Industry as Laboratory Research

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Abstract

Research in Systems Engineering should help organizations to create systems more effectively en efficiently. The research also establishes and extends the body of knowledge in Systems Engineering. However, research in Systems Engineering requires an appropriate environment, where real challenges and constraints are present. We explain how Research as Laboratory provides an opportunity to research Systems Engineering.

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logo
TBD

Why SE research?

To improve the Systems Engineering competence

by researching methods, techniques, formalisms, and tools

    (the means how to do Systems Engineering),

and by researching models, constructs, and patterns

    (multi-disciplinary technology).

To facilitate organizations to engineer systems more *effectively*

    (e.g. faster, more application value, higher performance,

    higher quality, lower cost of ownership)

and more *efficiently* (less resources, less cost).

USN ESI

SE = Hard + Soft Competence

Effectiveness and efficiency depends on:

technology and

technical means

organizational, social, cultural, psychological factors

project management

marketing management

business management

Systems engineering combines

hard (e.g. technical) and

soft (human related) competences

USN ESI

Size and Heterogenity

Effectiveness and efficiency suffers from:

combination of many different technologies

software, hardware (virtual, physical)

analog, digital

material, thermal, acoustic, production, et cetera properties

modern systems can
contain hundreds
of technologies

combination of many different people

technical disciplines

business disciplines

operational stakeholders

modern organizations can have
hundreds of employees
and suppliers

Systems engineering adresses the complexity introduced by

size and *heterogeneity*

both technical as well as organizational

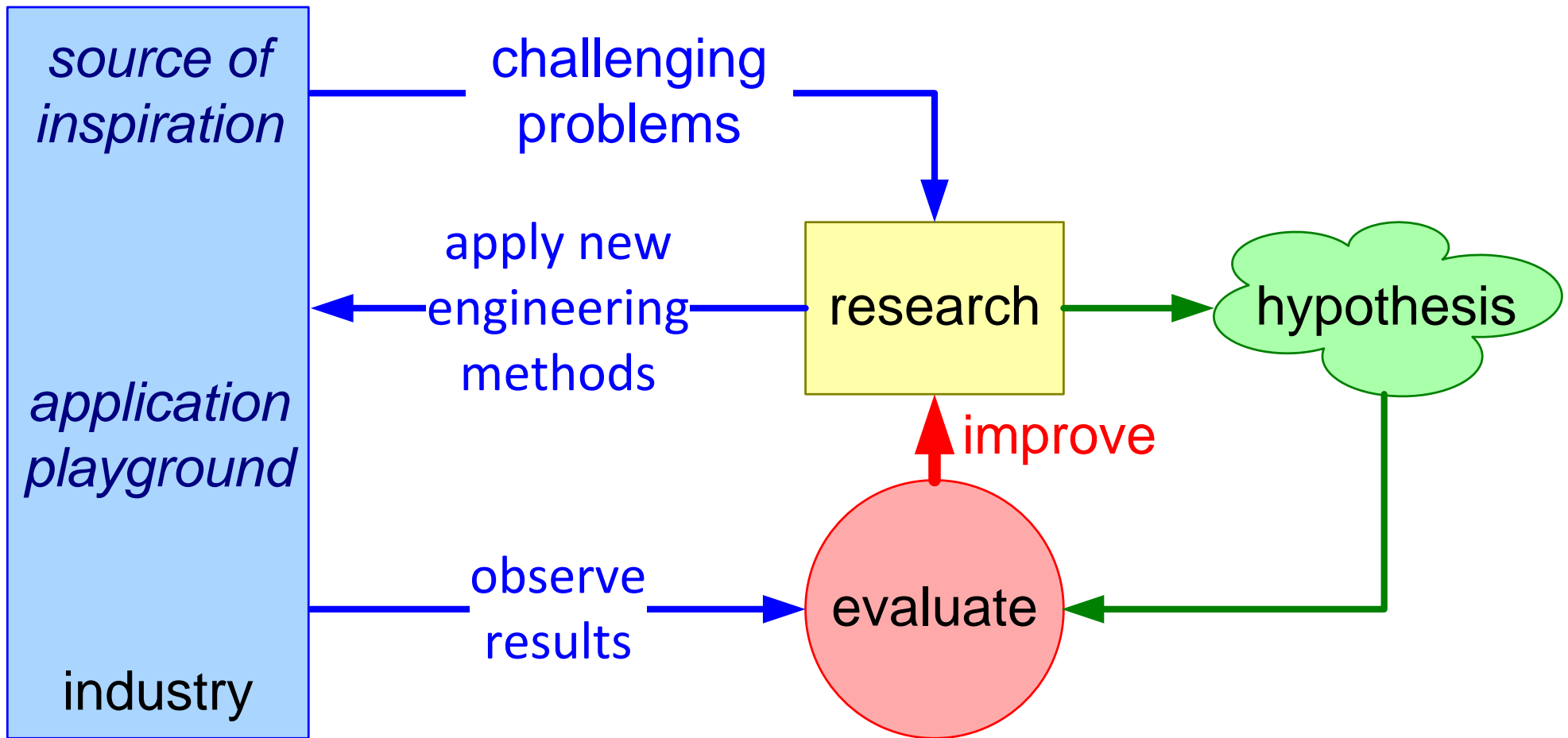USN ESI

Effectiveness and efficiency depends on:
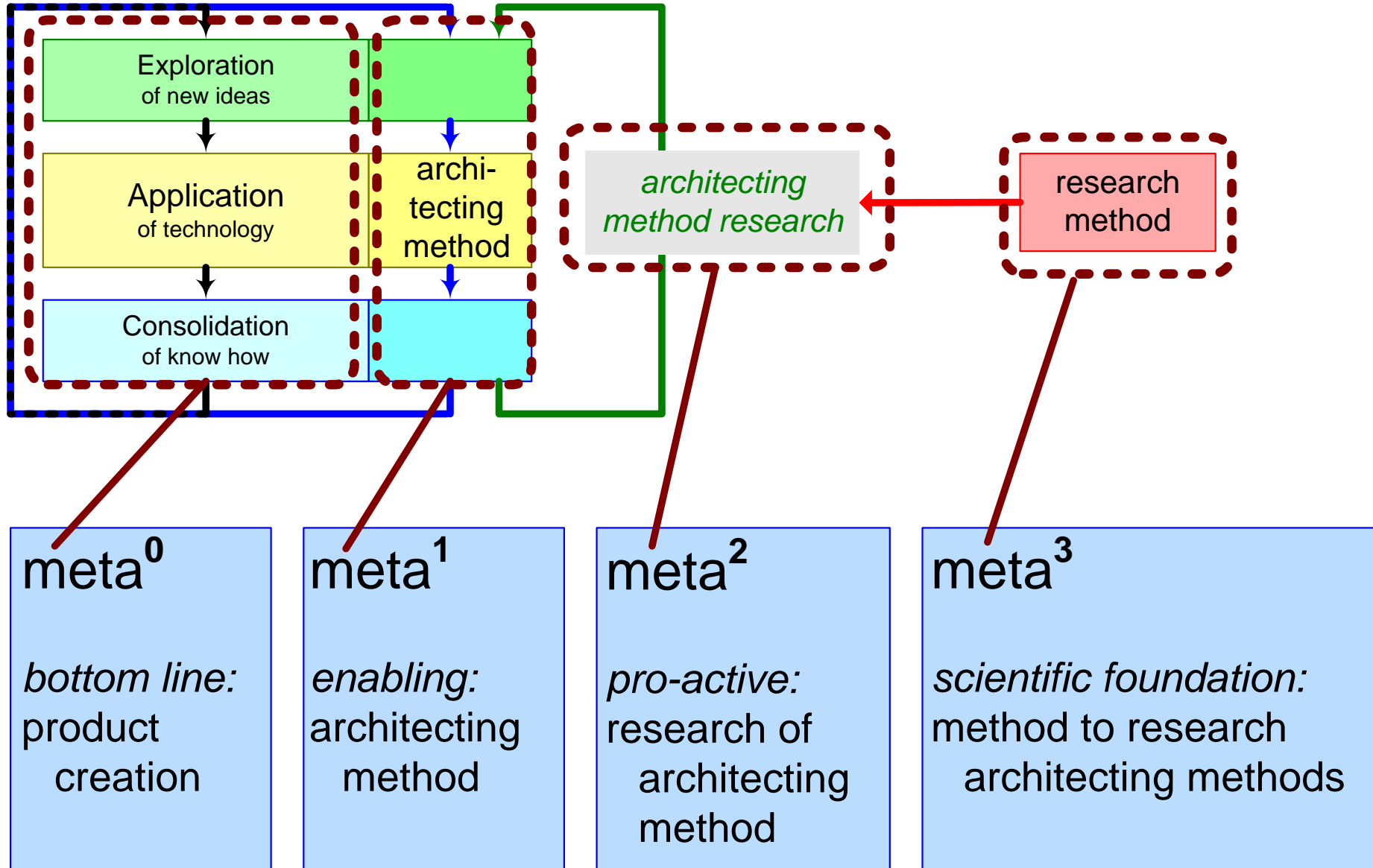
technology and

technical means

organizational, social, cultural, psychological factors

project management

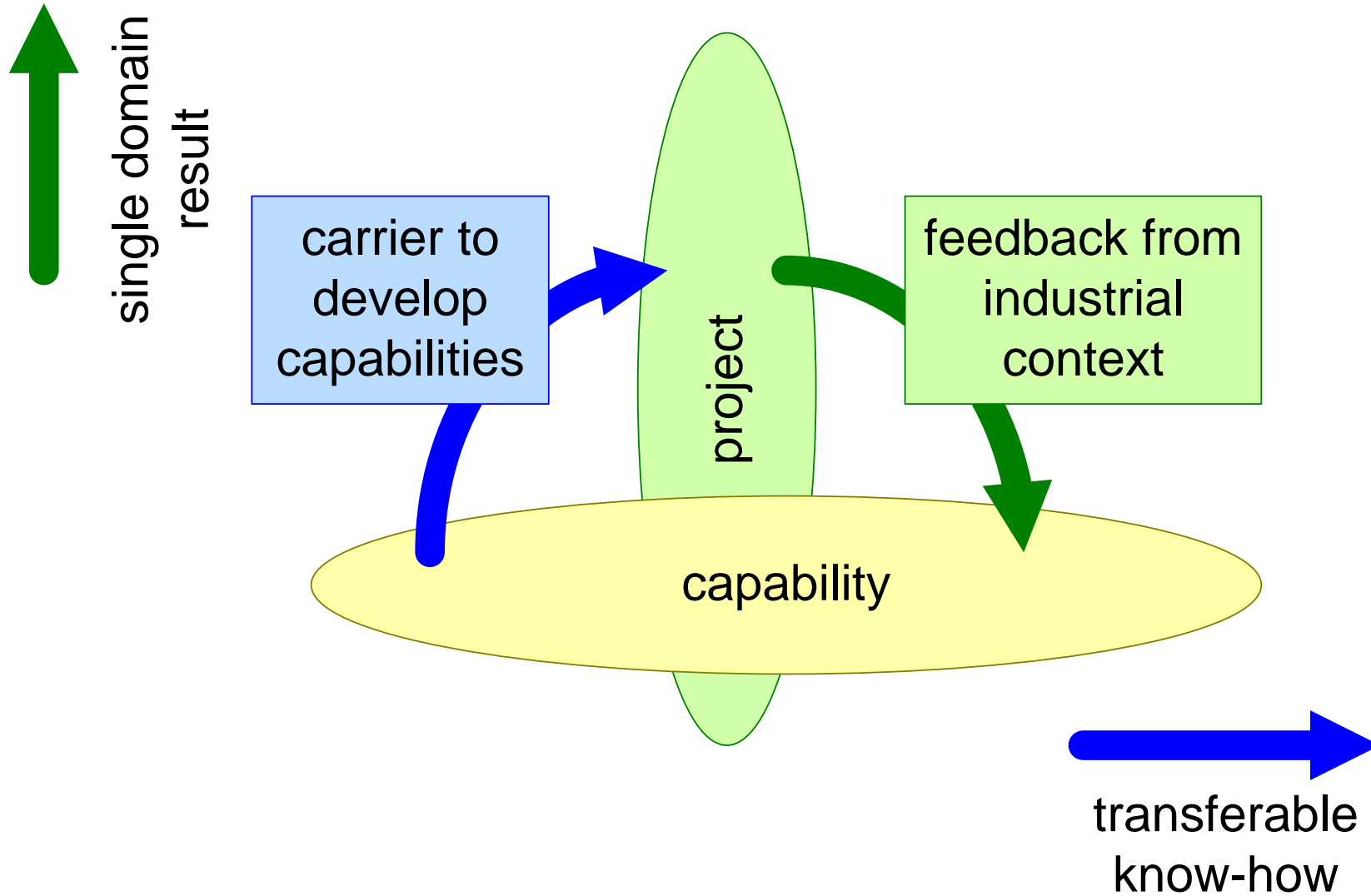marketing management

business management

Systems engineering combines

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SE Research Stakeholders and Concerns

funding agencies	proposal quality fit in political and national agenda
industry	customer: value from applicable results partner: sensible and responsible use of provided resources and facilities
researchers	academics: recognition through publications environment that facilitates research and validation
research institute	industrial appreciation academic respect cohesive program global identity

USN ESI

meta^0

bottom line:
product
creation

meta^1

enabling:
architecting
method

meta^2

pro-active:
research of
architecting
method

meta^3

scientific foundation:
method to research
architecting methods

Boxes in figure: Exploration of new ideas; Application of technology; Consolidation of know how; archi-tecting method; architecting method research; research method

USN   ESI

single domain result

carrier to develop capabilities

project

feedback from industrial context

capability

transferable know-how

USN ESI

intended dissemination and research partners

Kongsberg Industry Domains

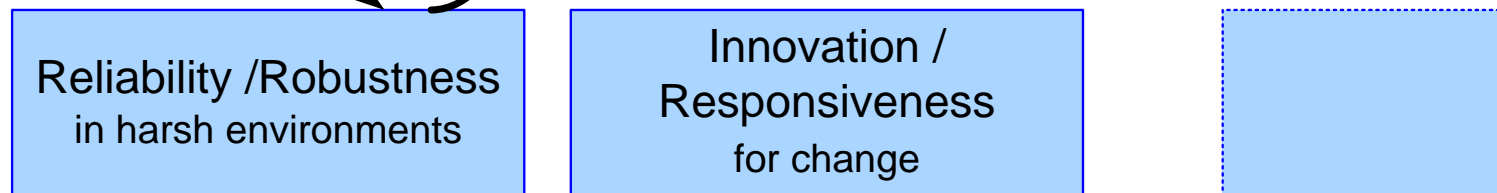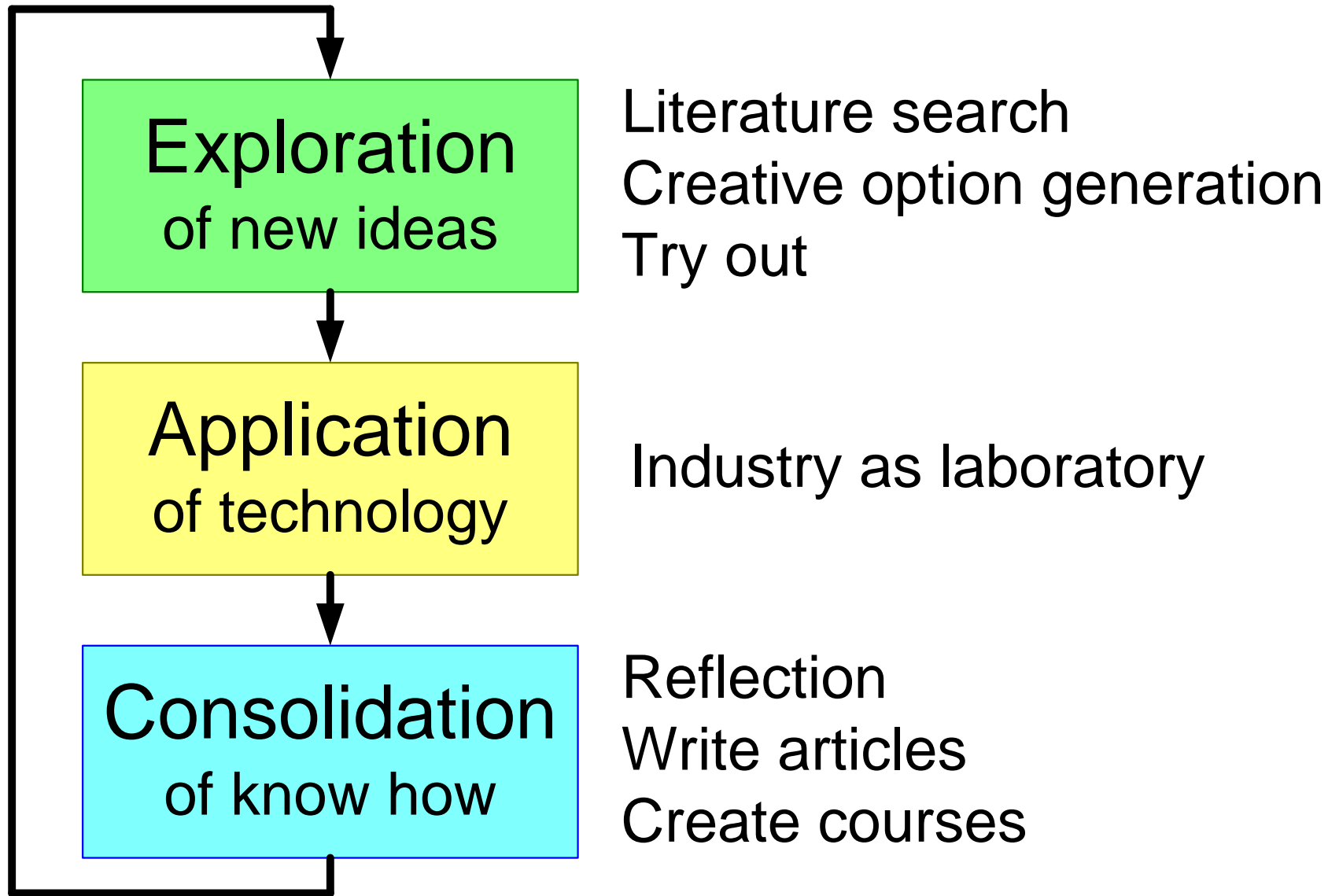| SubSea | Defence | Manufacturing | Maritime |

generalization and consolidation to facilitate use in other domains

single domain research focus on industrial problem
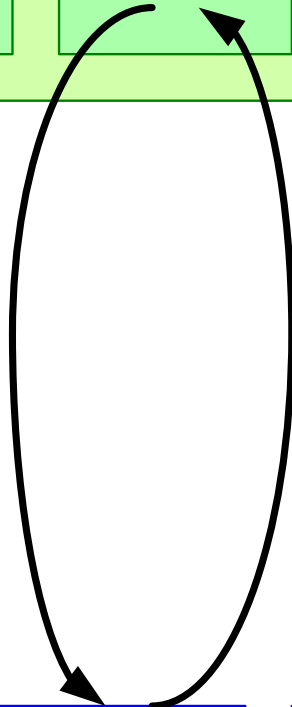
multi-domain research and expertise

Reliability /Robustness
in harsh environments

Innovation /
Responsiveness
for change

USN ESI

Exploration of new ideas — Literature search, Creative option generation, Try out

Application of technology — Industry as laboratory

Consolidation of know how — Reflection, Write articles, Create courses

system
context

system

constructs
patterns
models
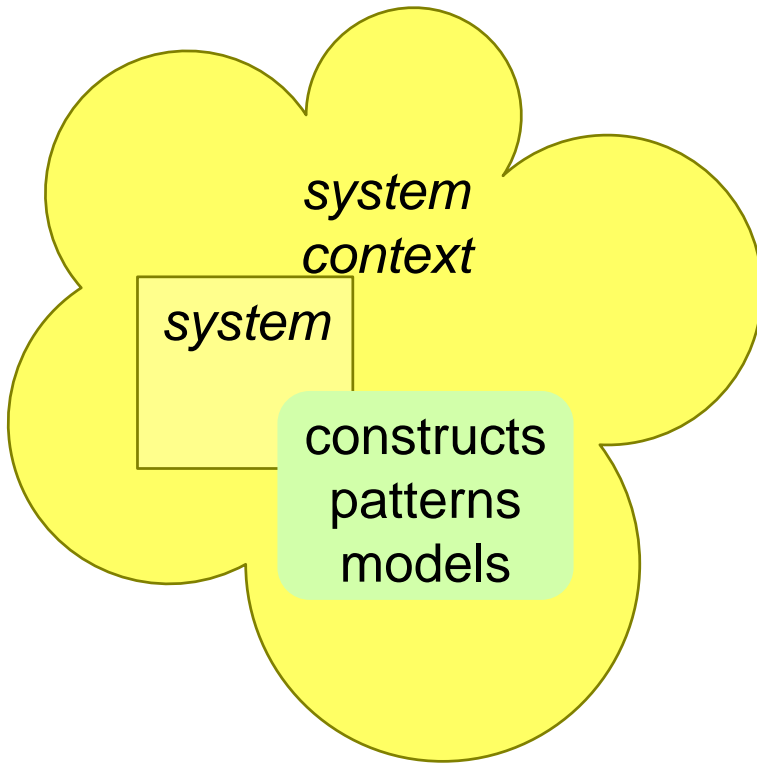
methods   CAFCR multi-view
           Zachman

techniques FMEA
           Pugh matrix

formalisms IDEF0
           SysML

tools
           Core
           Doors

meta^0

bottom line:
system fits needs

meta^1

enabling:
How to create