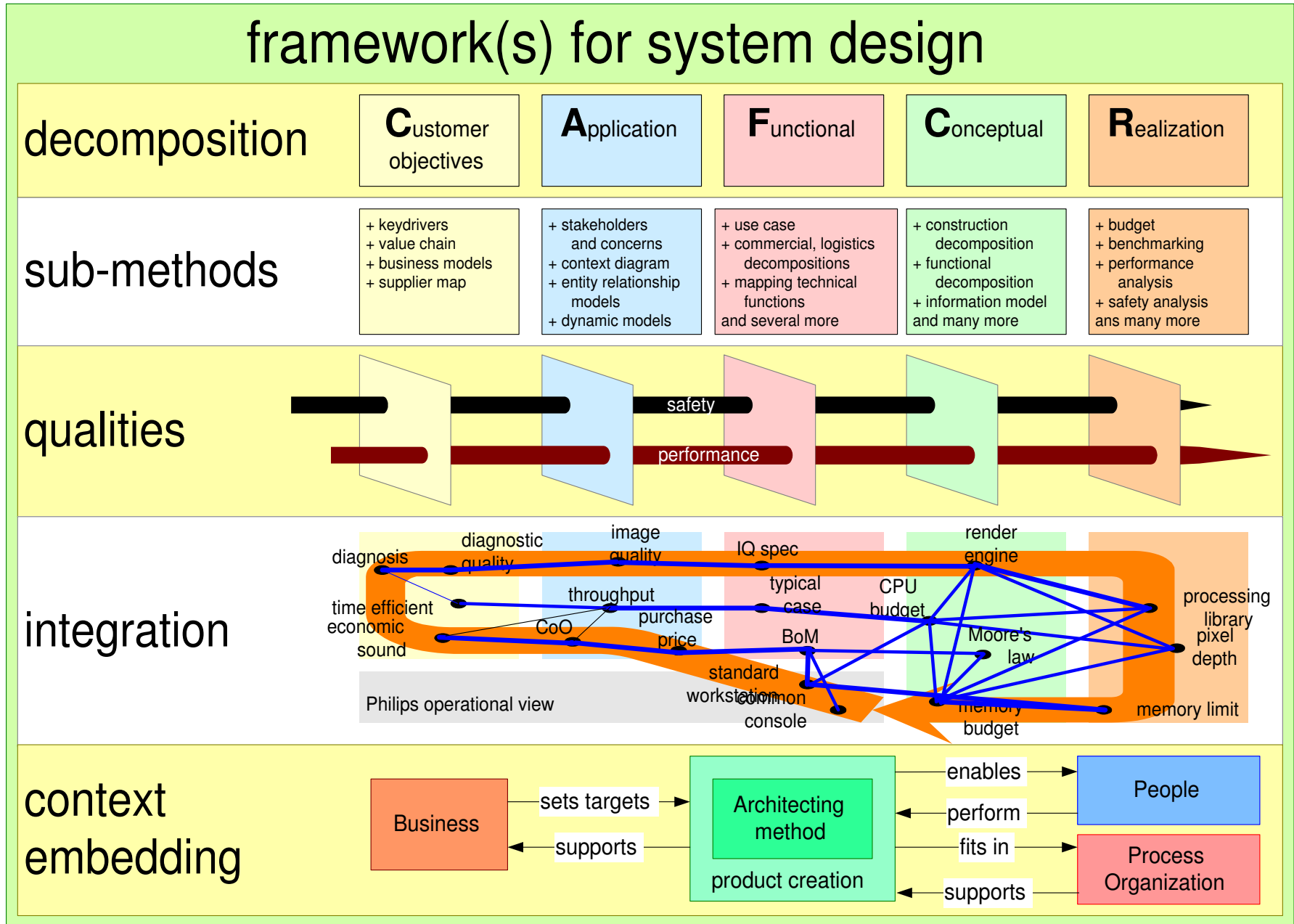
↓ *builds on top of*

mono disciplinary design methods

↓ *unlocks potential of*

technologies

# Overview of methods in relation with context



# Checklist of system qualities

---

## usable

usability  
attractiveness  
responsiveness  
image quality  
wearability  
storability  
transportability

## dependable

safety  
security  
reliability  
robustness  
integrity  
availability

## effective

throughput or  
productivity

## interoperable

connectivity  
3<sup>rd</sup> party extendible

## liable

liability  
testability  
traceability  
standards compliance

## efficient

resource utilization  
cost of ownership

## consistent

reproducibility  
predictability

## serviceable

serviceability  
configurability  
installability

## future proof

evolvability  
portability  
upgradeability  
extendibility  
maintainability

## logistics friendly

manufacturability  
logistics flexibility  
lead time

## ecological

ecological footprint  
contamination  
noise  
disposability

## down to earth attributes

cost price  
power consumption  
consumption rate  
(water, air,  
chemicals,  
et cetera)  
size, weight  
accuracy

# Domain specific aspects

## usable

- useability
- attractiveness
- responsiveness
- image quality
- wearability
- storability
- transportability

## reliable

- safety
- security
- reliability
- robustness
- integrity

## effective

- throughput or productivity

## interoperable

- connectivity
- 3<sup>rd</sup> party extendable

## liable

- liability
- testability
- traceability
- standards compliance

## efficient

- resource utilization
- cost of ownership

## consistent

- reproduceability
- predictability

## serviceable

- serviceability
- configurability
- installability

## future proof

- evolvability
- portability
- upgradeability
- extendability
- maintainability

## logistics friendly

- manufacturability
- logistics flexibility
- lead time

## ecological

- ecological footprint
- contamination
- noise
- disposability

## down to earth attributes

- cost price
- power consumption
- consumption rate  
(water, air, chemicals, etcetera)
- size, weight
- accuracy



# Preferred profile for ESI capabilities

domain specific

embedded  
(software intensive, electronics)

process, organisation, soft skills

specialistic

challenging

preferred profile:



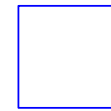
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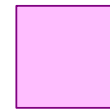
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2

# Ranking of all criteria

## usable

useability  
attractiveness  
responsiveness  
image quality  
wearability  
storability  
transportability

## reliable

safety  
security  
reliability  
robustness  
integrity

## effective

throughput or  
productivity

## interoperable

connectivity  
3<sup>rd</sup> party extendable

## liable

liability  
testability  
traceability  
standards compliance

## efficient

resource utilization  
cost of ownership

## consistent

reproduceability  
predictability

## serviceable

serviceability  
configurability  
installability

## future proof

evolvability  
portability  
upgradeability  
extendability  
maintainability

## logistics friendly

manufacturability  
logistics flexibility  
lead time

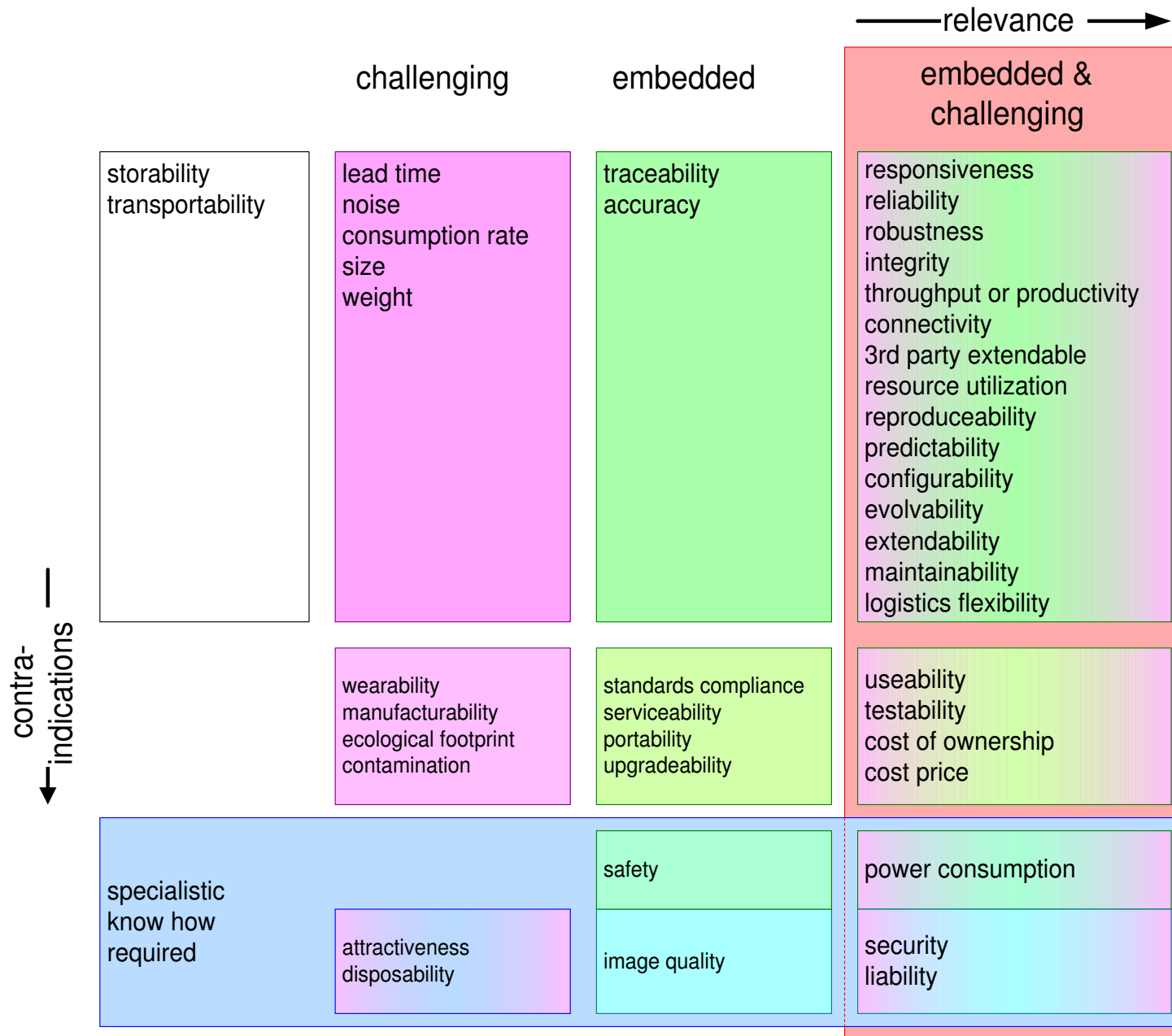
## ecological

ecological footprint  
contamination  
noise  
disposability

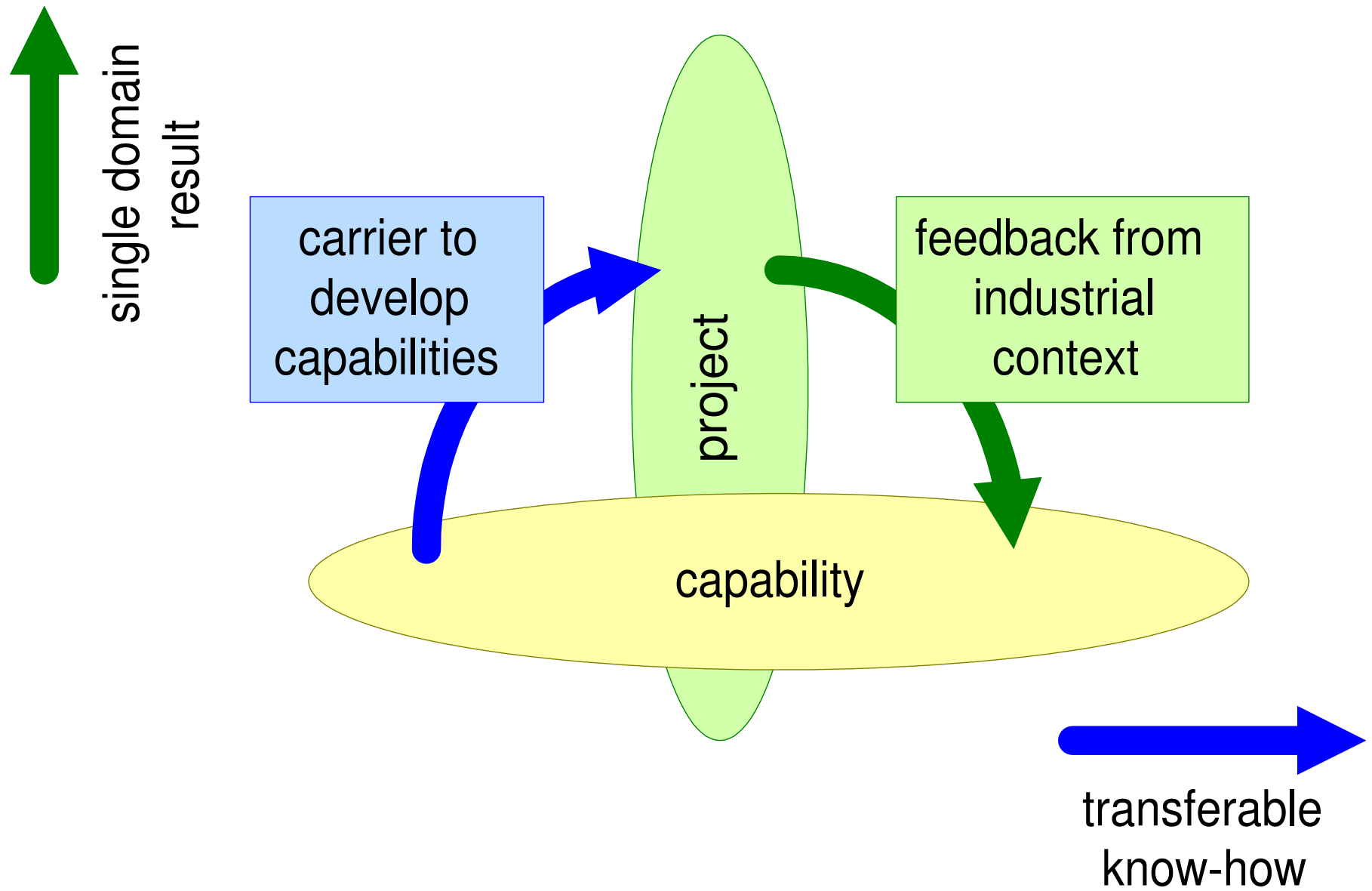
## down to earth attributes

cost price  
power consumption  
consumption rate  
(water, air,  
chemicals,  
etcetera)  
size, weight  
accuracy

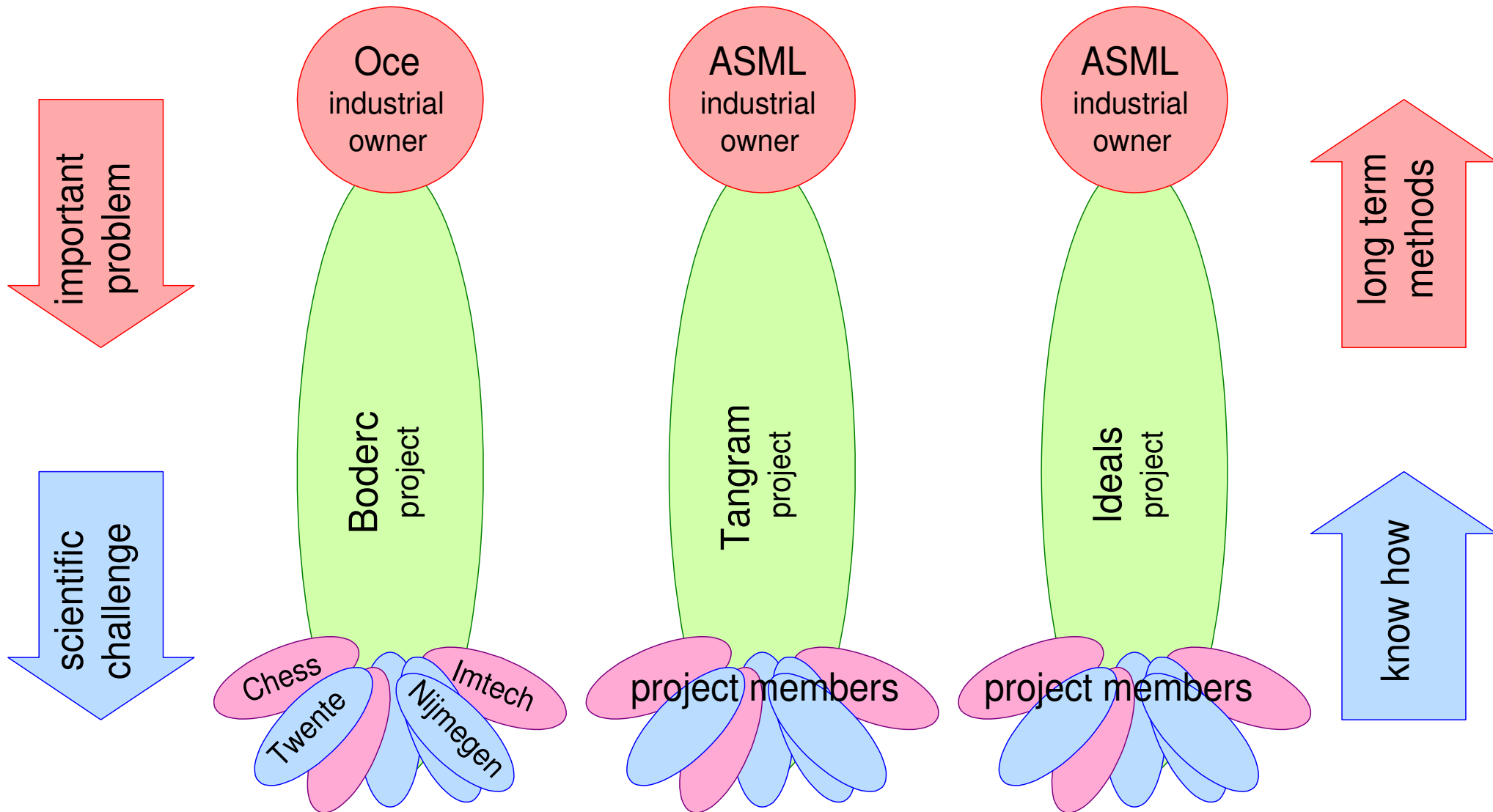
# Relevance for ESI quality map



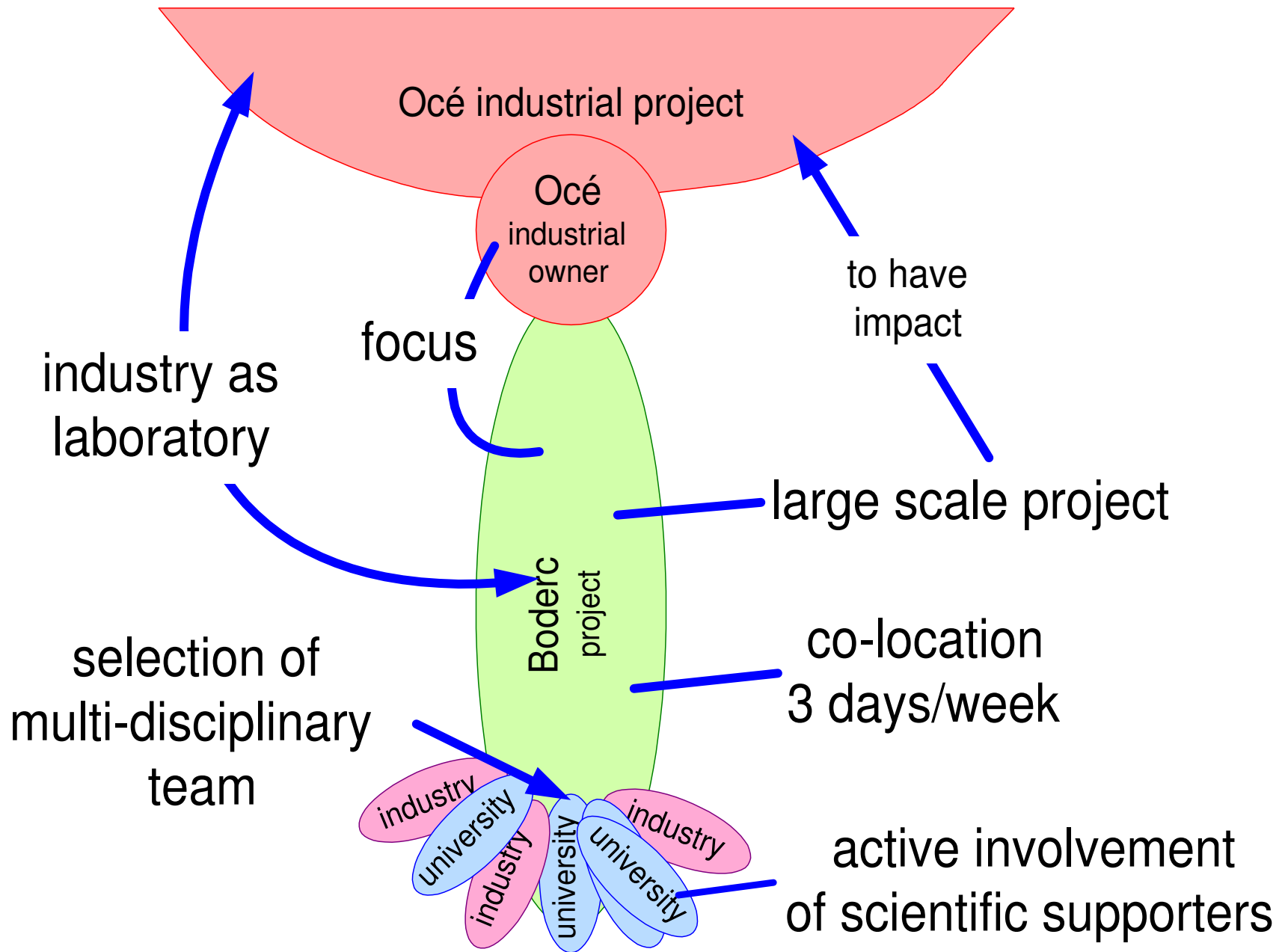
# Project as carrier for capability development



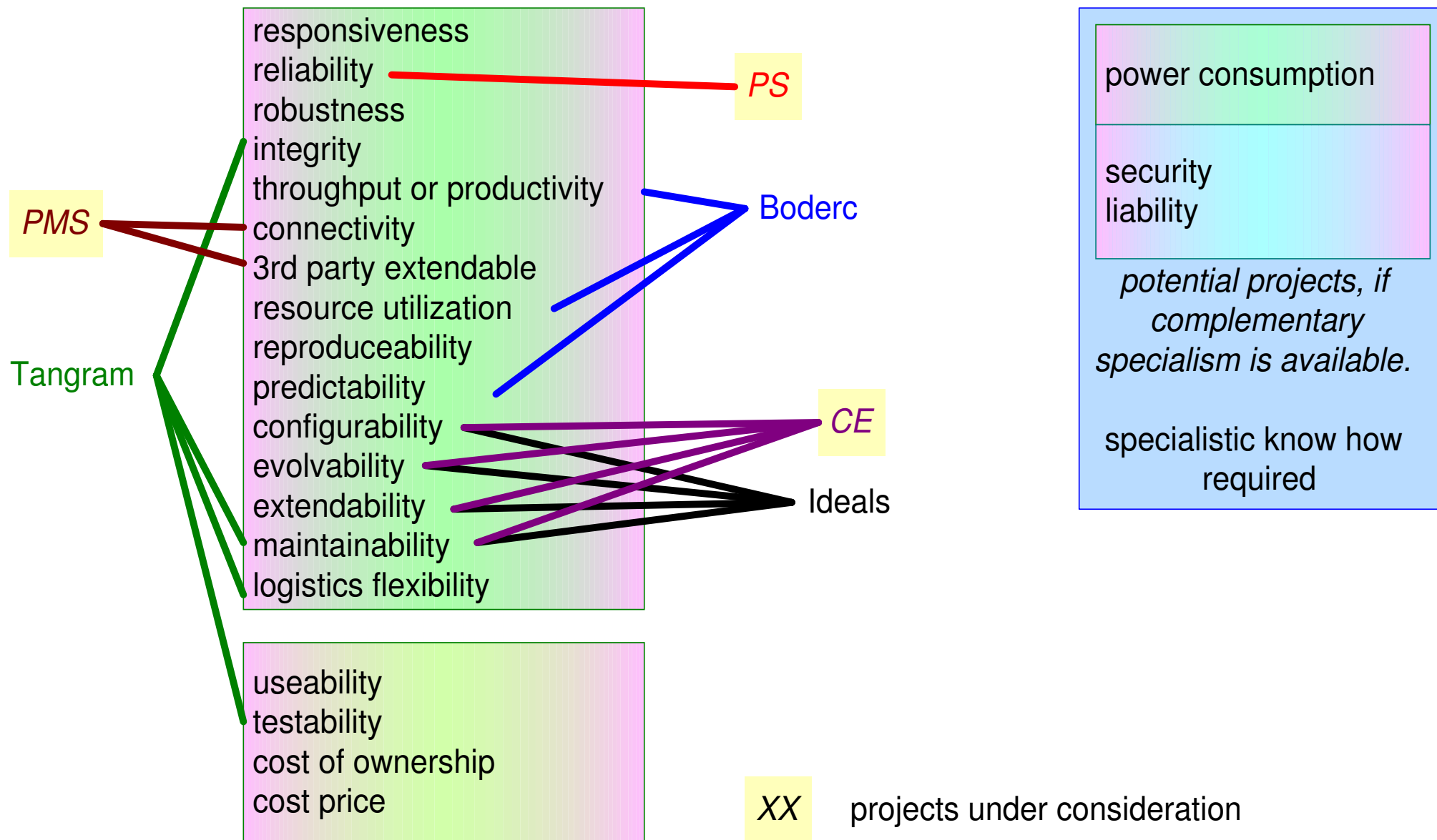
# ESI project approach



# Critical Success Factors for projects



# Mapping of capabilities to projects



# Role of Embedded Systems Institute 2

project management  
capability coaching  
facilitation

knowledge exchange  
administration  
housing  
means, tools

project

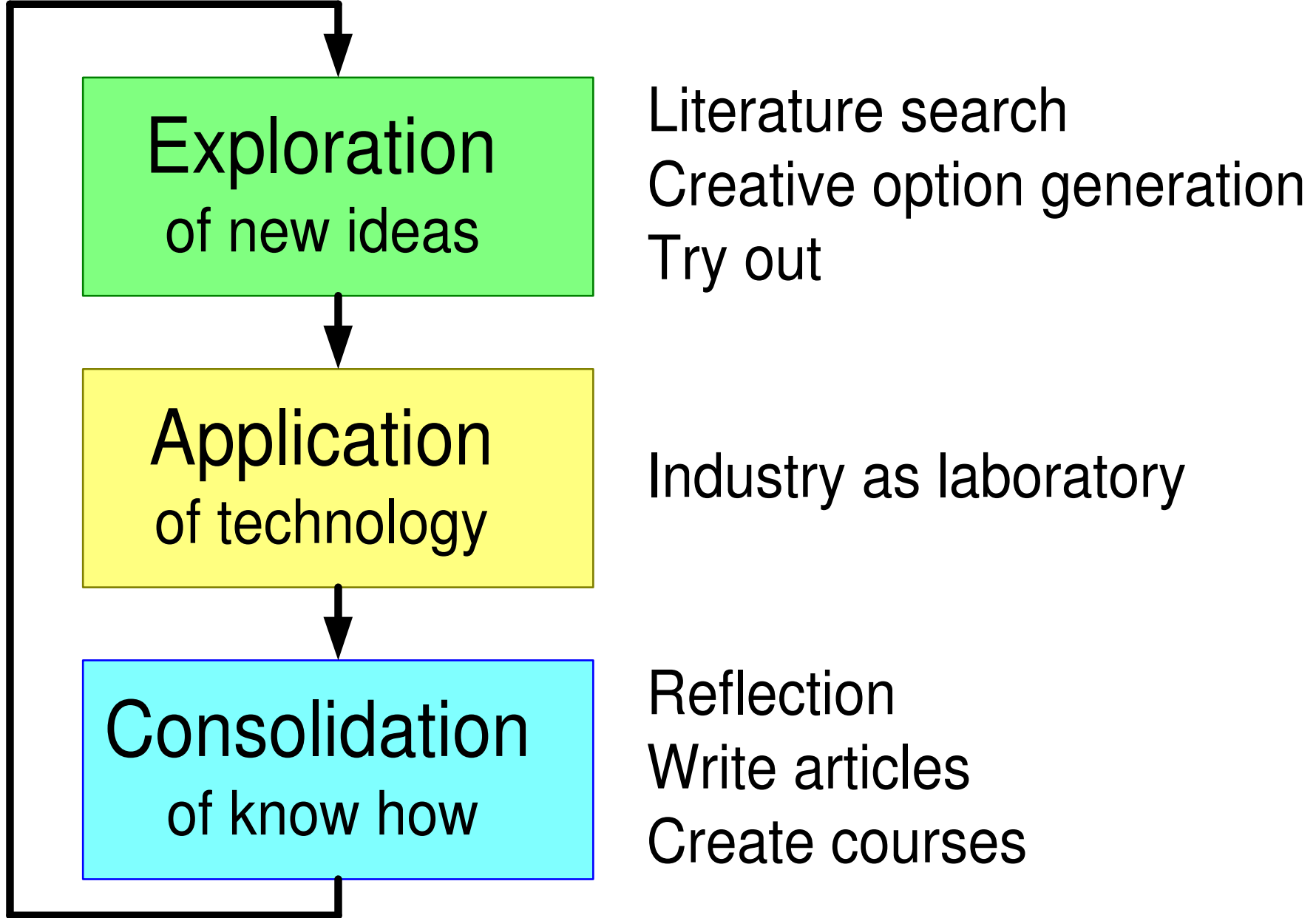
capability

project initiation  
knowledge consolidation  
facilitation

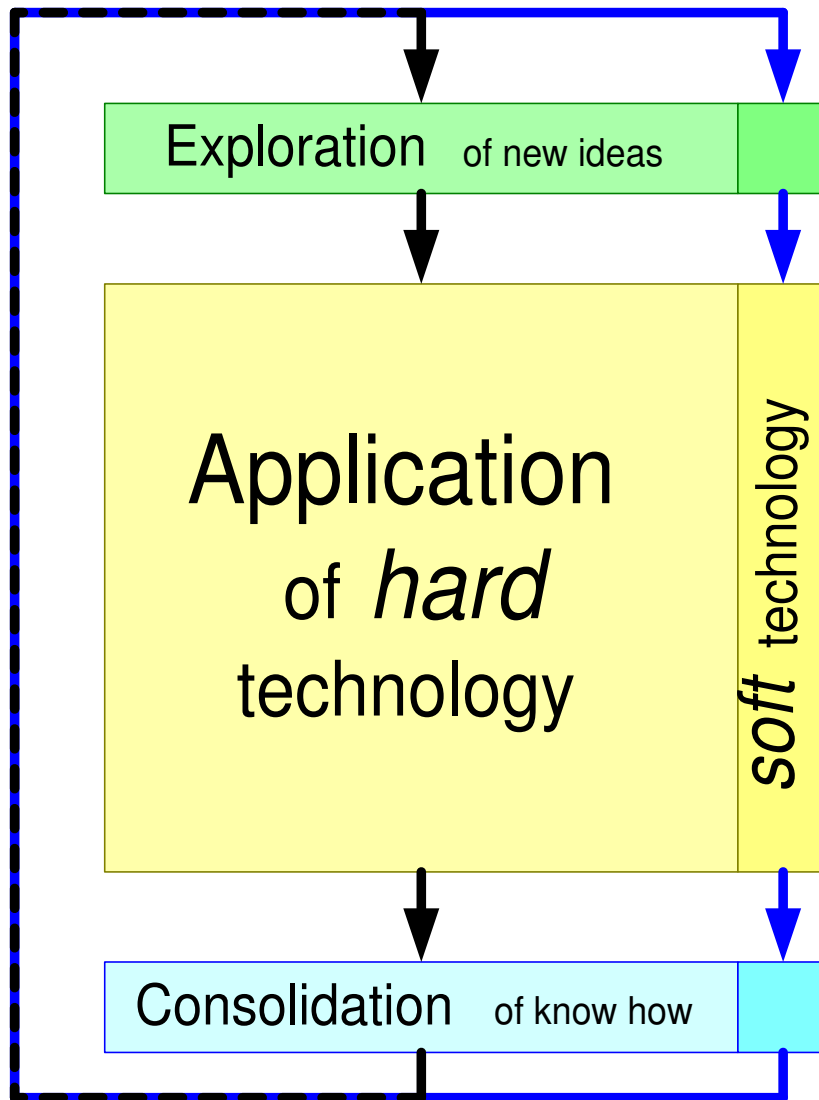
knowledge management  
knowledge transfer  
general management



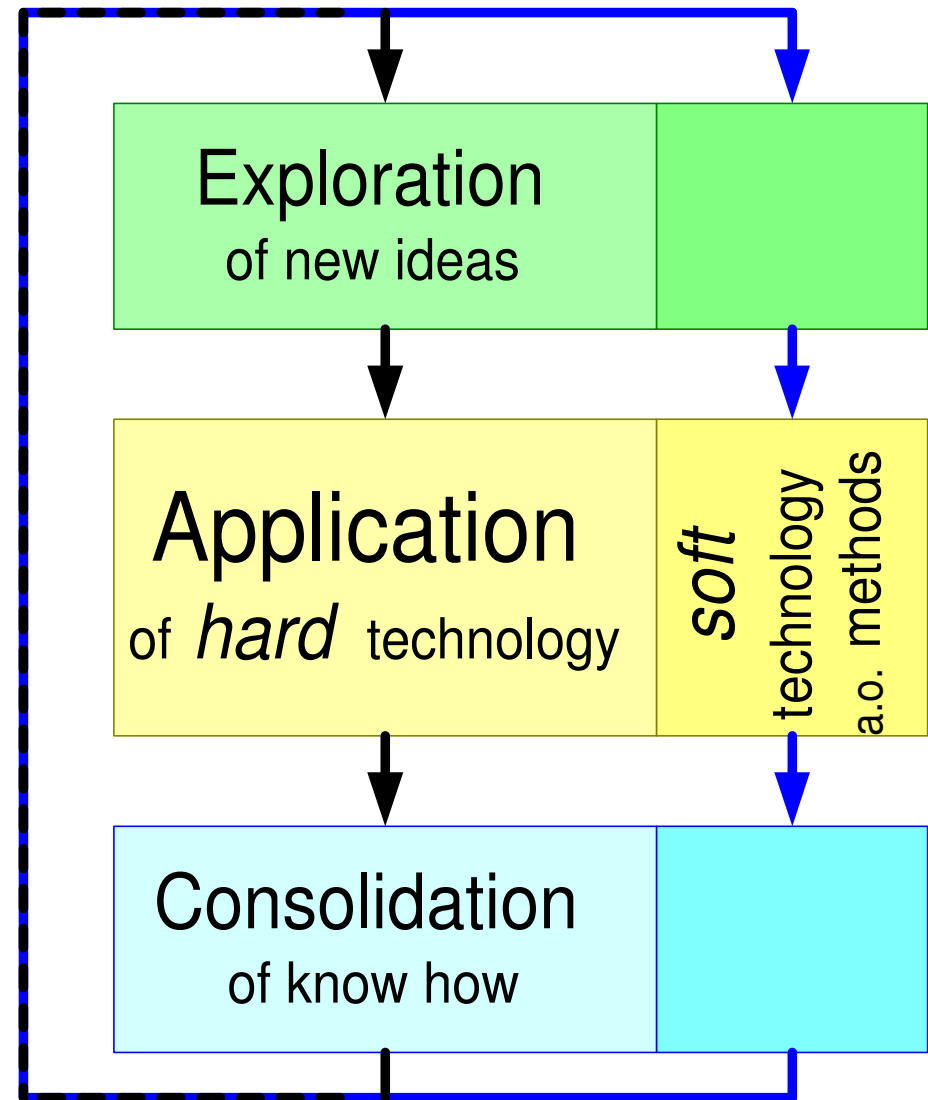
# Technology Management Cycle



# Industry as laboratory

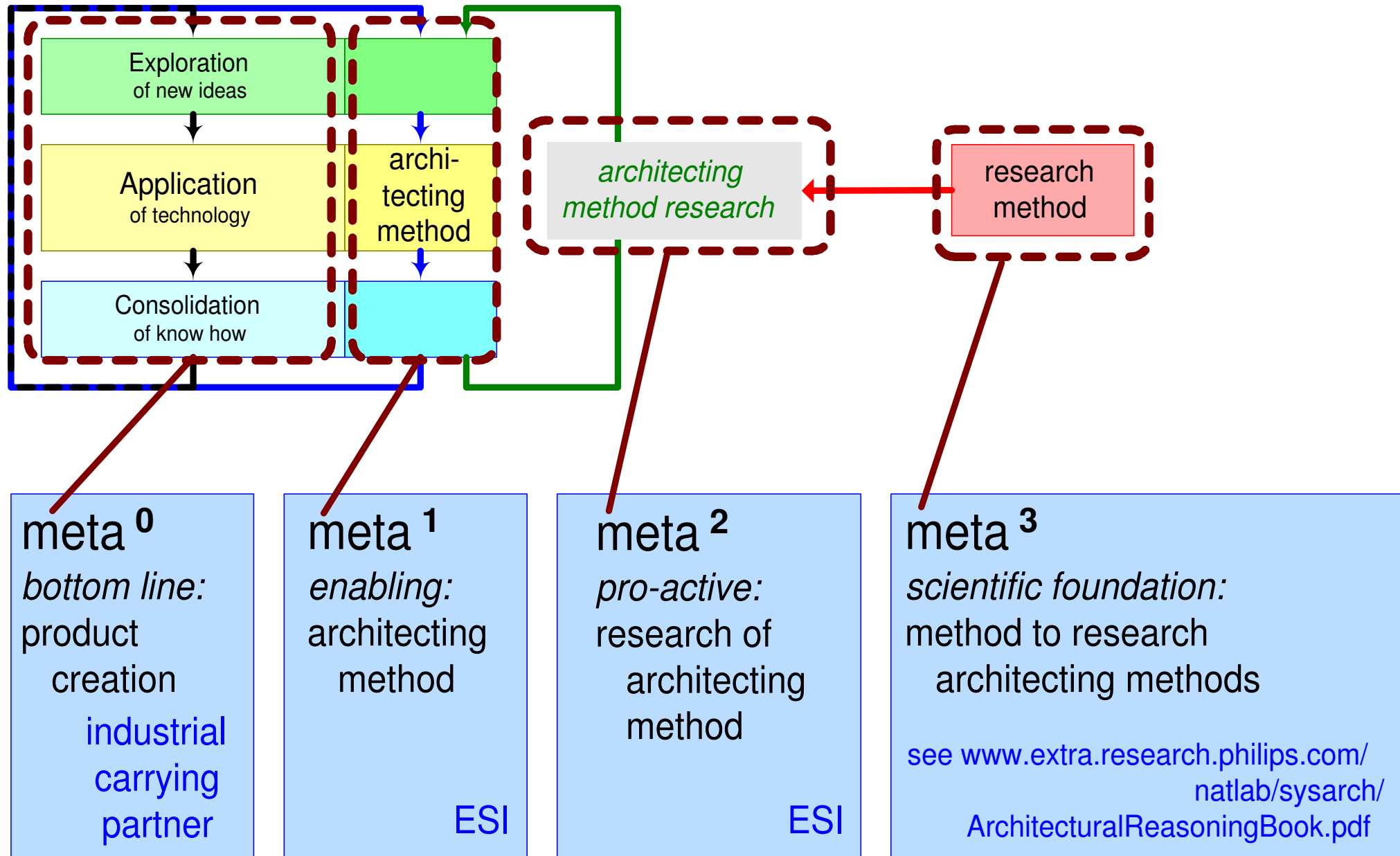


## Product Development

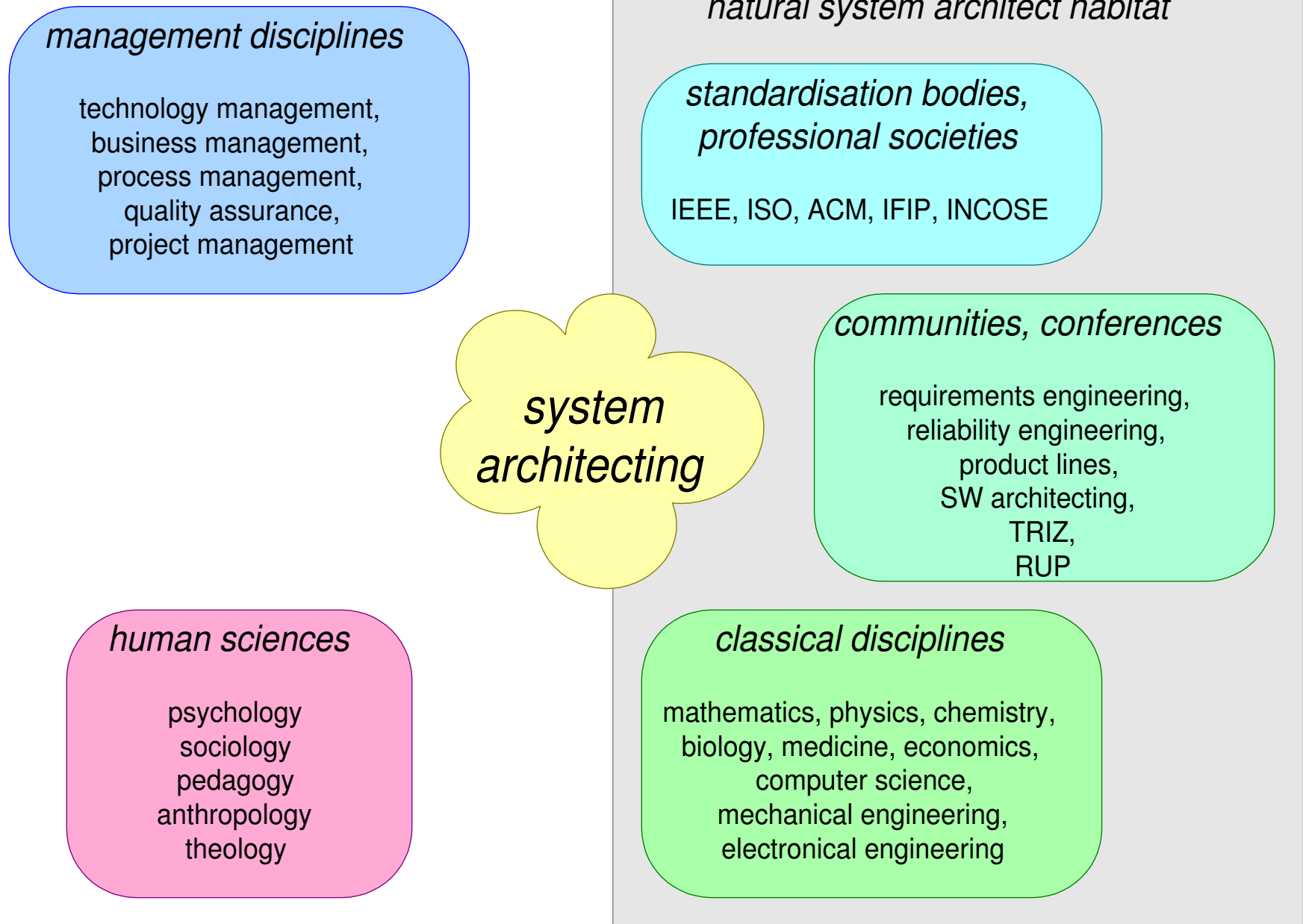


## Research

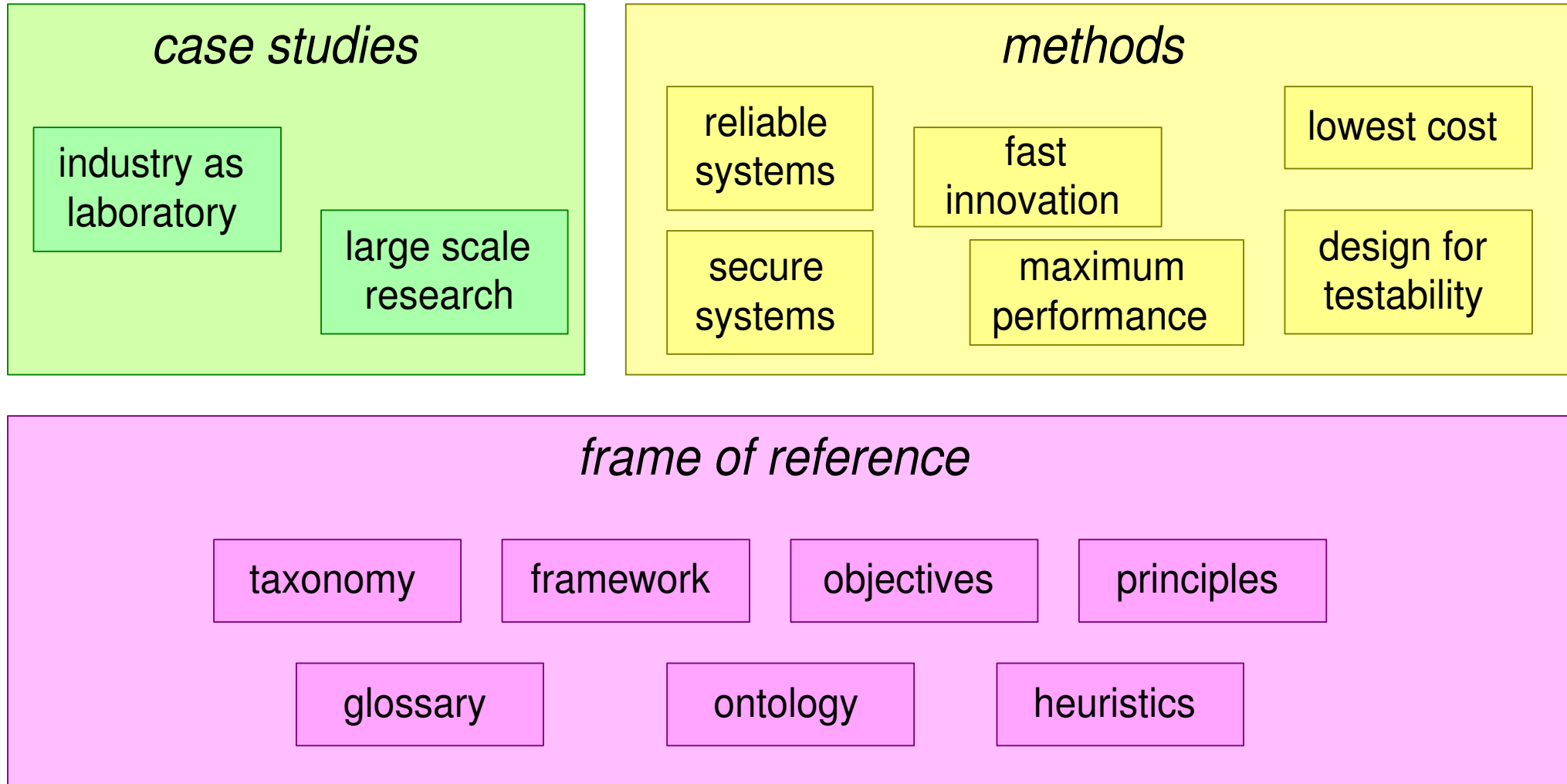
# Moving in the *meta* direction



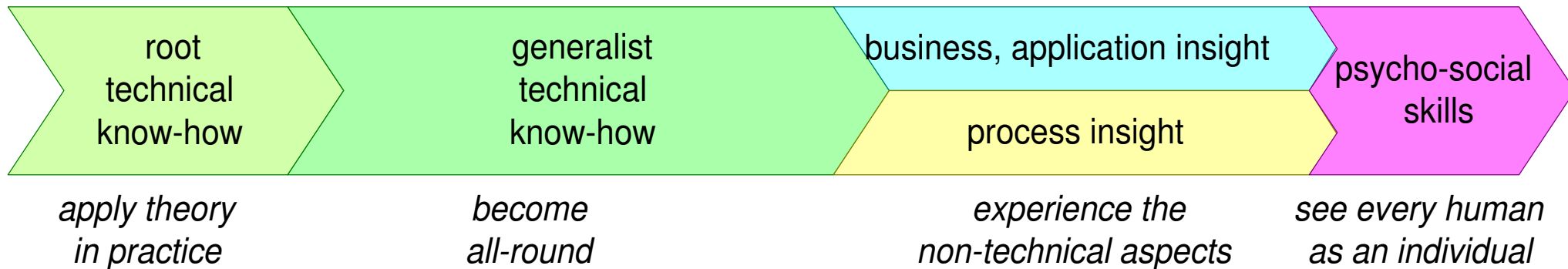
# The context of architecting



# System architecting research: to do



# Curriculum system architecting



## architecture school

