

# 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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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).

# 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

# Size and Heterogeneity

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 addresses the complexity introduced by

*size and heterogeneity*

both technical as well as organizational

Effectiveness and efficiency depends on:

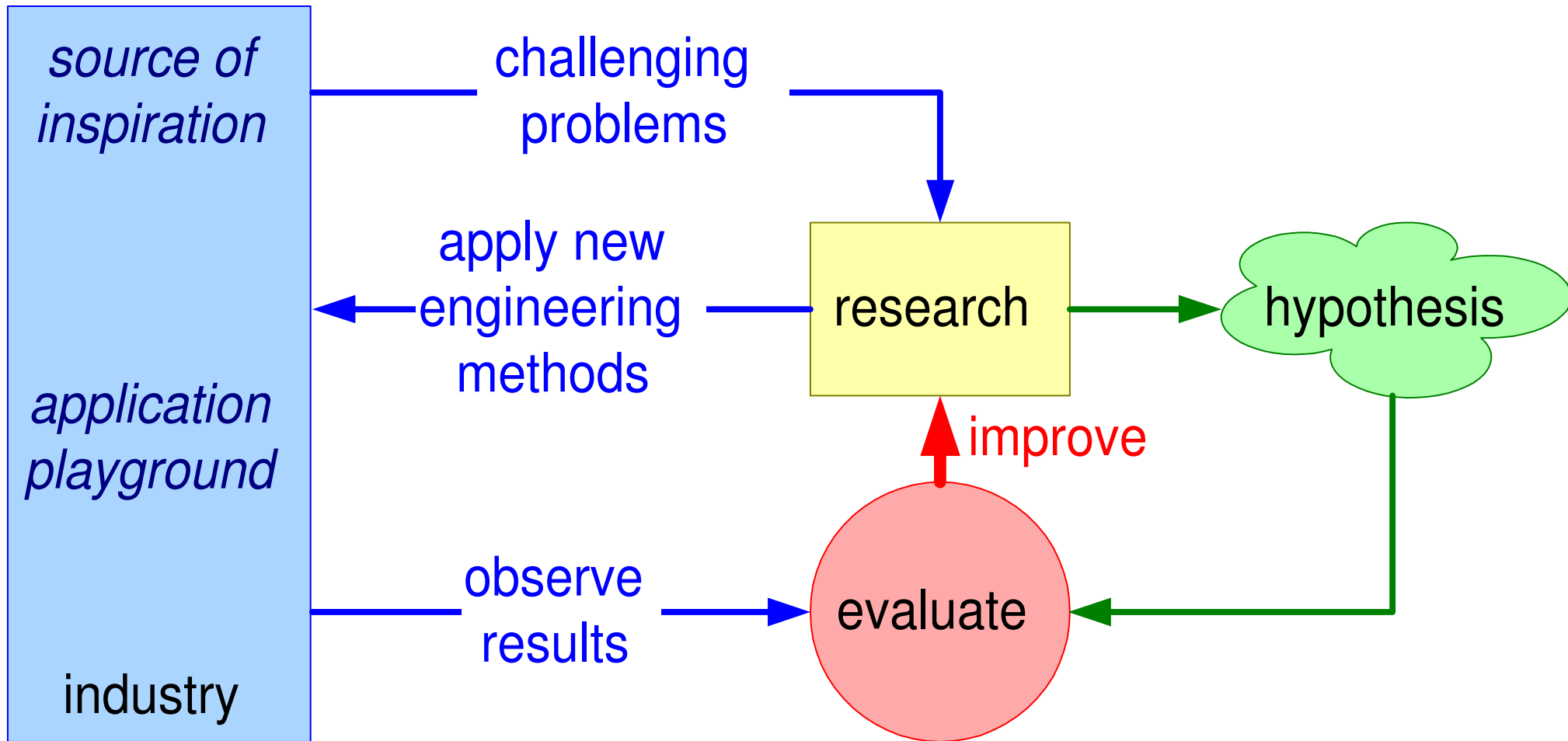
technology and  
technical means

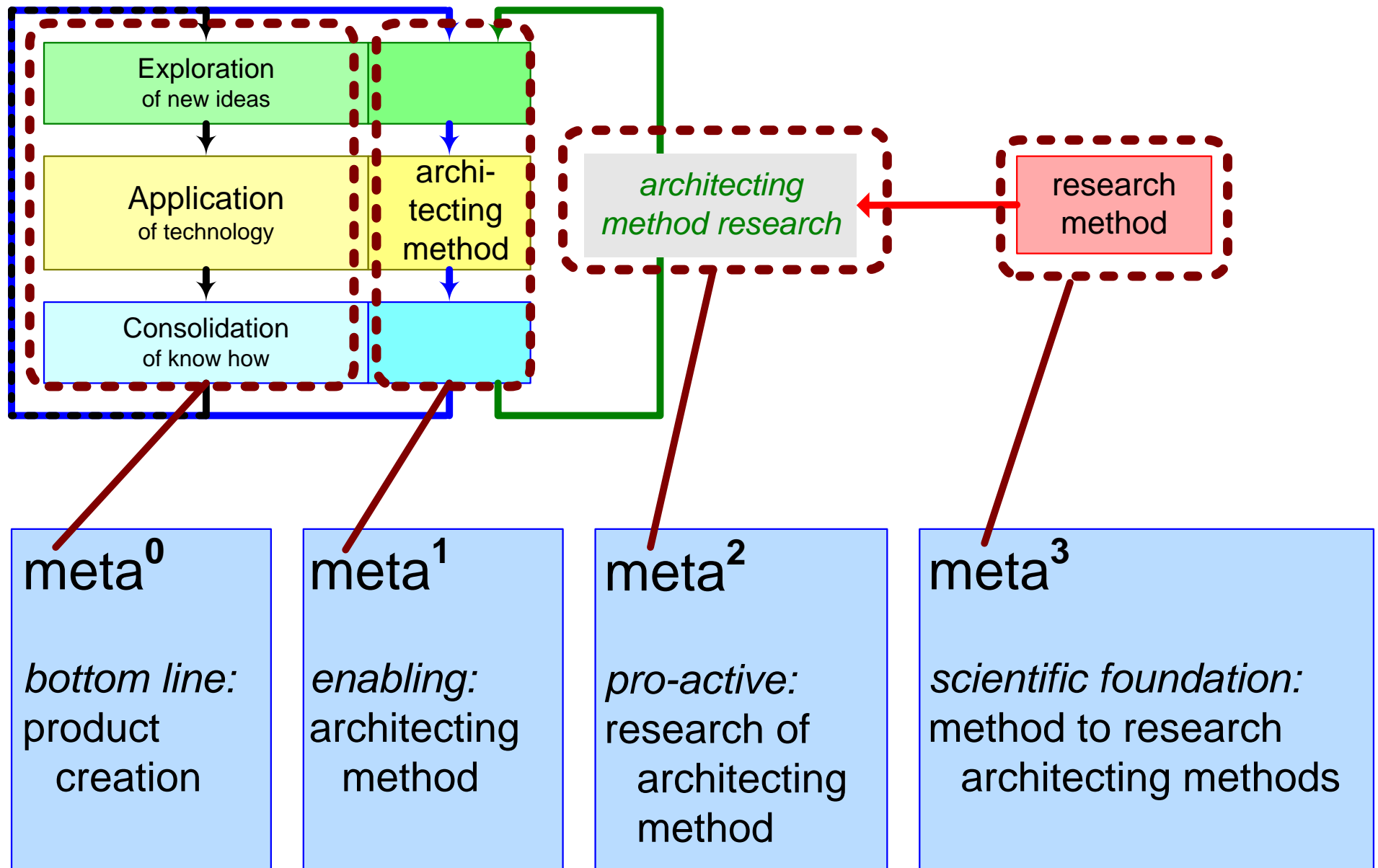
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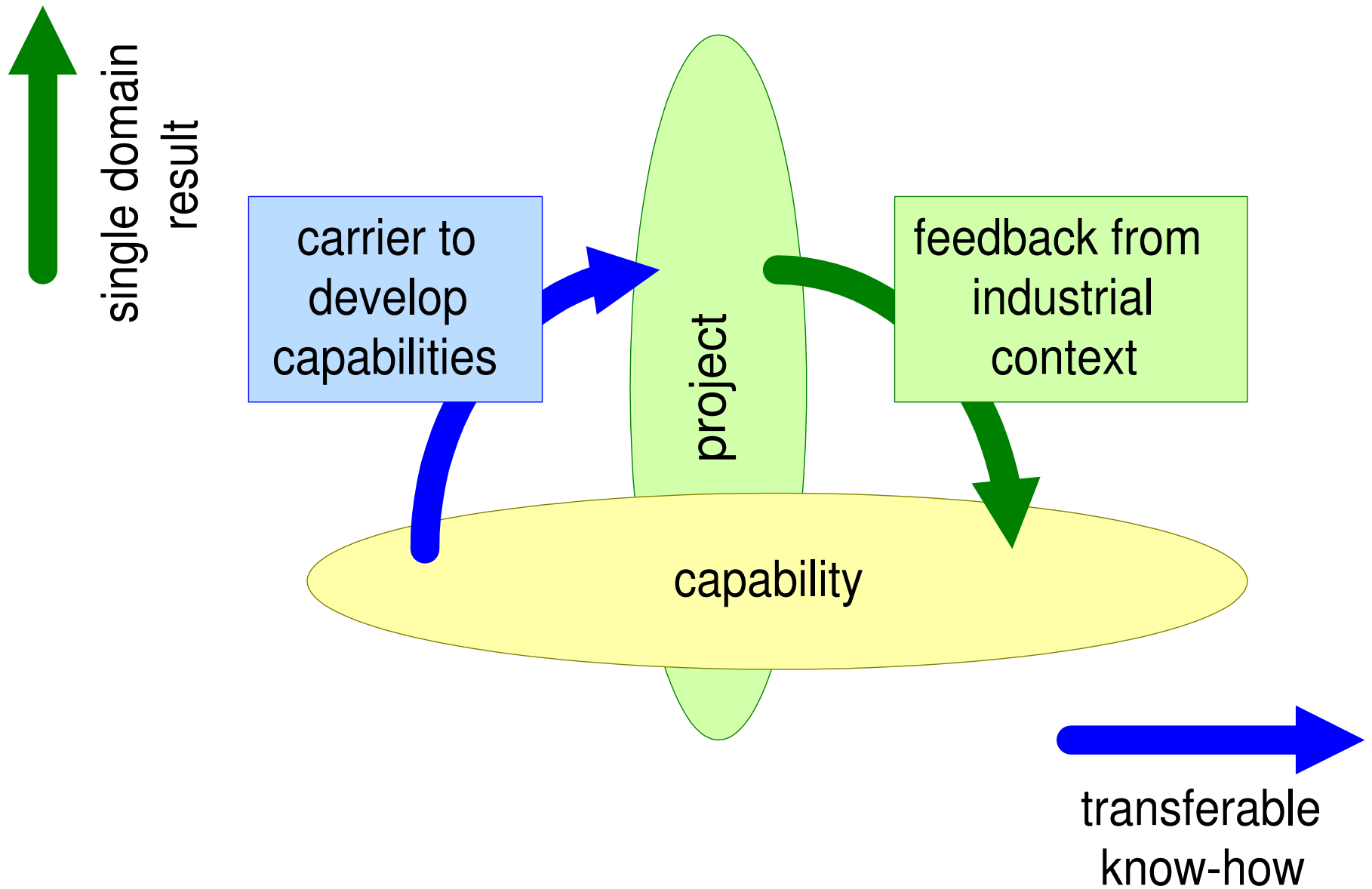
# SE Research Stakeholders and Concerns

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

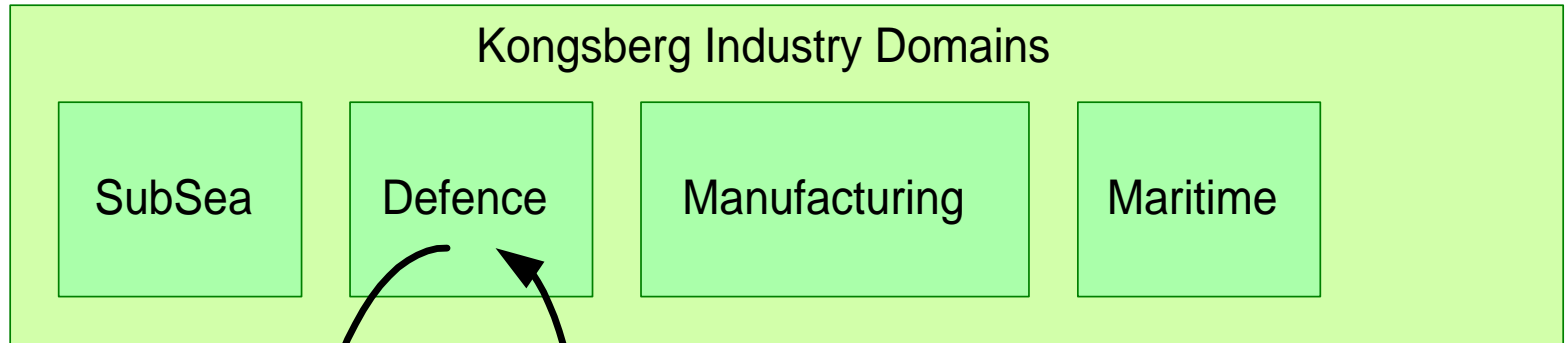






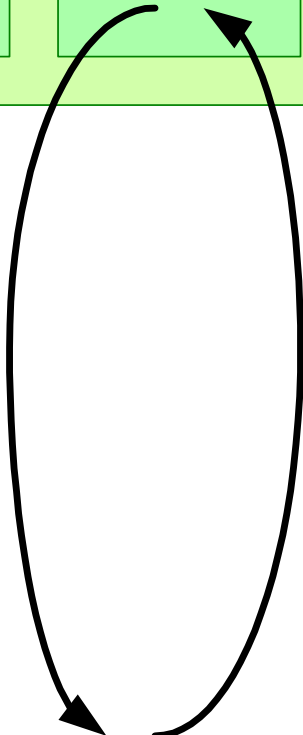


intended dissemination and research partners

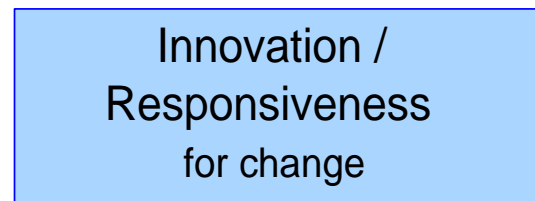
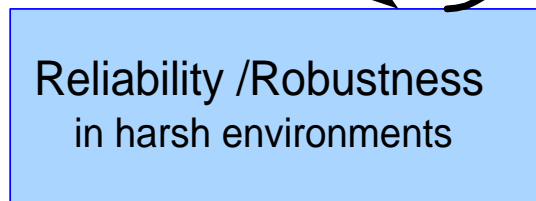


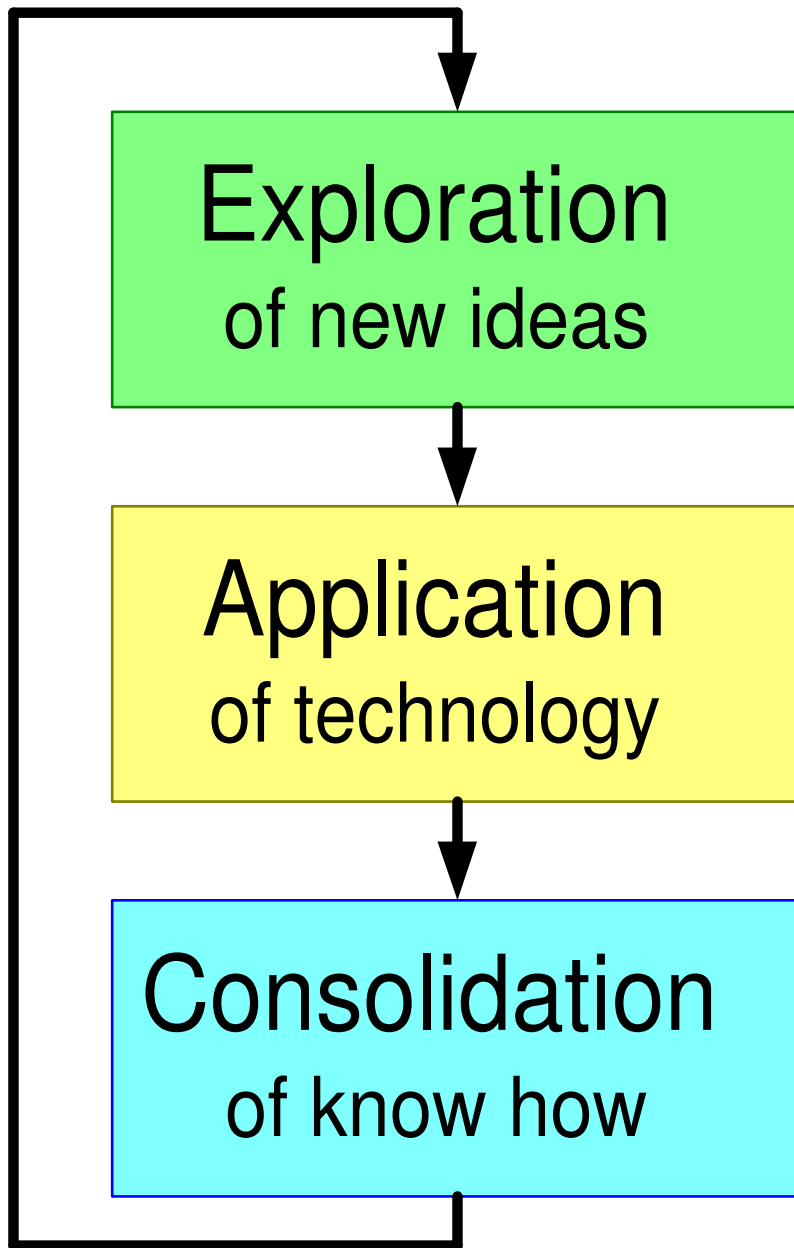
generalization and consolidation to facilitate use in other domains

single domain research focus on industrial problem



multi-domain research and expertise

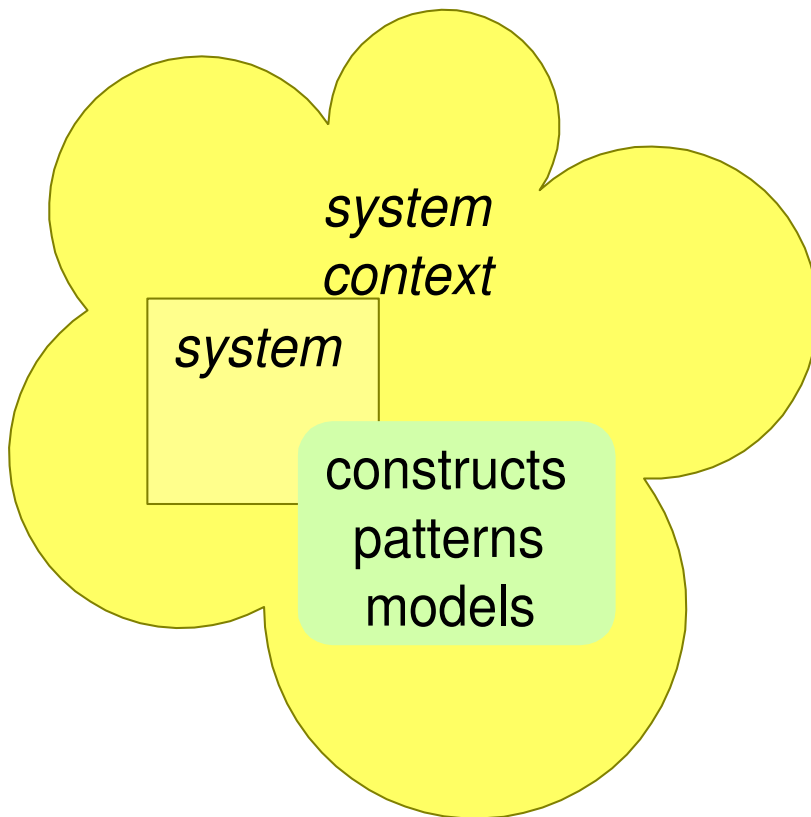




Literature search  
Creative option generation  
Try out

Industry as laboratory

Reflection  
Write articles  
Create courses



methods	CAFCR multi-view Zachman
techniques	FMEA Pugh matrix
formalisms	IDEF0 SysML
tools	Core Doors

meta<sup>0</sup>

*bottom line:*  
system fits needs

meta<sup>1</sup>

*enabling:*  
How to create