Buskerud University College: Program Systems Engineering

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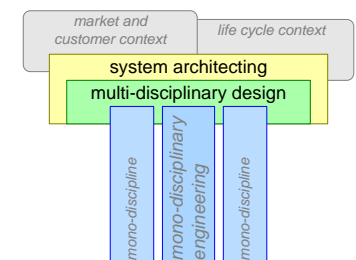
`www.gaudisite.nl`

Abstract

The focus of the Systems Engineering program of Buskerud University is on multi-disciplinary design fitting in the market and application needs and usable in industrial engineering processes. The research agenda focuses on reliability in rough circumstances and on innovation or agile architectures. As application domains the research will focus on system and supply industry as present in Kongsberg, such as sub-sea.

This is a rather preliminary agenda, under discussion with the Buskerud stakeholders.
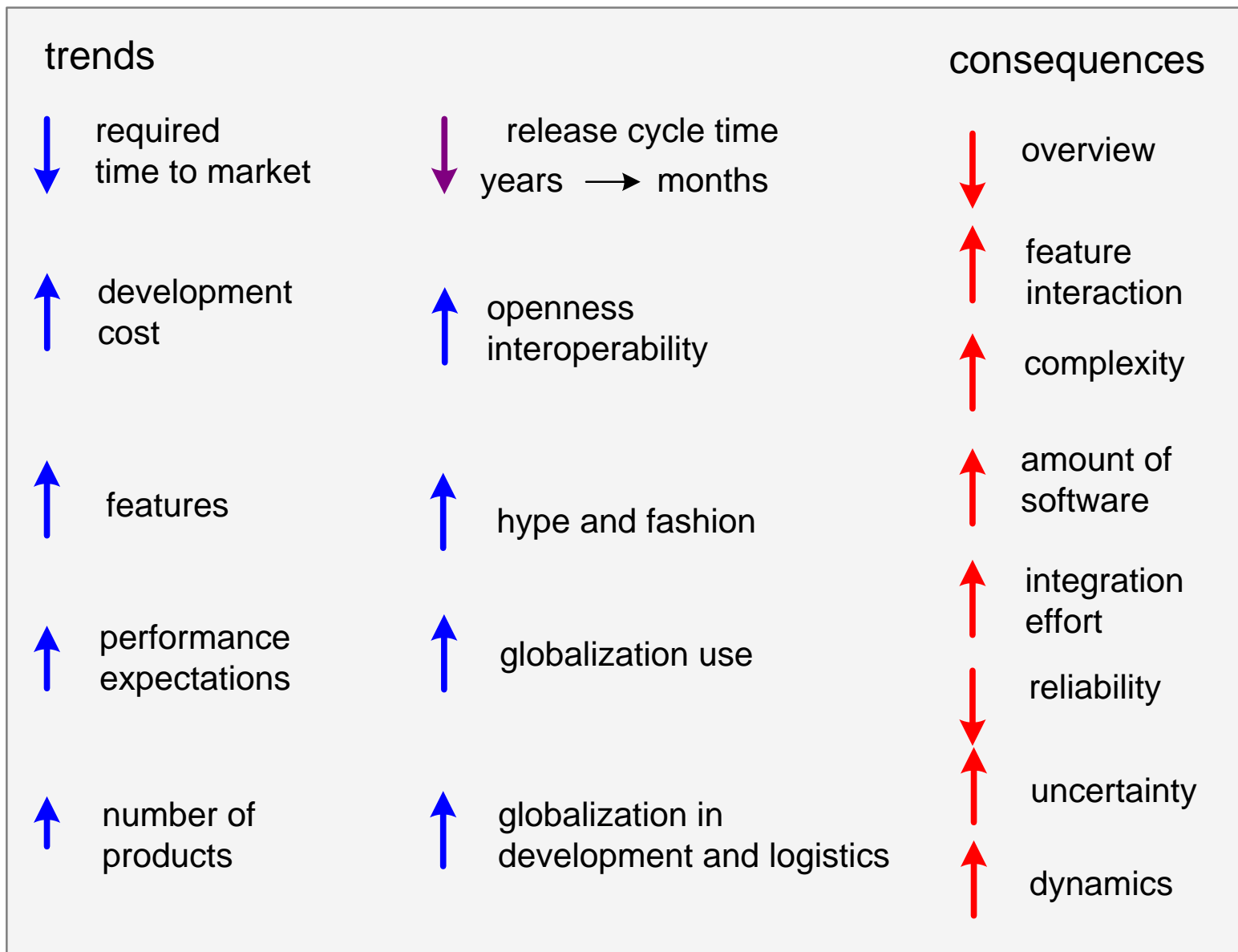
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status: preliminary
draft
version: 1.4

Today's Industrial Trends

trends

↓ required time to market

↓ release cycle time
years ⟶ months

↑ development cost

↑ openness interoperability

↑ features

↑ hype and fashion

↑ performance expectations

↑ globalization use

↑ number of products

↑ globalization in development and logistics

consequences

↓ overview

↑ feature interaction

↑ complexity

↑ amount of software

↑ integration effort

↓ reliability

↑ uncertainty

↑ dynamics

SE: address the gap between System and Realization

number of details →

10^0

10^1

10^2

10^3

10^4

10^5

10^6

10^7

system requirements

design decisions

parts
connections
lines of code

research focus

system

multi-disciplinary

mono-disciplinary

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SysEng = SysArch + Multi-Disciplinary design

market and customer context

life cycle context

system architecting

multi-disciplinary design

mono-discipline

mono-disciplinary engineering

mono-discipline

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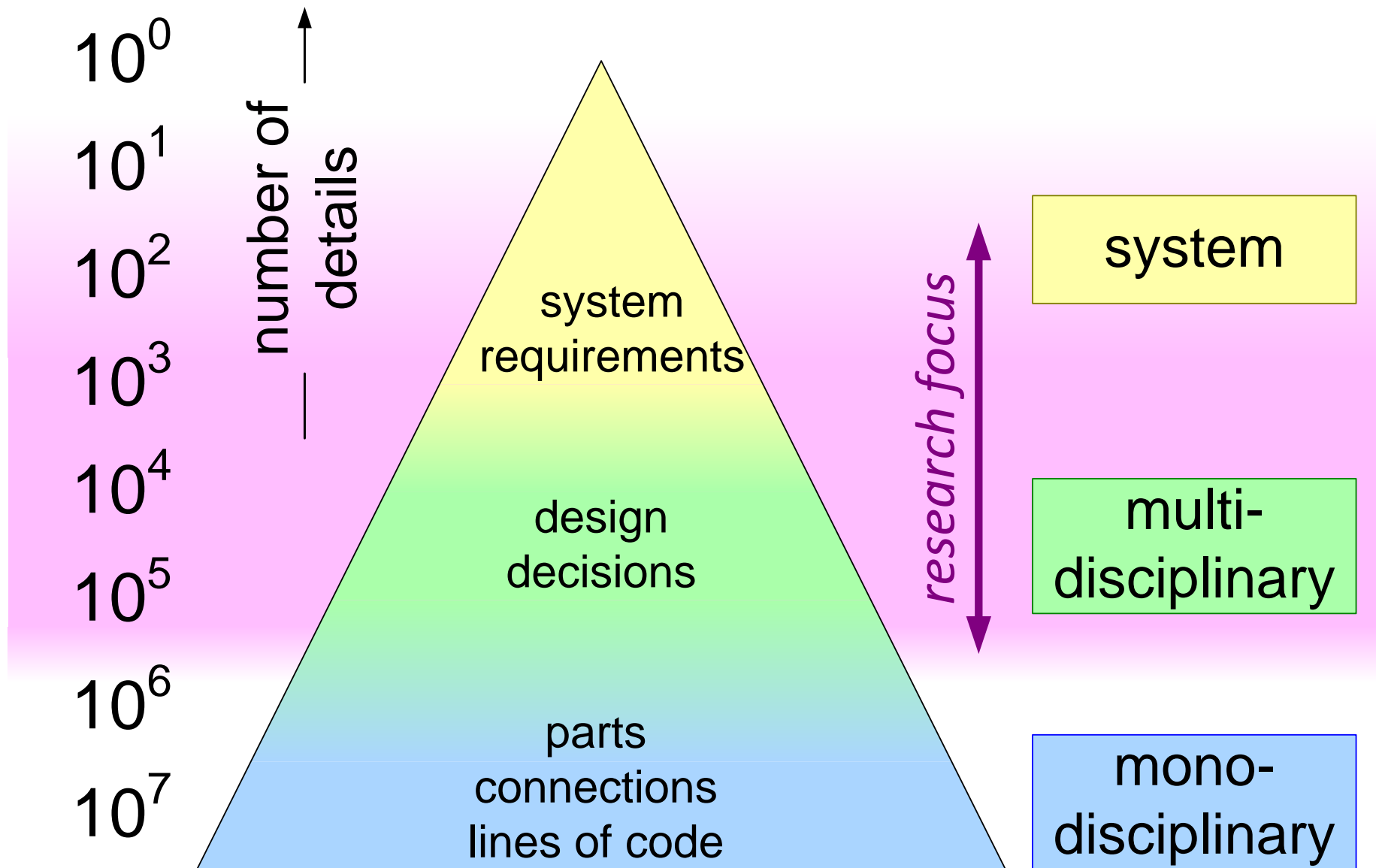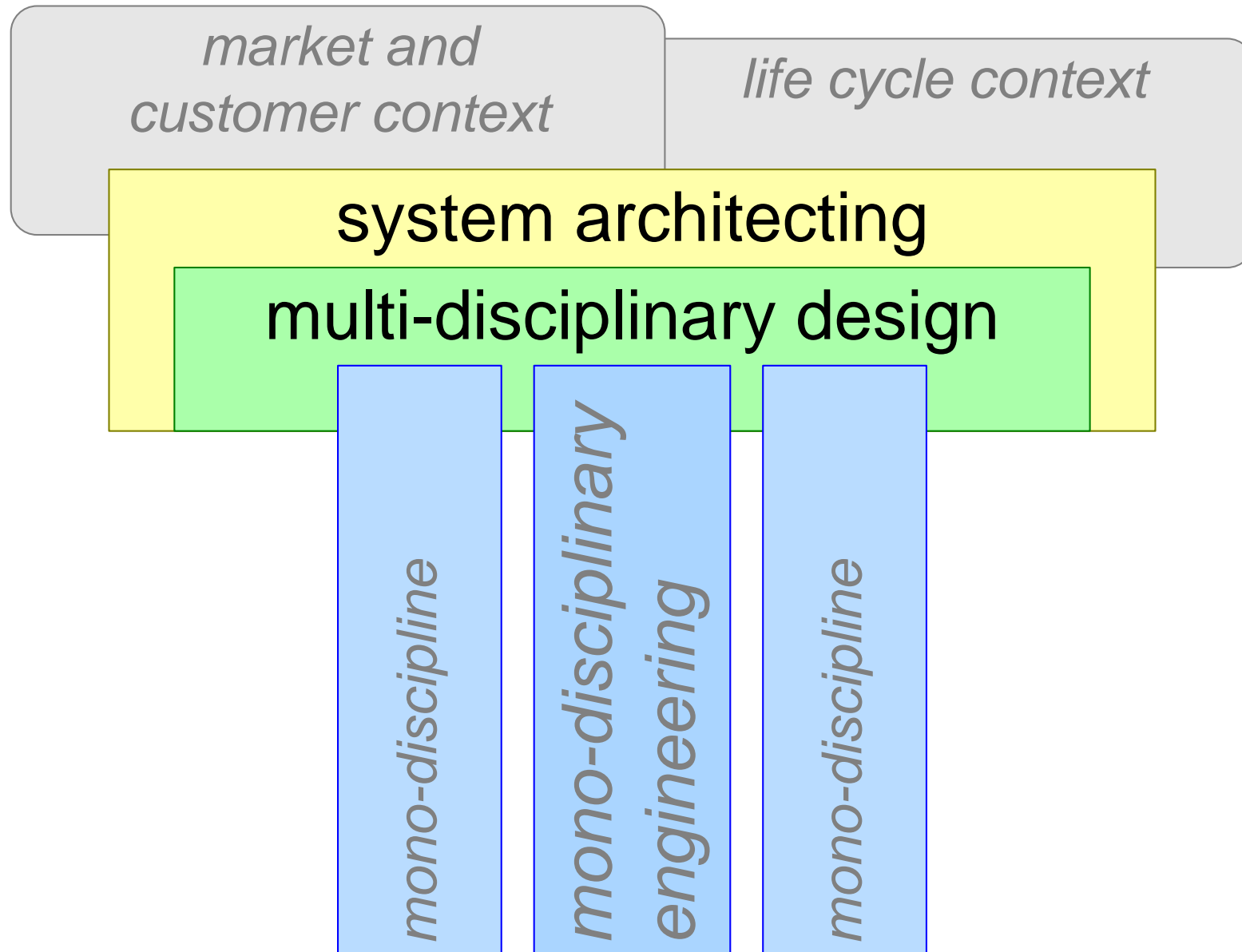
Focus of Buskerud SE program

root technical designer

technical generalist

business, application insight

process insight

psycho-social interests

educational focus
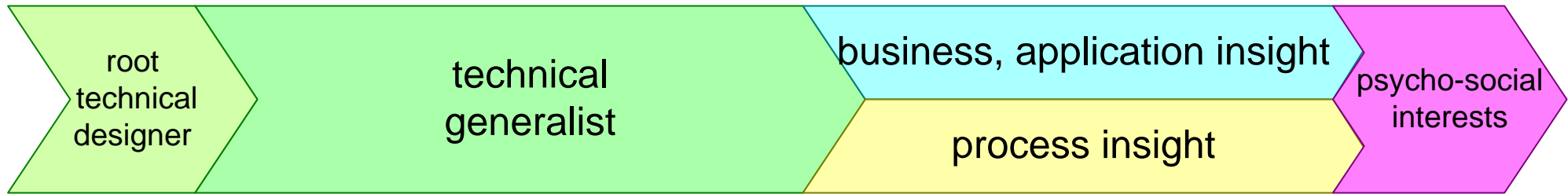
research focus

how much "depth" technical research and education do we want to offer;
How do we want to position *embedded* and *mechanical* engineering?

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Educational Focus

root technical designer → technical generalist → business, application insight / process insight → psycho-social interests
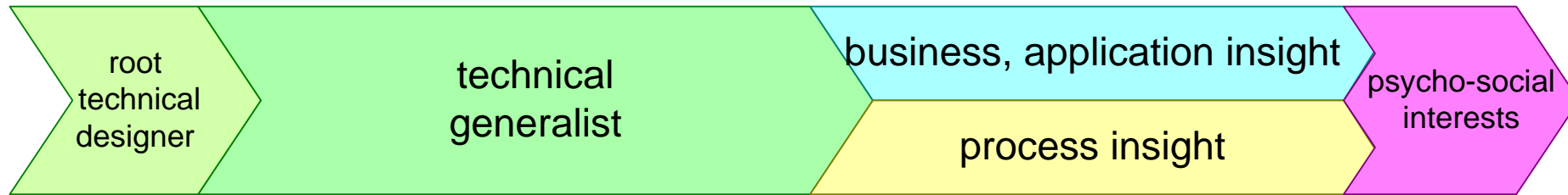
Buskerud, ESI course offerings

third party offerings for technical electives

third party offerings for leadership electives

Stevens course offerings

Buskerud technical course offerings (embedded, mechanical engineering)

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Preliminary Buskerud Research Agenda

intended dissemination and research partners

Kongsberg Industry Domains

| SubSea | Defence | Manufacturing | Maritime |

multi-domain research and expertise

| Reliability /Robustness in harsh environments | Innovation / Responsiveness for change | |

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Buskerud research agenda as graph

Systems Engineering

trends

- ↓ time to market
- ↑ dev. cost
- ↑ features
- ↑ performance expectations
- ↑ number of products
- ↓ release cycle time years → months
- ↑ openness interoperability
- ↑ hype and fashion
- ↑ globalization use
- ↑ globalization in development and logistics

consequences

- ↓ overview
- ↑ feature interaction
- ↑ complexity
- ↑ amount of software
- ↑ integration effort
- ↓ reliability
- ↑ uncertainty
- ↑ dynamics

Multi-disciplinary design
system modeling and analysis
system design methods

Reliability / Robustness
in harsh environments

Innovation
Responsiveness to change

capturing core know-how	*DR*
capturing customer understanding	*KDA*
confidence level	*KA*
change analysis	*Maritime*
SW in system	*FMC*
shopfloor automation	*VAN*

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Example of ESI research agenda

Reliability ——— run-time measures

trends	consequences
↑ variety	↑ amount of software
↑ features	↑ complexity
↑ dynamics	↑ team size
↑ openness interoperability	↑ multi-disciplinarity
	↑ error propagation avalanche
	↓ reliability

run-time measures

adaptation to changed environment
self correction   *Poseidon*
dynamic configuration   *Trader*
remote intervention   *Octopus*
interoperability system-of-systems

P run-time integration&acceptance

P awareness model
Tr user perception
Tr external system behavior

Tr,P,O in-system feedback
Tr,D,O resource scheduling

robust constructions   *Condor*
tolerant interfaces   *Poseidon*

C,P modeling with uncertainty
P incomplete information

P enriched interface

prevention   *Tangram*
test techniques   *Trader*

Ta fault diagnosis
Ta test sequence

Ta fault tree
Ta test sequence

Tr fault insertion
Tr stress testing
Tr load monitor
Tr deadlock monitor

legend   *method*   *model*   *concept*

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Reliability / Robustness in harsh environments

trends

↑ harshness

↑ variety

↑ features

↑ dynamics

↑ openness interoperability

consequences

↑ amount of software

↑ complexity

↑ team size

↑ multi-disciplinarity

↑ error propagation avalanche

↓ reliability

potential research subjects

state of practice:

methods, techniques

patterns

life time testing:

shorten duration

confidence level

analysis methods:

degree of formality

software and firmware in relation to system

Buskerud Innovation / Responsiveness

Innovation / responsiveness to change

trends

↑ "fit" to application

↑ dev. cost

↑ features

↑ performance expectations

↑ number of products

↓ release cycle time
years ⟶ months

↑ openness interoperability

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consequences

↑ variety

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↑ complexity

↑ amount of software

↑ integration effort

↑ team size

potential research subjects

state of practice:

   methods, techniques

   patterns

roadmapping:

   how much to anticipate

reusable assets:

   how to create and use resuable assets in projects

   impact on duration, cost of solution, and cost of development

   how much to generalize assets

tenders, bidding:

   how to improve quality and predictability
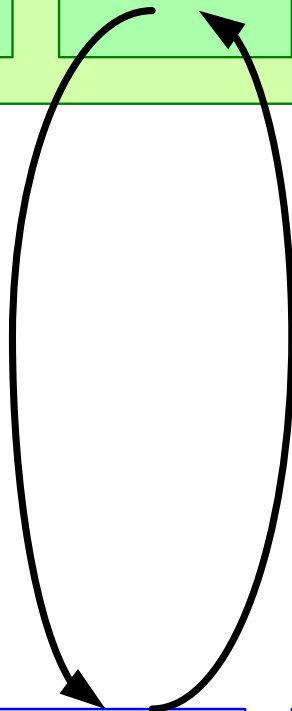
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Industry as Laboratory
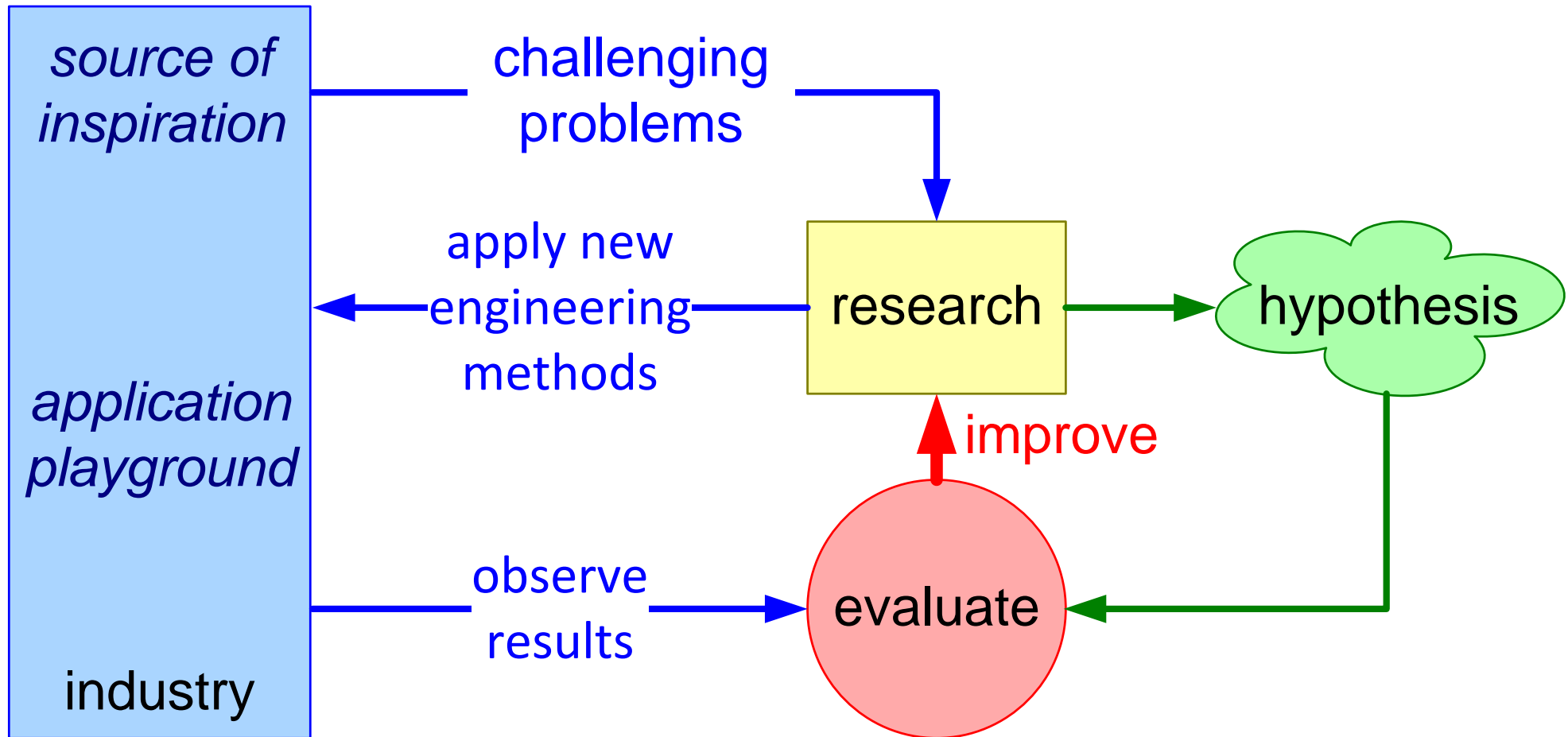
Industry as Laboratory (2)

intended dissemination and research partners

Kongsberg Industry Domains
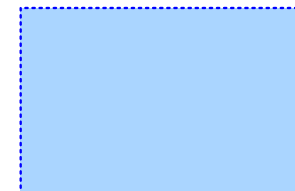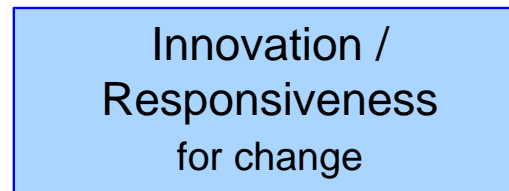
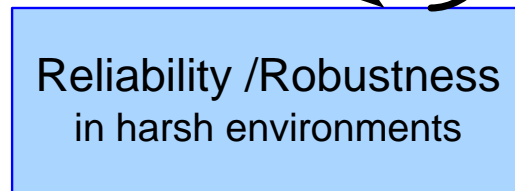| SubSea | Defence | Manufacturing | Maritime |

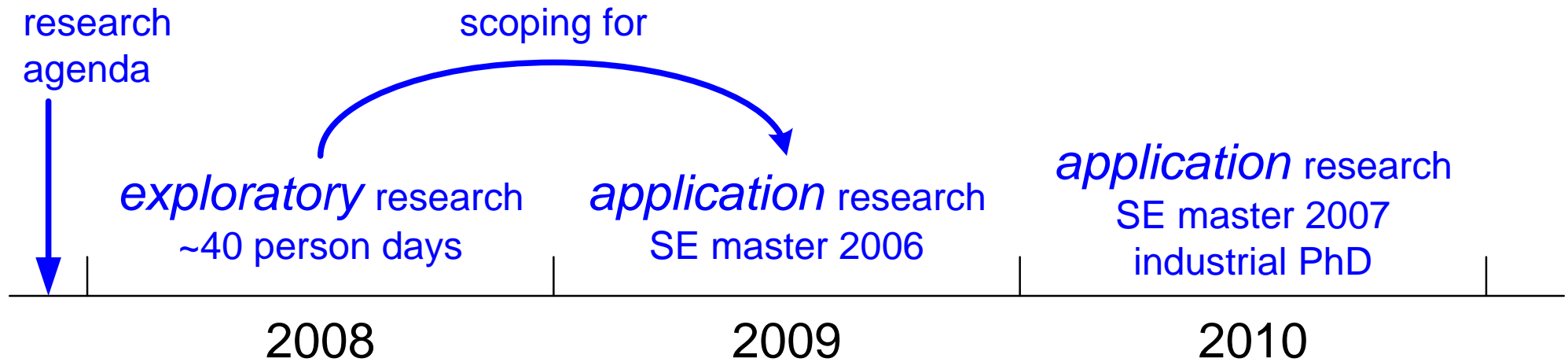generalization and consolidation to facilitate use in other domains

single domain research focus on industrial problem

multi-domain research and expertise

| Reliability /Robustness in harsh environments | Innovation / Responsiveness for change |

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Master Plan Reseaech

research
agenda

scoping for

exploratory research
~40 person days

application research
SE master 2006

application research
SE master 2007
industrial PhD

2008

2009

2010

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BCURRresearchMasterPlan

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Buskerud SE Educational Options