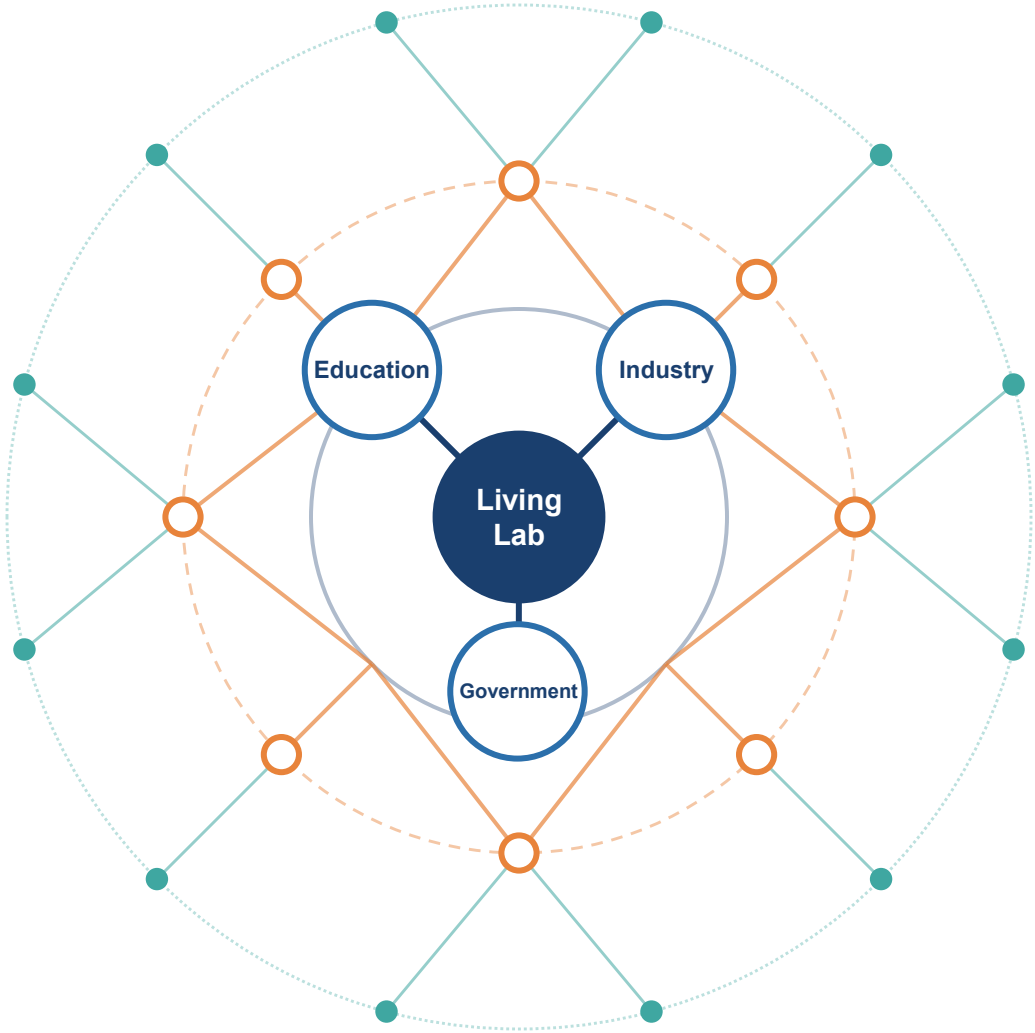
SPECIAL NETHERLANDS SESSION

Scaling Systems Capabilities in a High-Tech Economy

The Netherlands as a Living Lab



Systems Workforce Summit · Delft · October 2026

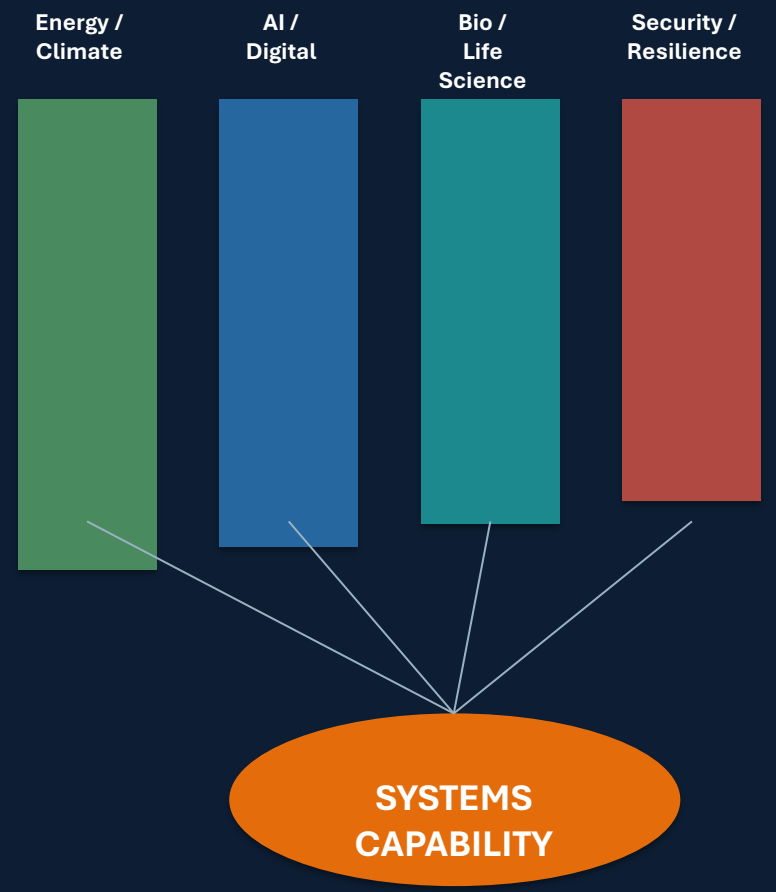
Systems Capability in an Age of Complexity

The Strategic Workforce Challenge — an Engineering Leadership Perspective

The Netherlands faces a structural shortage of systems engineers that threatens technological autonomy and long-term earning capacity.

Energy • Digital & AI sovereignty • Life sciences & biotechnology • Security & resilience

Hyper-specialized vertical silos cannot scale these transitions into coherent national systems.



AUTONOMY AT RISK

INTEGRATION GAP

WORKFORCE GAP

Leadership imperative: move from isolated excellence to integrated capability.

NAE Netherlands Academy of Engineering
CONNECT TO INNOVATE

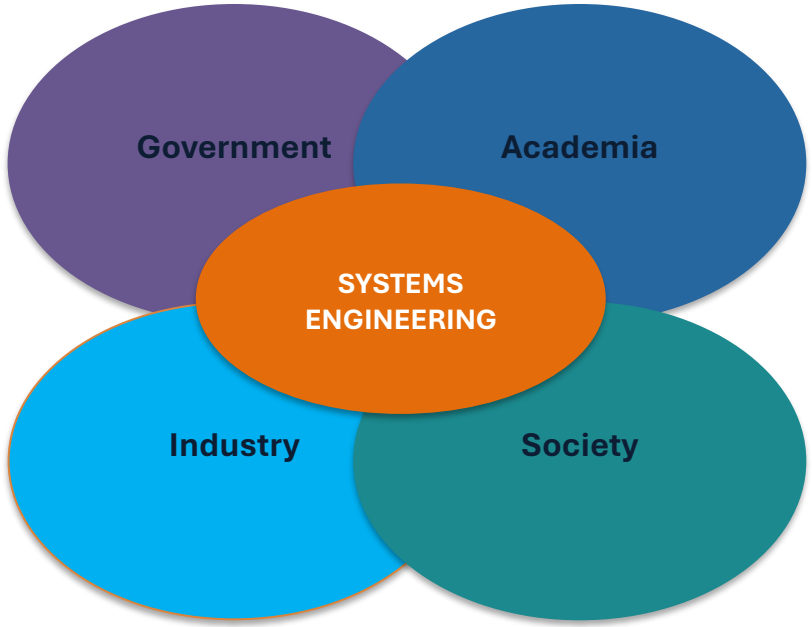
Systems Engineering as the Horizontal Connector

Not a niche post-graduate administrative function — the discipline that turns innovation into affordable, secure and scalable solutions.

National policy
Align technology systems concurrently with political frameworks.

Public procurement
Require systems-thinking methodologies in major government tenders.

Regional networks
Connect companies, knowledge institutes and regional bodies.



Global tech exports
Link export strength to Dutch structural earning capacity.

International talent
Retain highly educated graduates and remove avoidable bottlenecks.

National action agenda
Connect engineering capacity to 5-, 10- and 15-year planning.

Systems engineering connects technology, institutions, markets and societal value.

Build Systems Capability Through Education

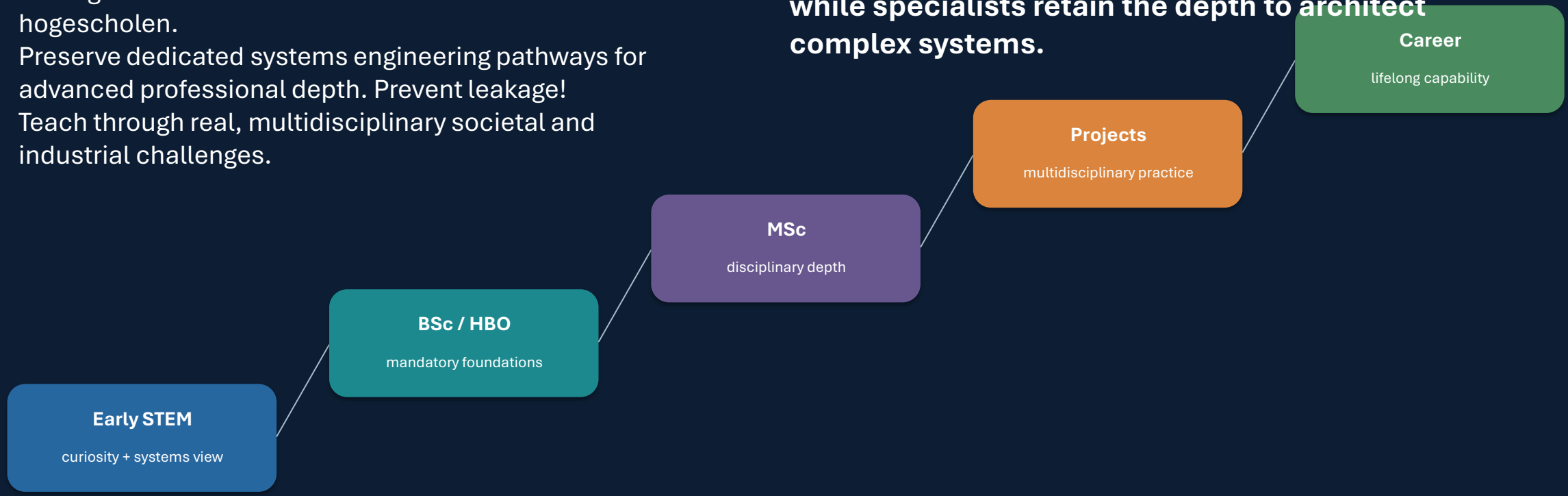
Teach systems engineering as a discipline — and embed systems thinking throughout technical education.

Immediate action

- Expose young children early to STEM education, inflow here can never be compensated at later moments
- Integrate foundational systems engineering into all undergraduate technical tracks at universities and hogescholen.
- Preserve dedicated systems engineering pathways for advanced professional depth. Prevent leakage!
- Teach through real, multidisciplinary societal and industrial challenges.

Outcome

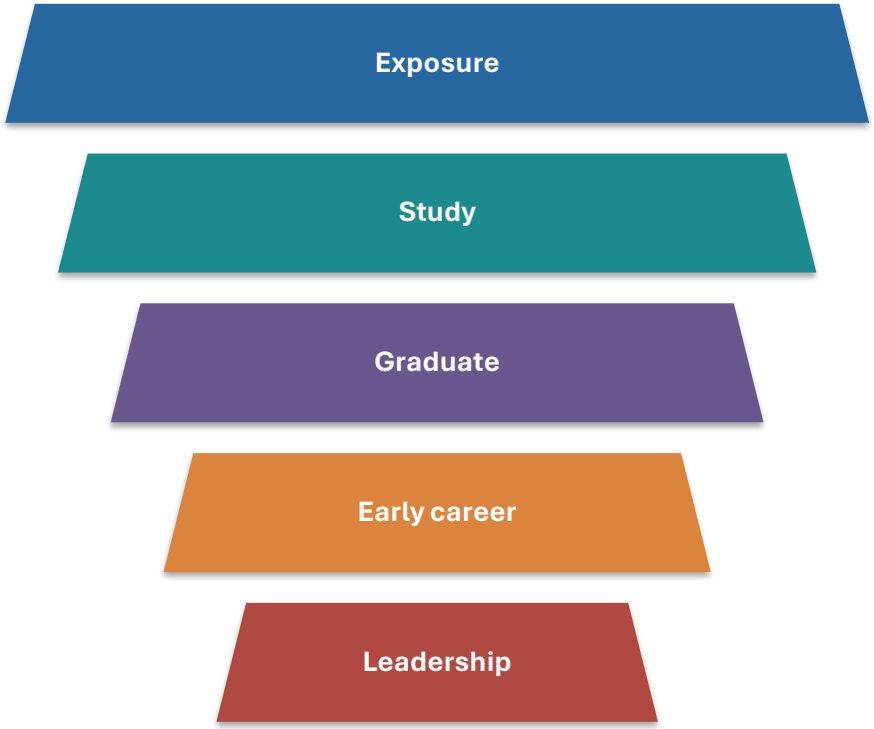
Every engineer learns to understand interfaces, lifecycle consequences, uncertainty, stakeholders and trade-offs — while specialists retain the depth to architect complex systems.



NAE Netherlands Academy of Engineering
CONNECT TO INNOVATE

Plug the Leaky Pipeline — and Reshape the Engineering Narrative

A systems-capability strategy fails if talent leaks out, or if society does not see engineering as a compelling place to contribute.



Structural measures must retain women and diverse talent at every transition — not only increase entry.

SHIFT THE PUBLIC IMAGE

SOLITARY CODER → COLLABORATIVE CREATOR

Purpose
Show how engineers enable sustainability, security, health and prosperity.

Belonging
Make role models, inclusive teams and sponsorship visible.

Progression
Create fair career paths, flexibility and return-to-engineering routes.

Talent is a system: attraction × retention × advancement.

Engineering Leadership Agenda: Educate • Include • Engage

Engineering must become better at shaping decisions — with politicians, policymakers and the public.

EDUCATE

Make systems engineering foundational across curricula, while building deep specialist capability.

INCLUDE

Treat the workforce pipeline as a national system; retain women, diverse and international talent.

ENGAGE

Translate complexity into choices, consequences, trade-offs and public value.

NATIONAL HORIZON

5 YEARS	10 YEARS	15 YEARS
curricula + procurement + pipeline measures	scaled regional networks + stronger retention	mature systems capability supporting autonomy

The strategic advantage is the ability to integrate technology, talent, institutions and society into systems that work.

NAE Netherlands Academy of Engineering
CONNECT TO INNOVATE

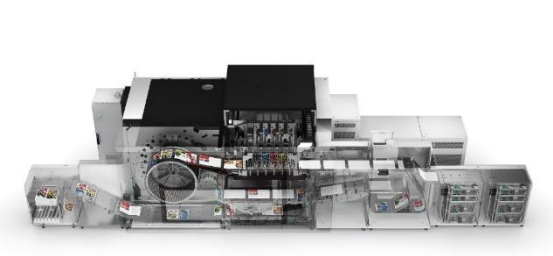

Energy Materials
Semiconductor Technologies
Mechatronics and Optomechatronics
Quantum Technologies
Process Technology, including Process Intensification
Cybersecurity Technologies*
Biomolecular and Cell Technologies
Optical Systems and Integrated Photonics
Artificial Intelligence and Data*
Imaging Technologies
10 prioritised Key Enabling Technologies
*In collaboration with Knowledge and Innovation Digitalisation

Systems Engineering for Dutch earning power and sovereignty

Wouter Leibbrandt
HHT Program Council Member for Domain Systems Engineering

Holland High Tech
Global Challenges, Smart Solutions

Systems engineering crucial for industry and society



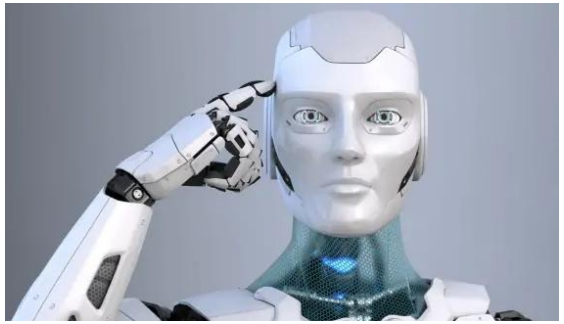
Equipment Manufacturing



Energy Assets



Critical Infrastructure



Robotics



Med Tech



Agri Tech



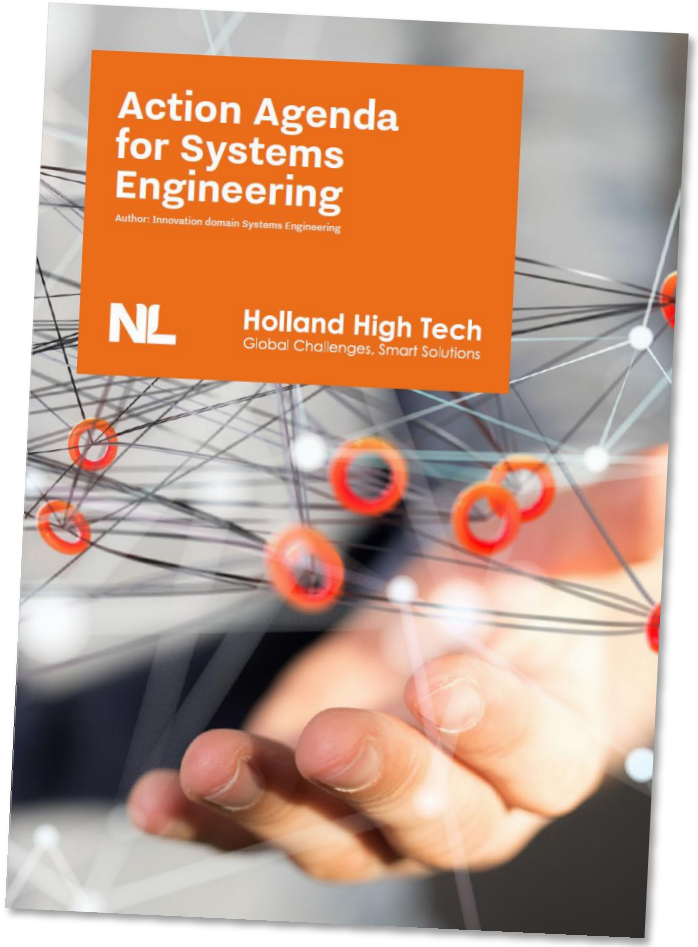
Defence



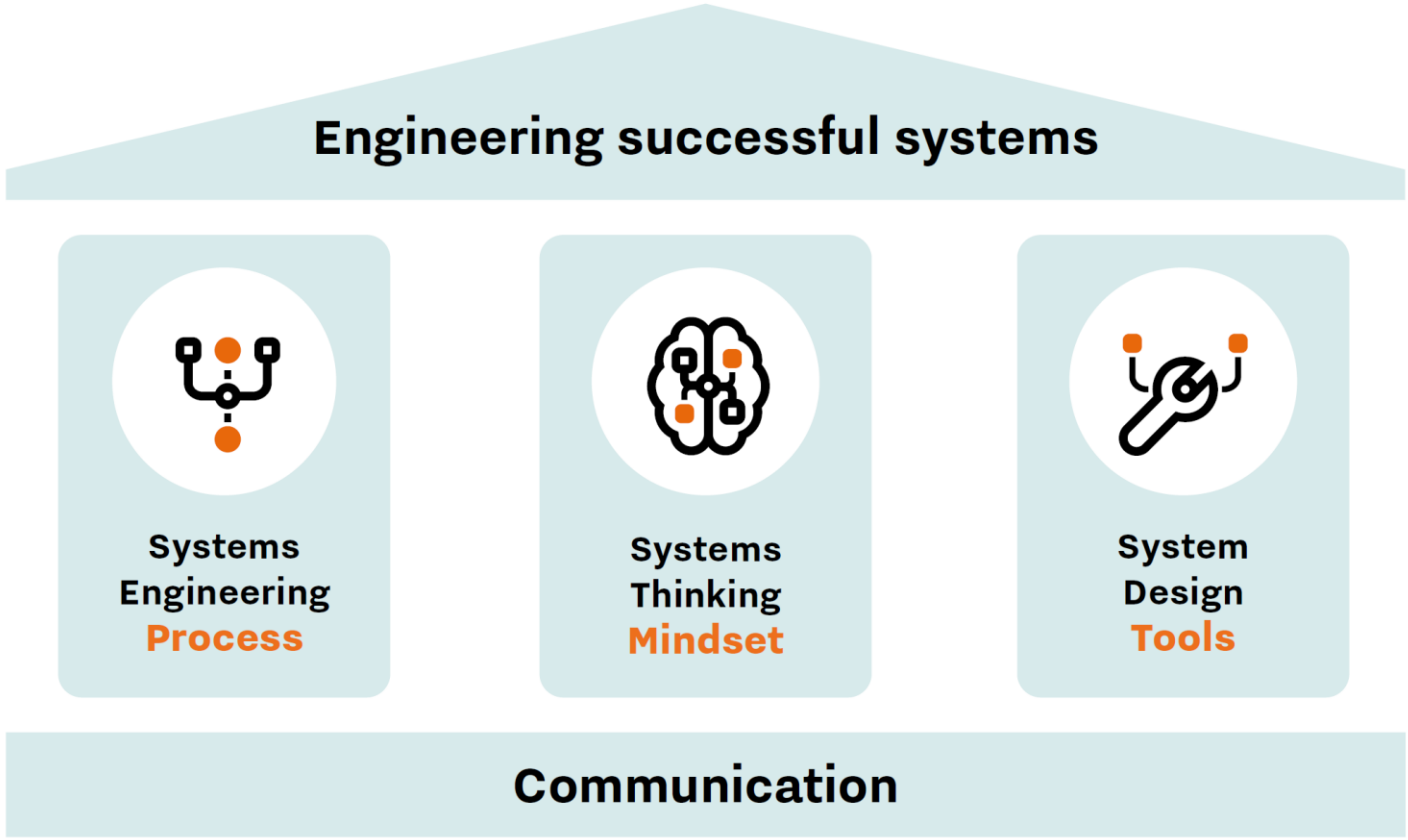
Semiconductor Tech

A new agenda to guide SE innovation, adoption and education

Systems Engineering *is a transdisciplinary and integrative approach to enable the successful realization, use, and retirement of engineered systems, using systems principles and concepts, and scientific, technological, and management methods.*



Systems Engineering: mindset first

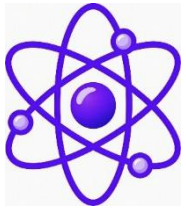


Systems Thinking: From the whole to its parts, and back to a working system

SE serves needs for every NTS domain



Optical and photonic technologies



Quantum technologies



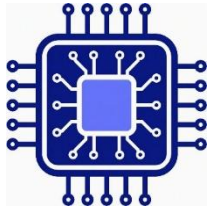
Process technology



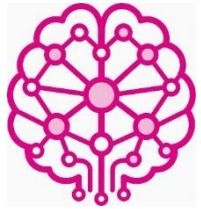
Biomolecular and cell technologies



Imaging technologies



Semiconductor technologies



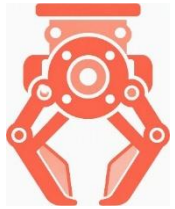
Artificial intelligence and data science



Energy materials



Cybersecurity technologies



Mechatronics and opto-mechatronics



Priorities for innovation, adoption and education



SE method innovation

- Managing increasing complexity
- Digital engineering and productivity
- Ecosystems and supply chains
- Trustworthy, resilient, and sovereign systems
- AI-enabled systems
- Sustainability and emerging challenges



SE adoption

- Introducing SE into existing organizations
- Evidence-based SE adoption
- SE for growing organizations



SE education and lifelong learning

- Expanding the SE talent base
- Accelerating SE competence development
- Continuous learning for digital and societal transitions

Thank you!

Wouter.Leibbrandt@tno.nl

www.hollandhightech.nl

Holland High Tech

Global Challenges, Smart Solutions

'Building the future systems workforce through education, training and talent development'

The SE Compass

A Holistic Model for Systems Engineering Practice



Etman, P., Tsoutsou, S., Pereira Pessoa, M., Van Osch, M., Darmoul, S., Puente Gomez, S., Akay, I., Puik, E., Custers, J., Vasenev, A., Gill, E., De Wit, T., Teixeira, J., Bonnema, G. M., and Van den Aker, J. (2026). The SE Compass: A holistic model for Systems Engineering practice. In Proceedings of the 2026 INCOSE international Symposium, 13 – 18 June, Yokohama, Japan, submission 94.

Saber Darmoul

Systems Workforce Summit

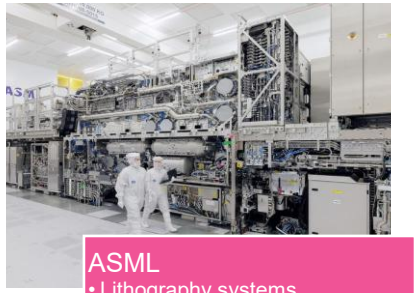
28th October 2026

This project receives a Dutch National Growth Fund contribution through the NXTGEN Hightech program

Systems Engineering context

> **More is needed !!**
  - More Systems Engineers
  - More efficient (e.g., speed, cost)
  - More effective (e.g., quality, impact)

> **However, fragmentation, heterogeneity:**
  - Different interpretations (e.g., responsabilities)
  - Different implementations (e.g., orgcharts)
  - Different practices
  - Misalignments between industry and academia



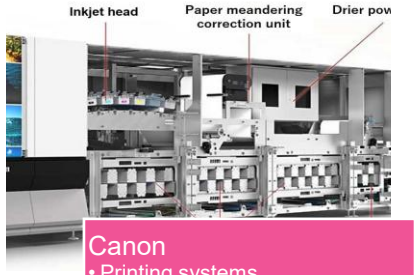
ASML
• Lithography systems



Philips
• Healthcare systems



Vanderlande
• Airport & Parcel Systems



Canon
• Printing systems



Thales
• Aerospace and defence



VDL-ETG
• High-tech



Thermo Fischer
• Scientific instruments



Sioux Technologies
• Advanced innovation platforms

A Holistic Model for SE Practice

A consortium-driven, evidence-based process



Review of standards

INCOSE SE Handbook, competency frameworks, and SE role taxonomies

Industry workshops

Industry perspectives on core SE ingredients & subject areas

Iterative design

Successive versions reviewed and refined with consortium partners

Validation

Two use cases: navigator and job description analyzer

Introducing The SE Compass

Provides a reference framework to unify SE practice in both industry and academia

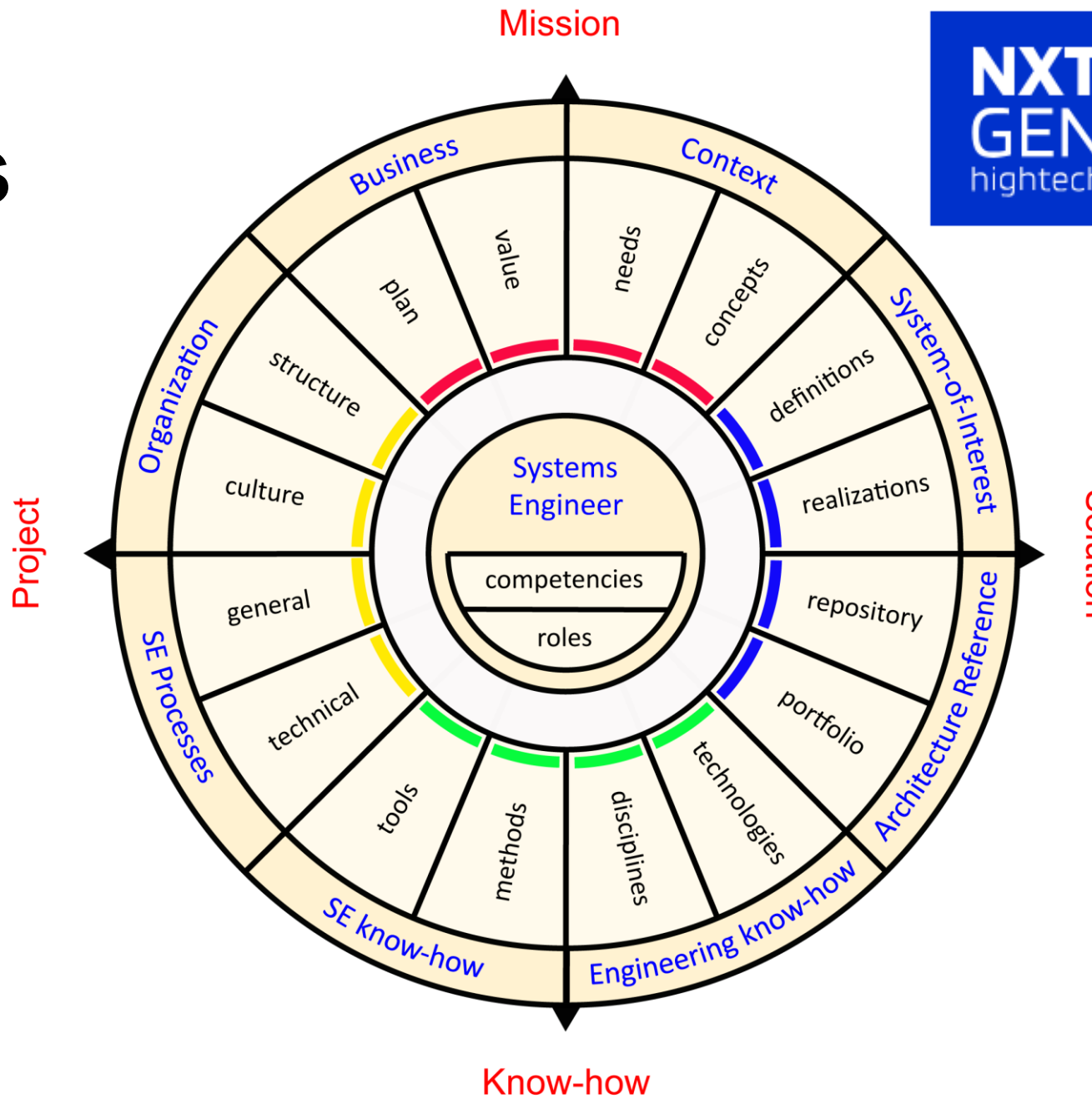
Places the Systems Engineer at the center

Supports multiple perspectives (technical, organizational, business, education)

Integrates SE subjects, Competencies and Roles

Provides a basis for lifelong learning in Systems Engineering

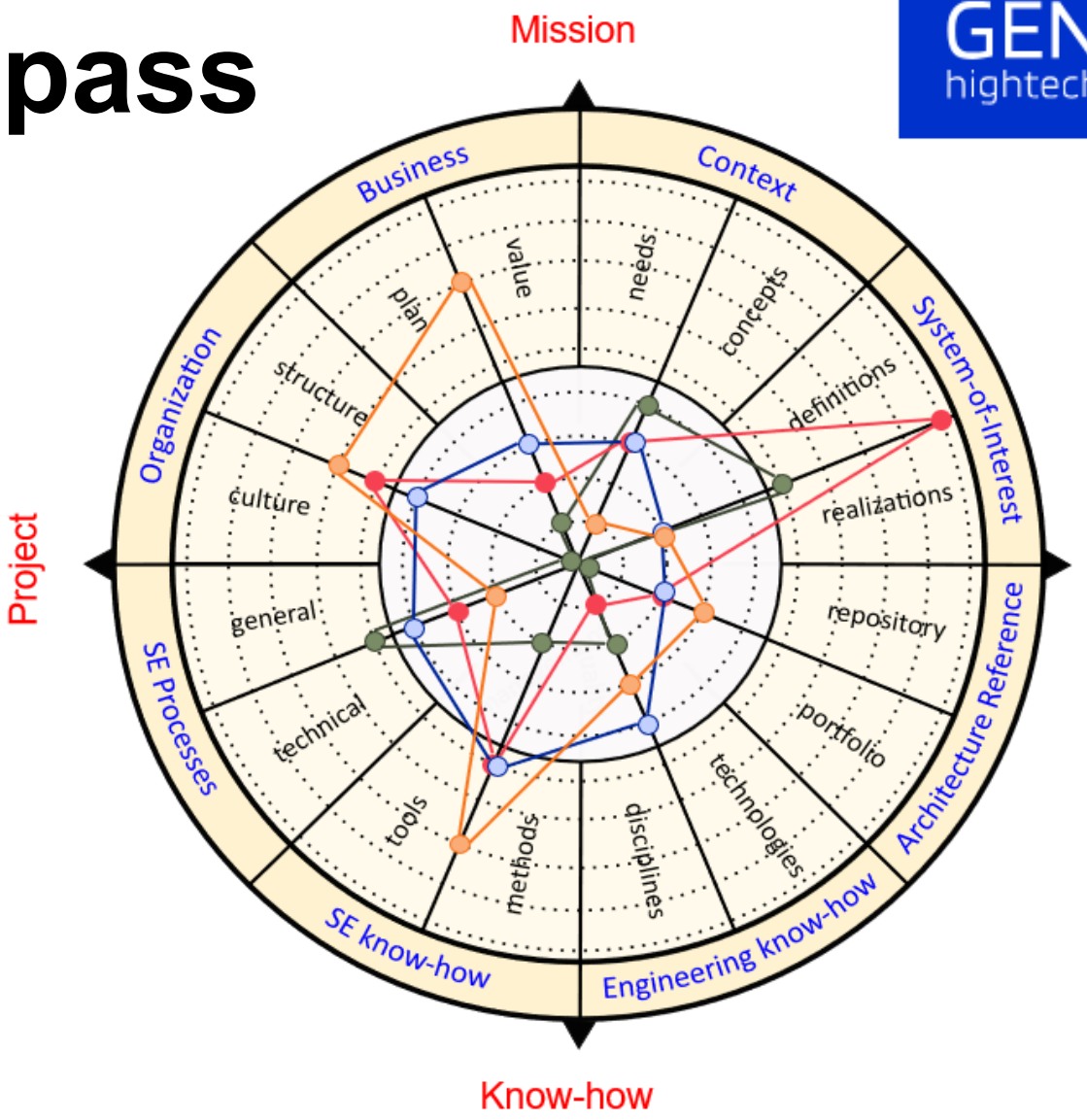
Supports organizational alignment



Mirroring SE at Philips through the SE Compass

- Test and integration systems engineer
- Project systems engineer
- Systems engineering leader
- Systems engineering principal

INCOSE Competency Categories				
Technical	7	7	8	6
Professional	2	5	4	8
Management	2	4	2	6
Core	1	6	3	2
Integrating	0	3	1	1



'Building the future systems workforce through education, training and talent development'



From Systems Engineering Practice to Competence Development

Sapfo Tsoutsou

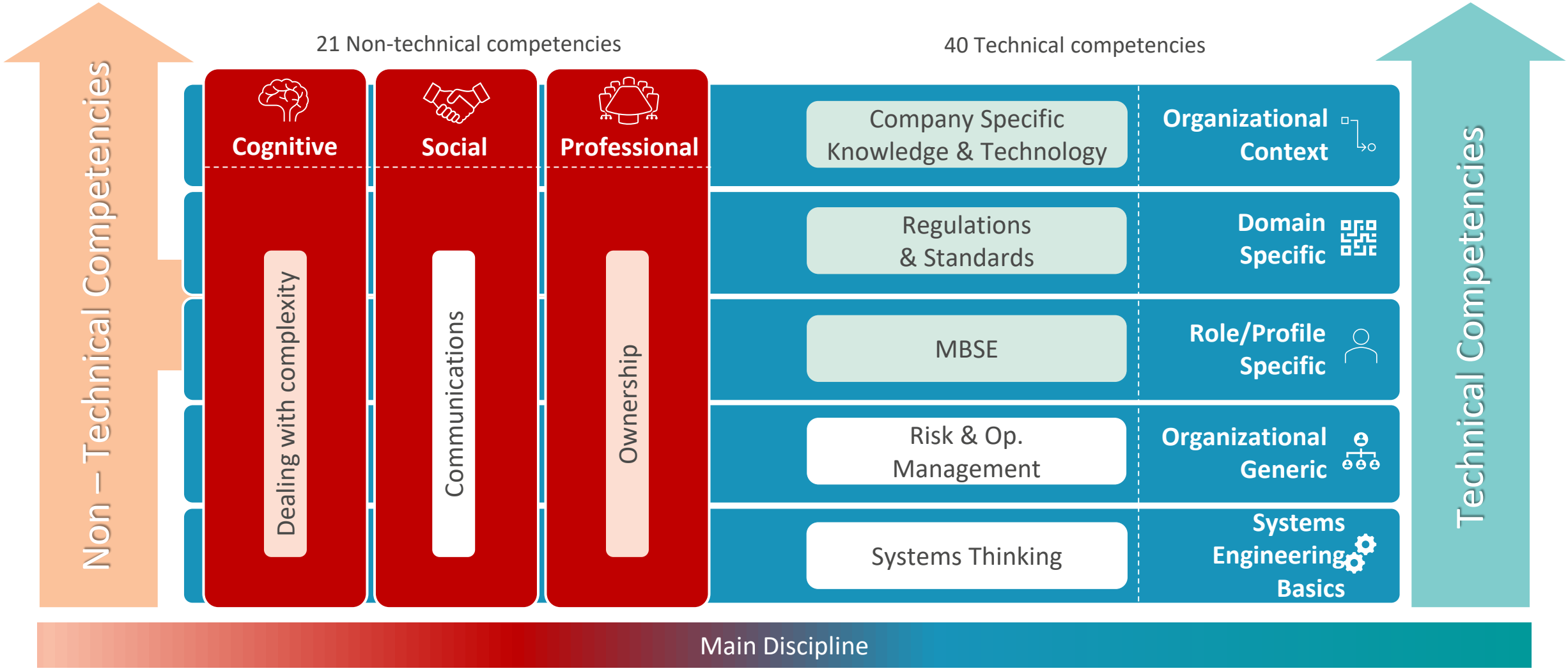
Systems Workforce Summit

28th October 2026

This project receives a Dutch National Growth Fund contribution through the NXTGEN Hightech program

NXTGEN SE Educational Framework

An integrated architecture of technical and non-technical competencies



New competencies, we extend the INCOSE CF, **from 37 to 61** competencies

NXTGEN SE Roles to Competences Profiles

Which roles do Systems Engineers fulfil in the Netherlands? Which competences do they require?

	NON – TECHNICAL			TECHNICAL			
NXTGEN SE Role \ Competence	Dealing with Complexity	Communications	Ownership	Systems Thinking	Risk & Op. Management	Regulations & Standards	MBSE

● = strongly required for this role ● = somehow required for this role

Full matrix maps **24 roles to 61 competencies**

Based on "Systems Engineering Roles for a New Era" by S. Sheard and A. Pickard

★ *New NXTGEN roles not present in INCOSE CF or Sheard taxonomy (2025)*

The Dependency Model (DSM)

From a list to a system

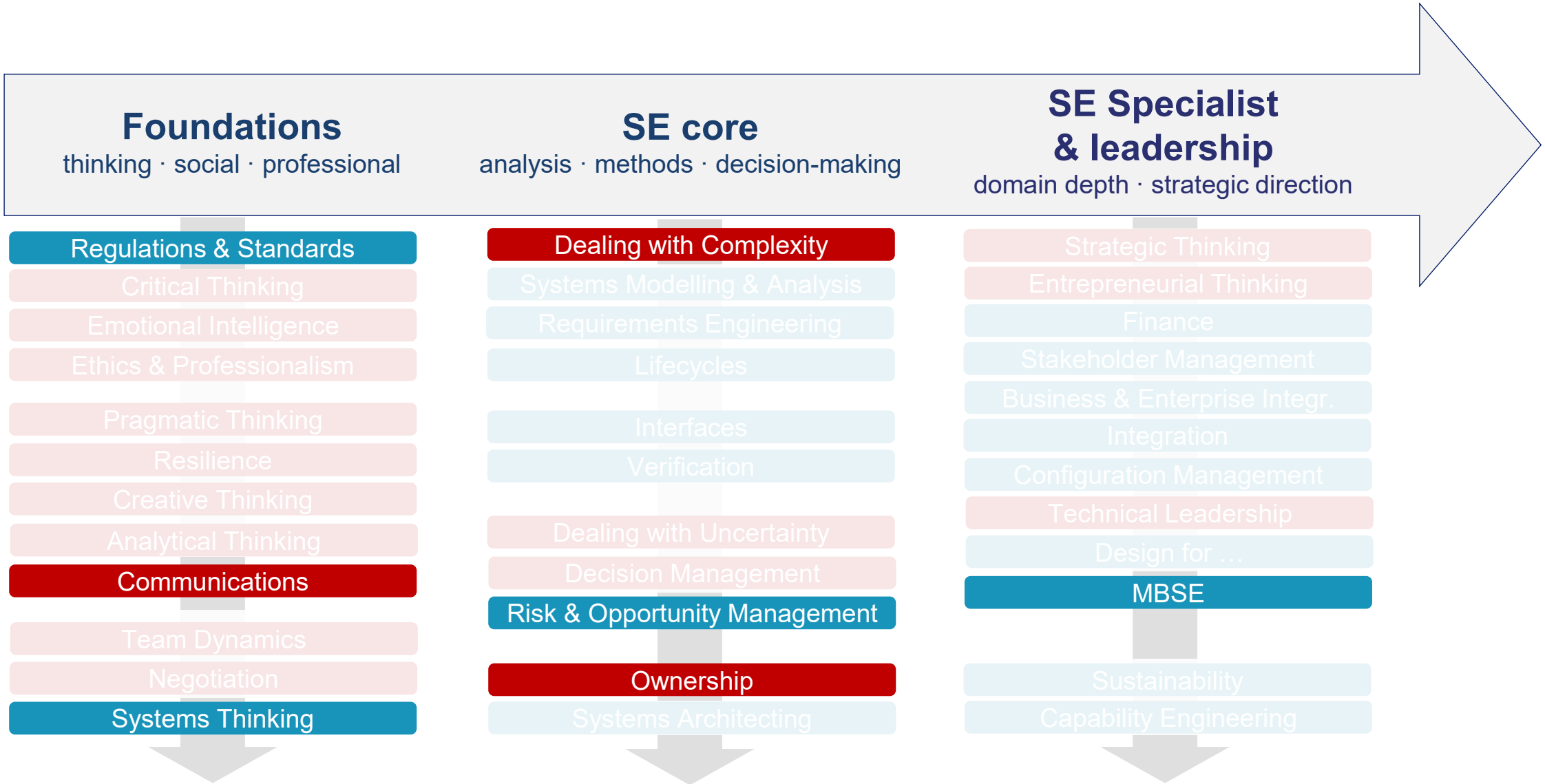
Competences	Communications	Systems Thinking	Dealing with complexity	Regulations & Standards	MBSE	Ownership	Risk & Op. Management
Communications							
Systems Thinking			↑				
Dealing with Complexity	↑	↑					
Regulations & Standards							
MBSE		↑	↑				
Ownership	↑						↑
Risk & Op. Management	↑	↑				↑	

↑ = requires

Full matrix displays **61 x 61 competencies**

Structured learning paths – Grounded in real industry data

System Architect Example



'Building the future systems workforce through education, training and talent development'



International Validation and Global Relevance

How Dutch Is the Dutch Approach to Systems Engineering?

Joana Teixeira

Systems Workforce Summit

28th October 2026

This project receives a Dutch National Growth Fund contribution through the NXTGEN Hightech program

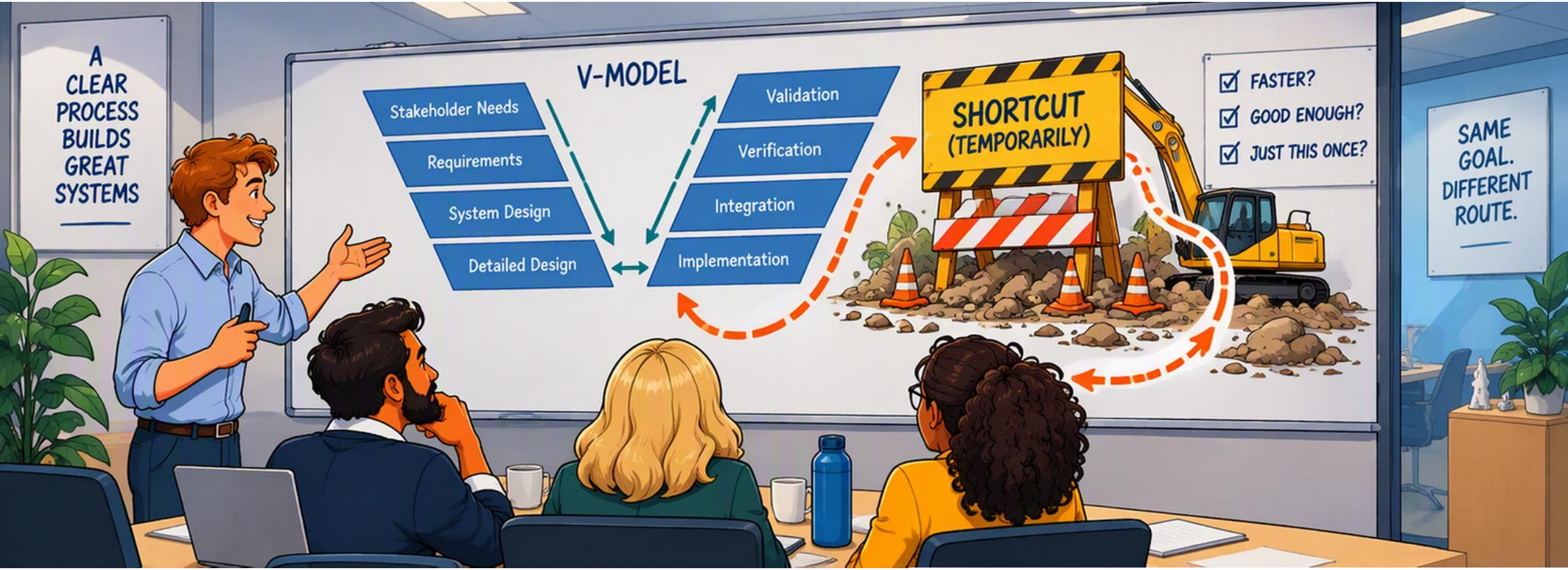
Everyone gets a say.

Not everyone gets to decide.



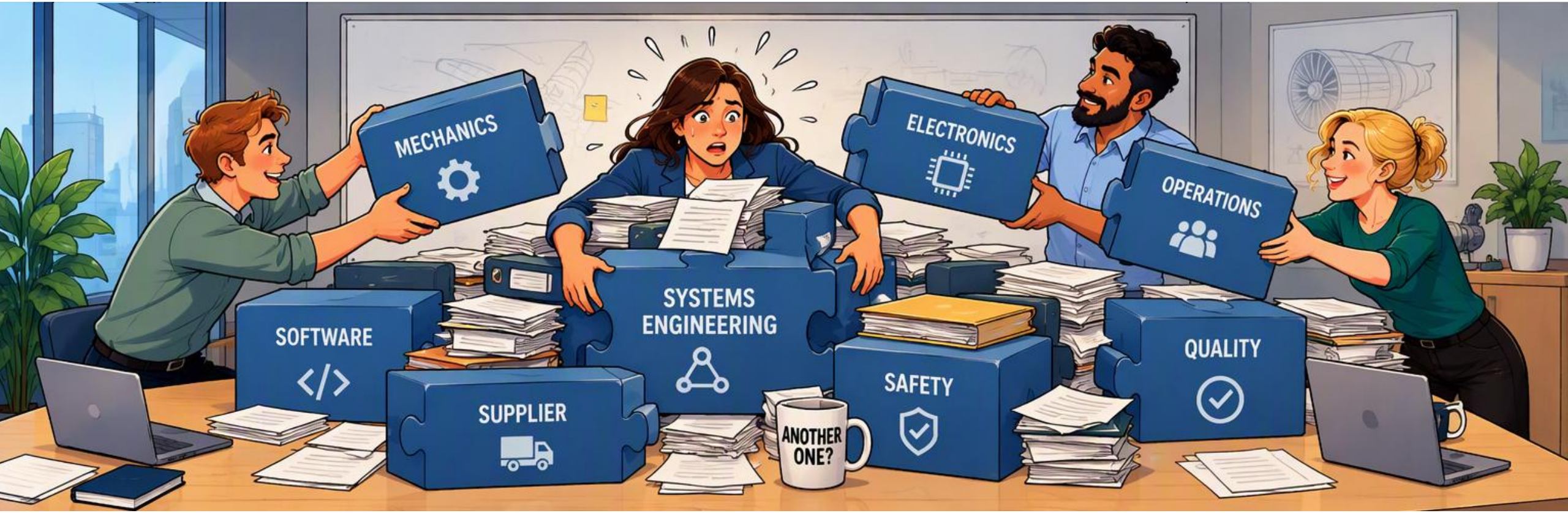
Of course we have a process.

Ignoring it is step three.



We take ownership.

Including yours.



We build systems together.

We negotiate everything else.



Our most valuable architecture repository…

is retiring next year.



CONSENSUS MEETING

V-MODEL
SHORTCUT (TEMPORARILY)

MECHANICS
ELECTRONICS
OPERATIONS
SYSTEMS ENGINEERING
SOFTWARE
SAFETY
QUALITY
SUPPLIER

OEM
CUSTOMER
REGULATOR
SUPPLIER
SUPPLIER


CASE FILE:
SYSTEMS ENGINEERING IN PRACTICE
Shared foundations or distinctive approach
Different contexts. Same passion.
GLOBAL PERSPECTIVES
ABOUT THE INVESTIGATION
The NXTGEN DASE project characterized SE in the Dutch high-tech and is now validating the findings through an industry survey.
Your input will help shape future SE education and strengthen international competitiveness.
PEOPLE
TECHNOLOGY
SYSTEMS
SOCIETY
GET INVOLVED
Would you like to participate and/or share the survey within your company or network?
Leave your details and we'll get in touch.
NXT GEN hightech
One profession. Many contexts.
We need your perspective.



nxtgenhightech.nl

Broadening Systems Engineering Across Domains

Carlos Hernandez Corbato

Associate professor, Cognitive Robotics | ME

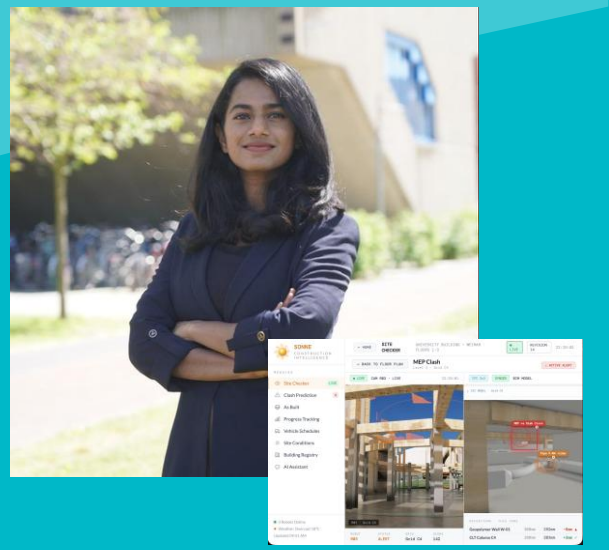
Chair of the Systems Engineering Platform

TU Delft



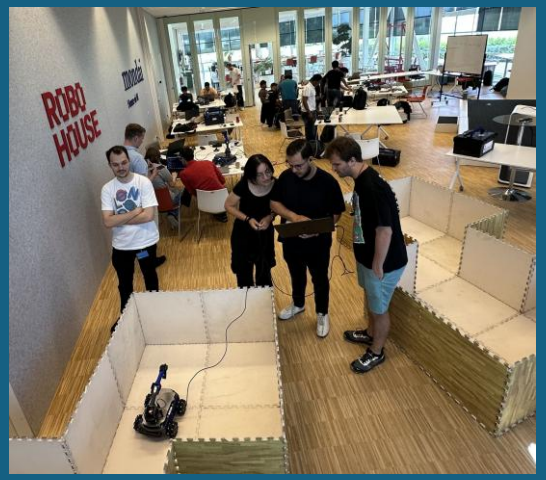
Systems Workforce @ TU Delft

MSc CME **student** at CEG
AEC Global Teamwork Prog.



Winner Systems Engineering
Student Challenge ‘26

Systems and Software
Engineering for Robotics’26



International summer school
@ RoboHouse, TUD campus

SAM X



MBSE fieldlab
Self-Adaptive Robots

TUD Systems Engineering Platform

AS

ABE



SAM XL

AE



NXT GEN hightech

DASE

IDE



FRAIM

shaping the future of work



SEP



CEG

Systems Workforce Summit

TPM



ME

EEMCS

ellis | UNIT DELFT

Scaling the Systems Workforce @ TU Delft: **Systems Engineering Expert Track** plan

BSc

one systems **foundation**, **different** domain flavours

- Capstone projects
- Minors

Supported by SEP experts

MSc

Interdisciplinary by design connected to stakeholders **societal impact**

- Systems Engineering courses
- Joint Interdis. Project SE track

EngD

(Engineering Doctorate)

think **beyond** system **boundaries**

- Systems Eng. Experts,
- System Architects and Chief Engineers

Broader views, better systems

Carlos Hernandez | TUD Systems Engineering Platform

Thank you for your attention

let’s get in touch 👉



TU Delft

[]

COMPANIES

18 kick-off → **6** one year later

LECTURERS

11 kick-off → **23** later



[]

The question changed

~~“Can you teach our engineers the V-model?”~~

“Can you educate systems engineers?”

Fontys Master of System Design: around 40 students

Requirements · Synthesis · Traceability · Robustness
Design for Six Sigma · Governance · Linear & iterative development

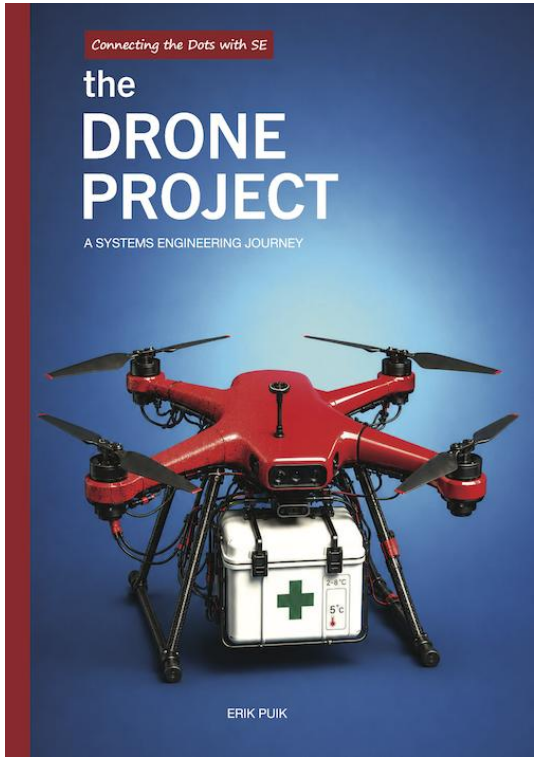
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The question changed again

This time, we asked it ourselves

“How do you teach when knowledge is one prompt away?”

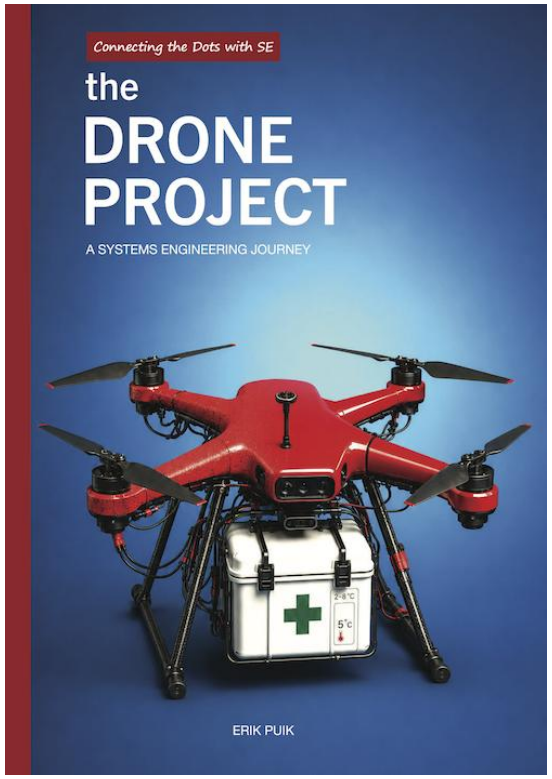
Talent Oriented Education: capability in real projects, theory when the project needs it



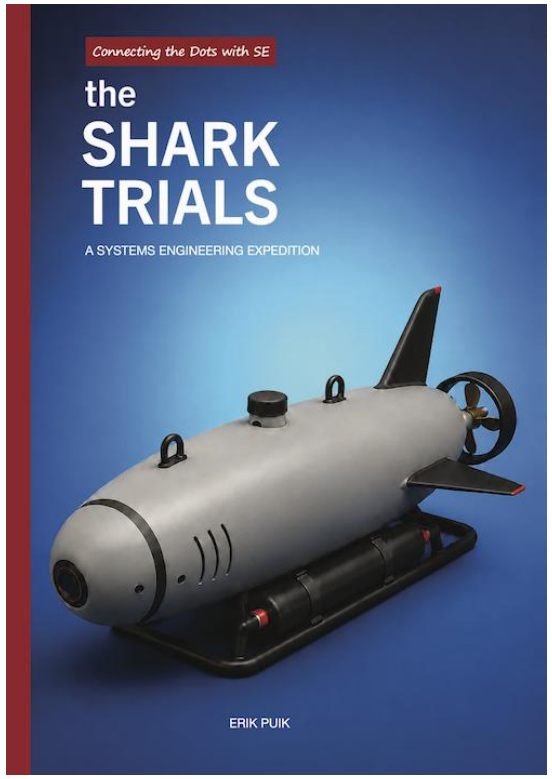
“Nothing is broken at all. And it cannot fly.”

Chapter 6

Every engineer knows that Wednesday evening.



V-model
Early 2027



Iterative design
Mid 2027



Axiomatic Design
Oct 2027

NXT GEN hightech

Books · films · teaching guides · exercises · rubrics · assessments

OPEN SOURCE, USE IT, IMPROVE IT



Erik Puik
Systems Engineering | Axiomatic Design |
Author of Beyond the V-Model | Bridging...



Erik Puik
Systems Engineering | Axiomatic Design | Author of Beyond the V-Model | Bridging...

UNIVERSITY OF TWENTE.

Systems Engineering: Dealing with the Uncertain Future

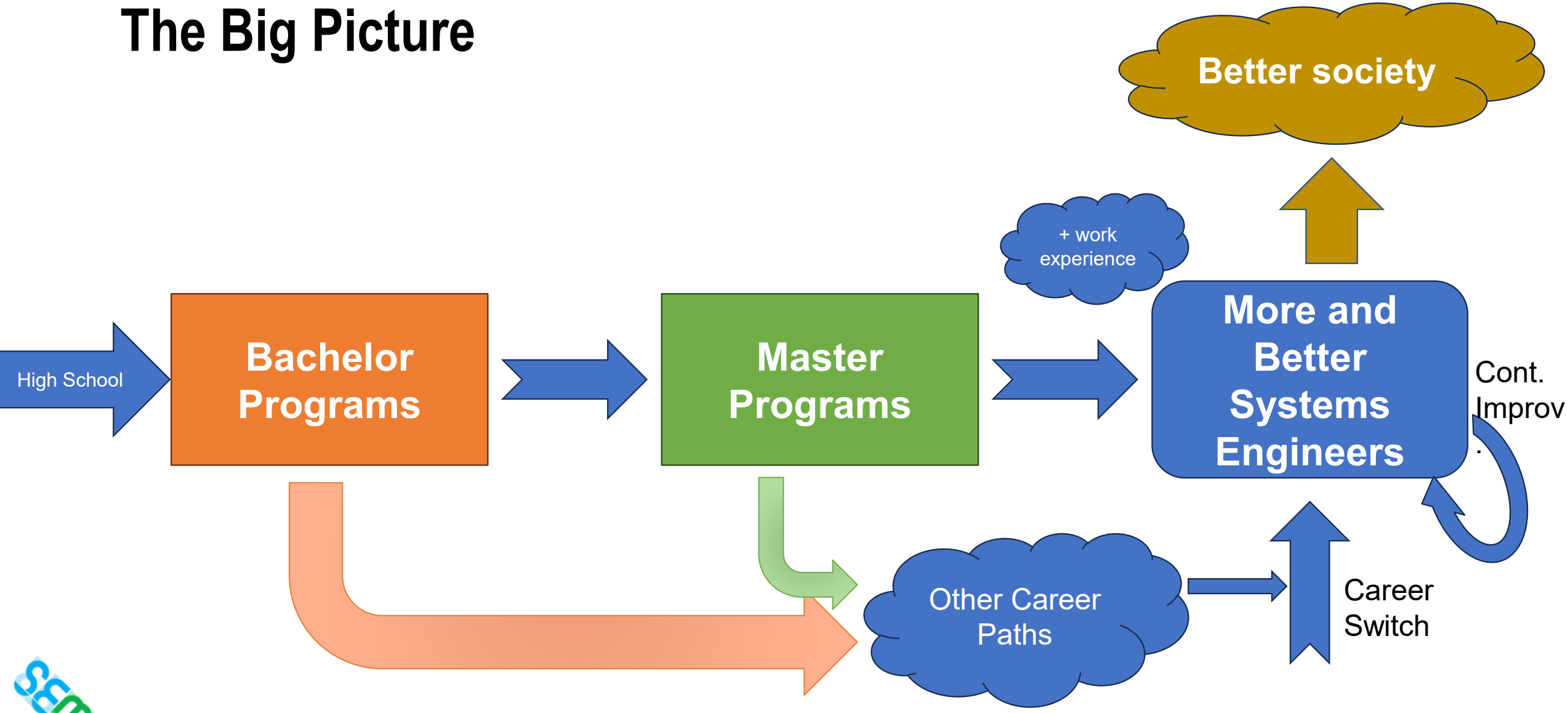
Maarten Bonnema

Professor of Systems Engineering and Multidisciplinary Design

INCOSE Fellow

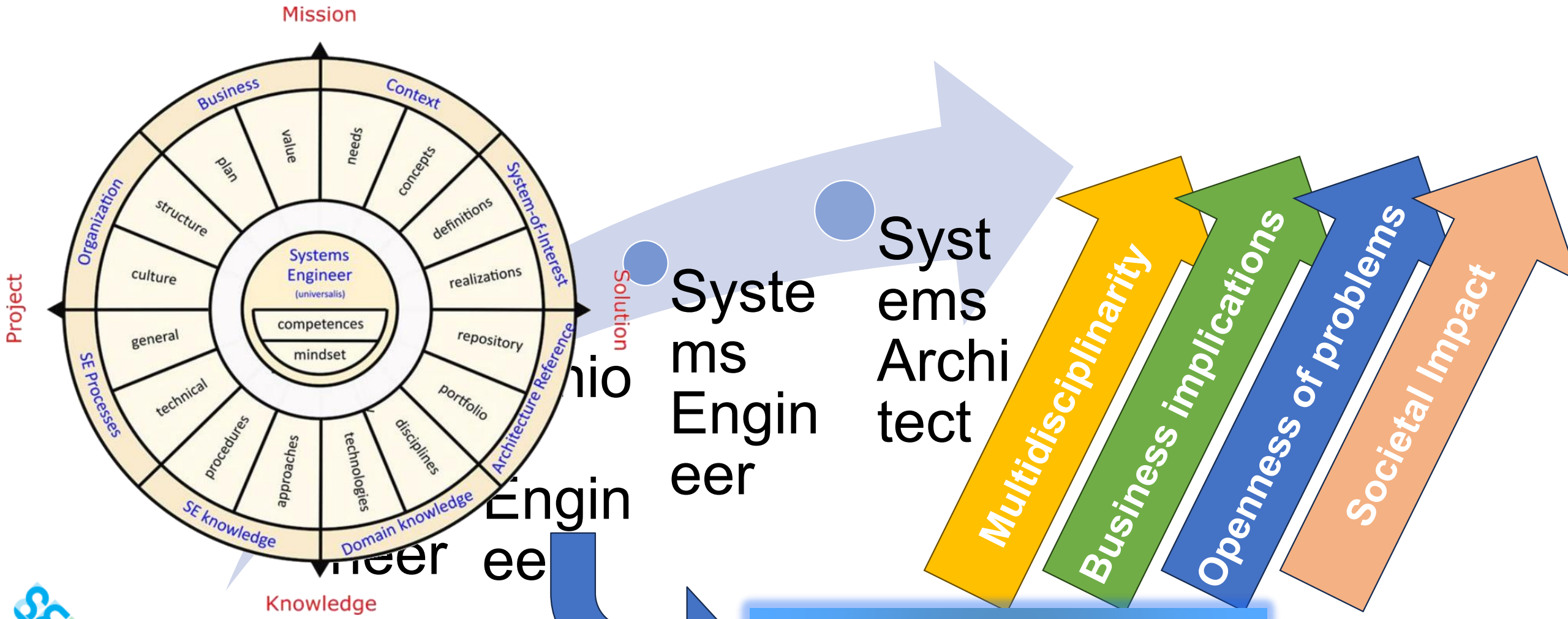
SYSTEMS ENGINEERING & SEMD MULTIDISCIPLINARY DESIGN

The Big Picture

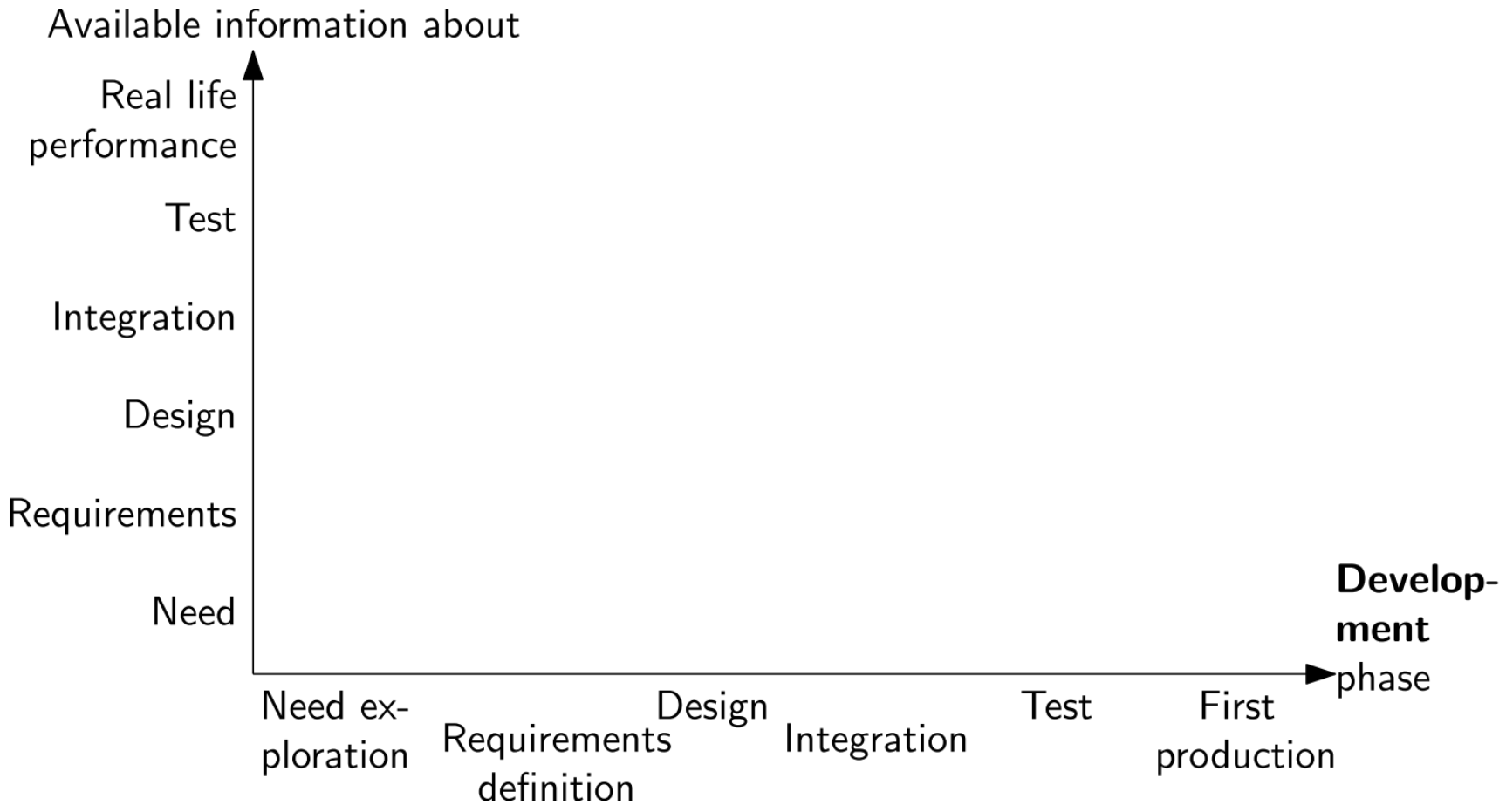


Backbone from Systems Summit 2024

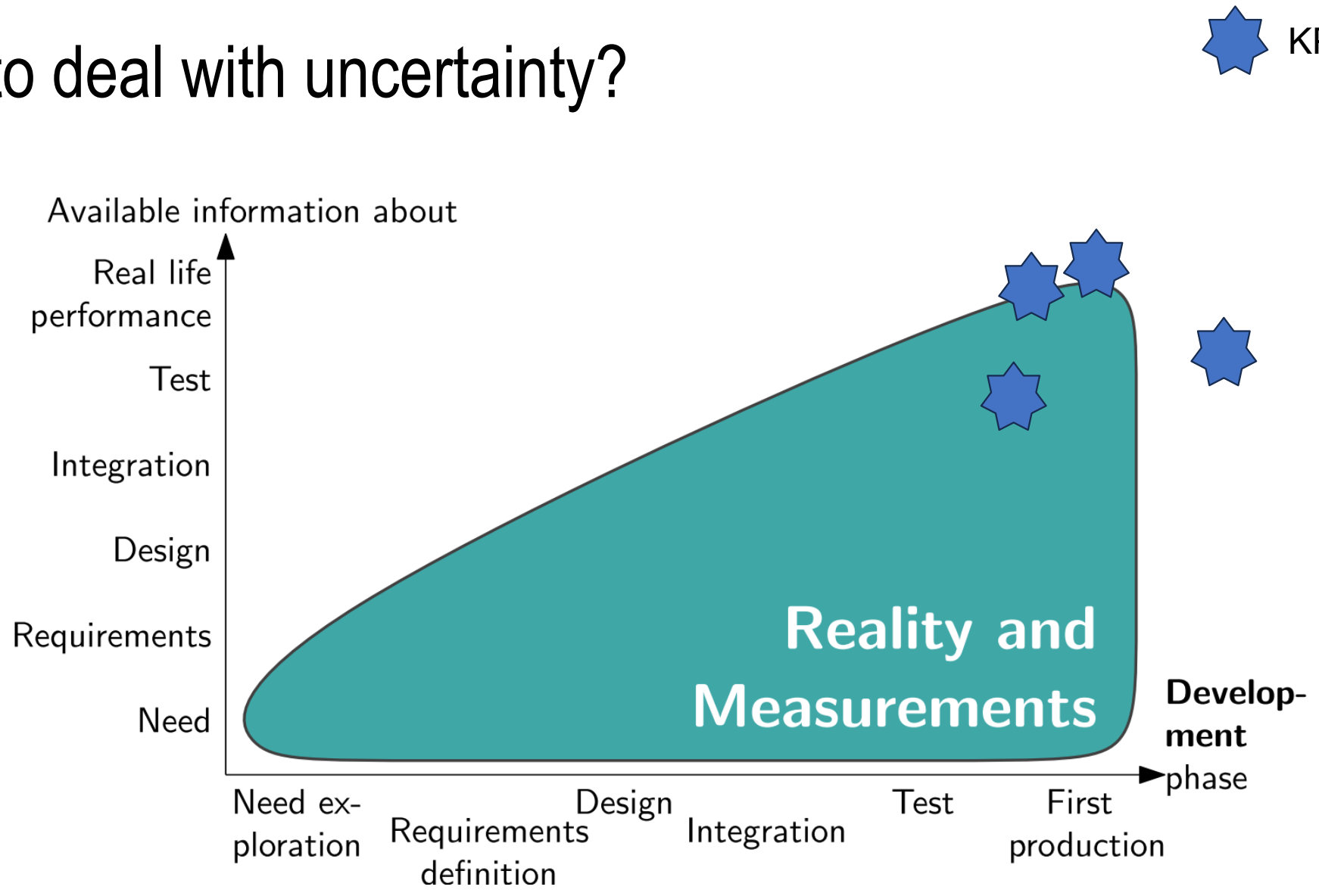
- Typical Development of a SE



How to deal with uncertainty?

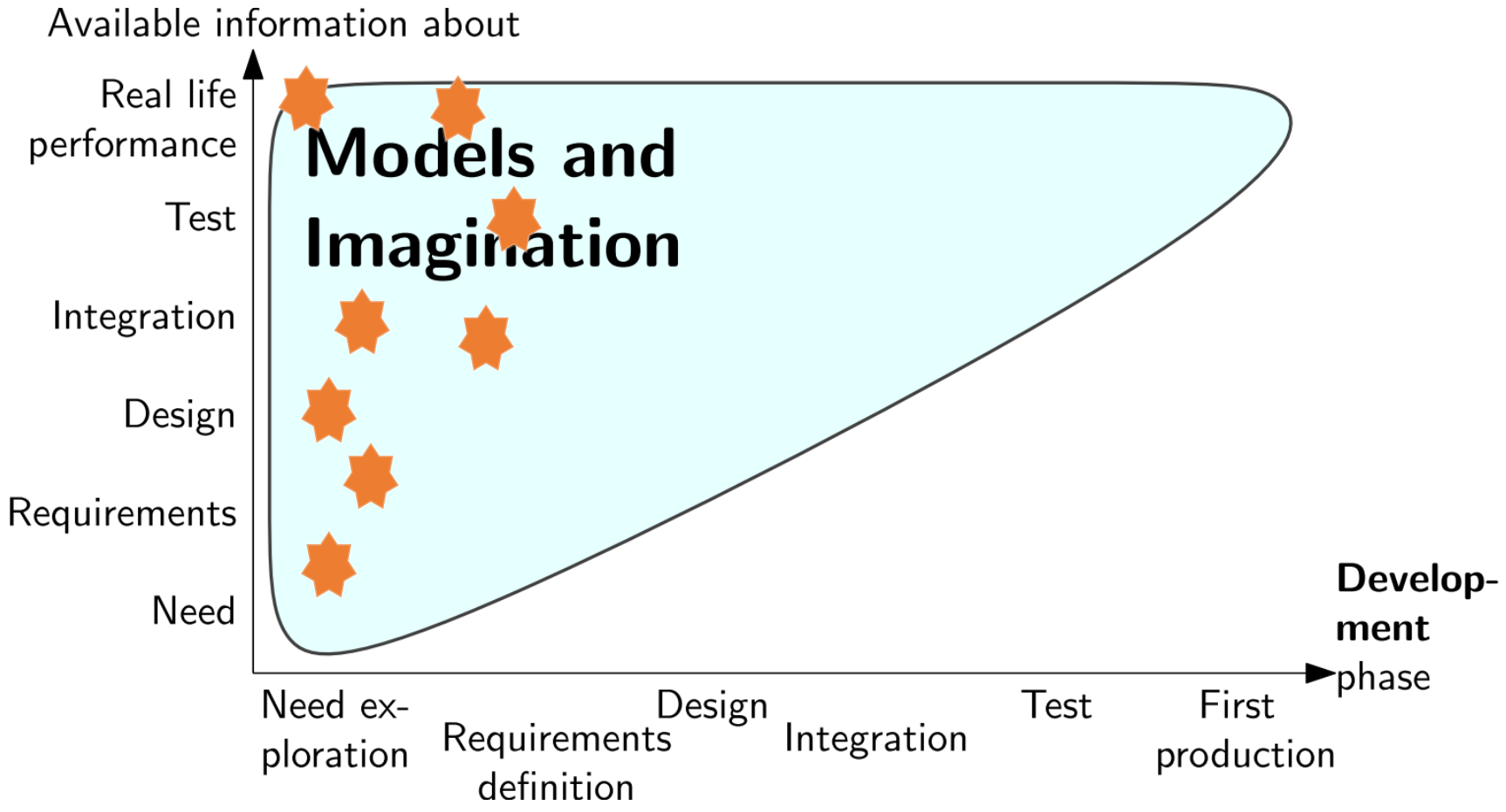


How to deal with uncertainty?

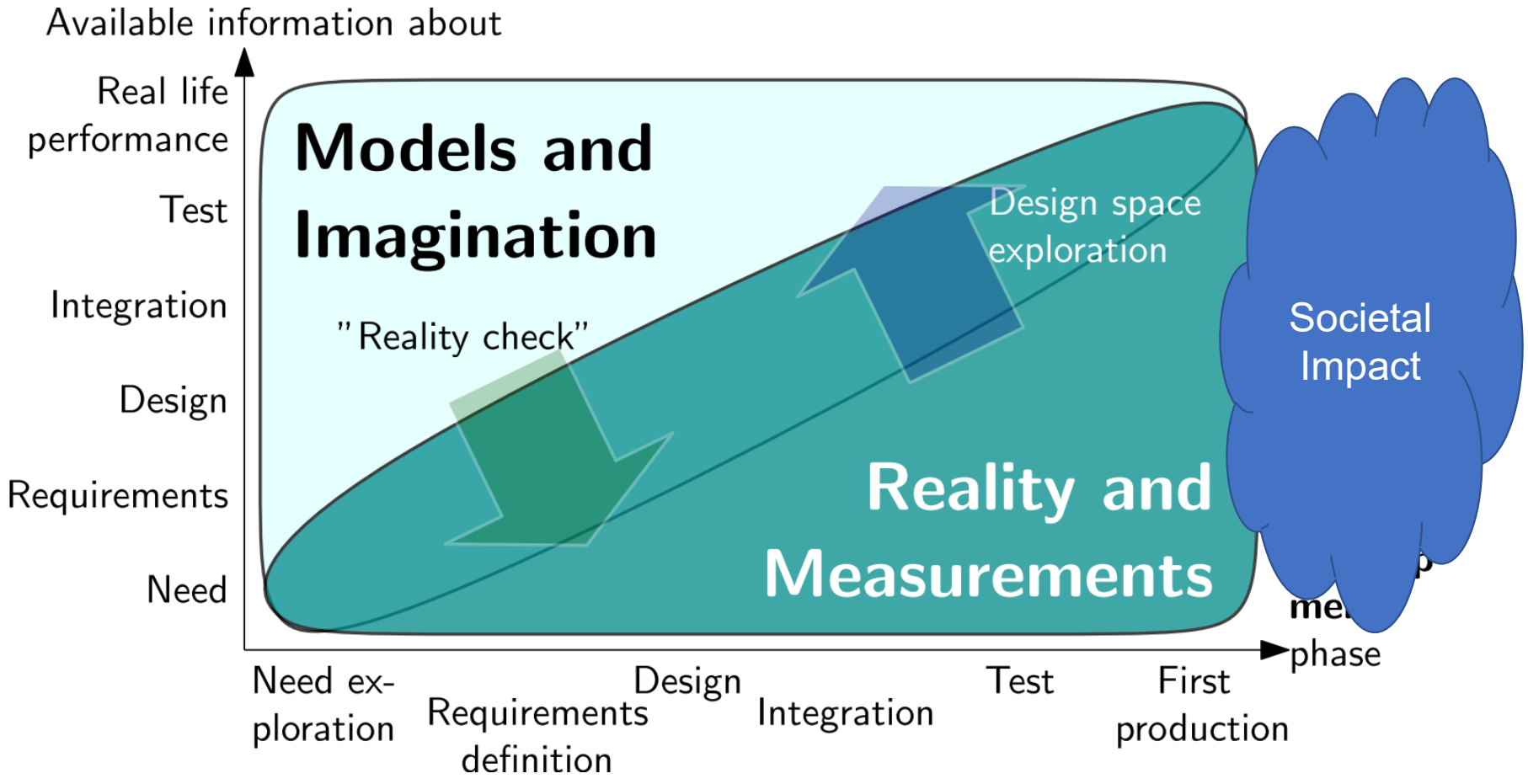


How to deal with uncertainty?

Key Driver



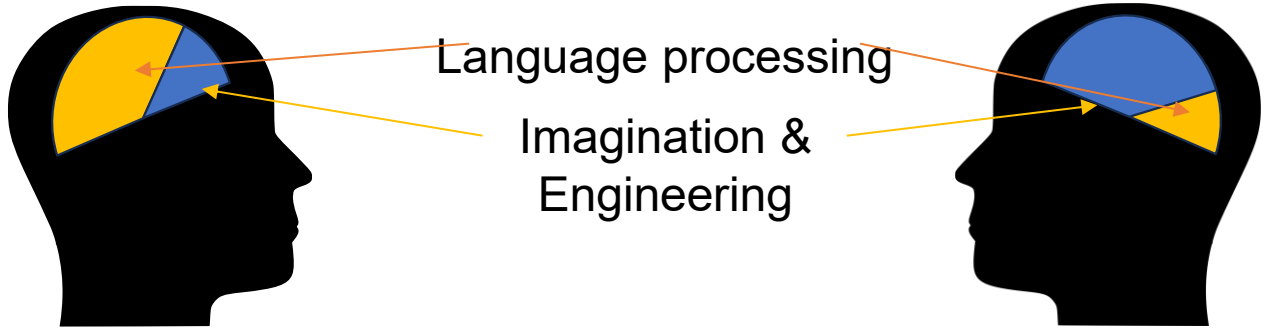
How to deal with uncertainty?



We need to stimulate *Imagination*, founded on Models and Reality

- Models use languages
  - SysML (v1 or v2)
  - Math
  - Domain specific languages
  - ...
- Requires *processing* to create understanding
- The more *processing*, the less mental space for Imagination and Engineering

- Keep the models Simple!
- A SE uses many “simple” diagrams to acquire, manage and show very diverse types of information and knowledge





Mural inside the Sydney Harbour Bridge

https://research.utwente.nl/en/publications/complex-tasks-simple-tools

Thank You!

For more information:

www.utwente.nl/SEMD

www.utwente.nl/SEKCT

SYSTEMS ENGINEERING & MULTIDISCIPLINARY DESIGN

UNIVERSITY OF TWENTE.
SYSTEMS ENGINEERING KNOWLEDGE CENTRE TWENTE
www.utwente.nl/sekct


TU/e
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UNIVERSITY OF
TECHNOLOGY



SE Workforce Summit

Scaling Systems Capability Through Continuous Development

Joana Teixeira
10-2026

Planting the Capability

Knowing what to learn is only the beginning.



Growing the Capability

Learn



Growing the Capability

Apply

Learn



Growing the Capability

Apply

Learn

Reflect



Growing the Capability

Apply

Learn

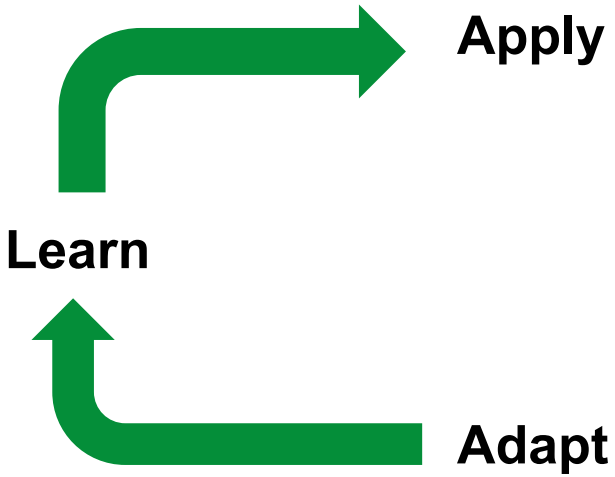
Reflect



Adapt



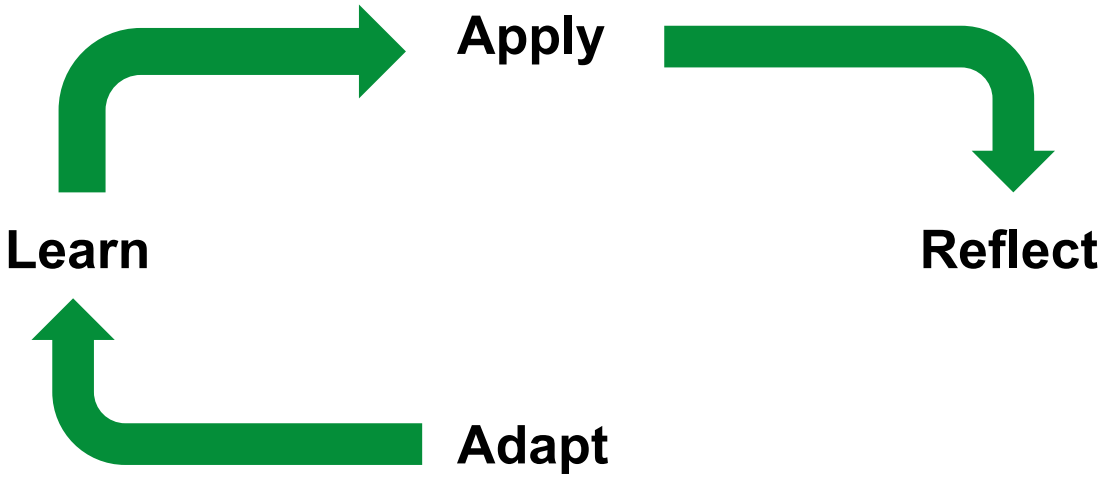
Growing the Capability



Reflect

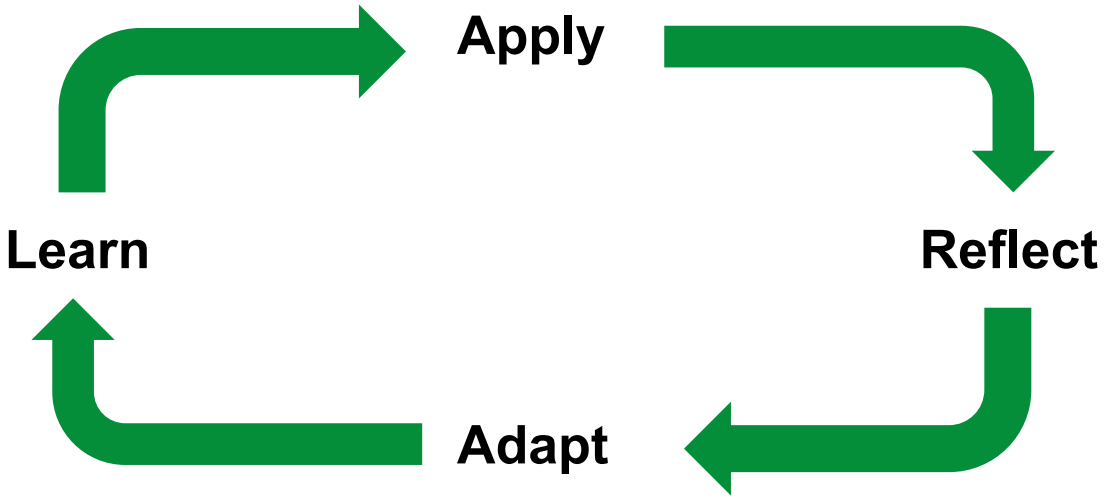


Growing the Capability



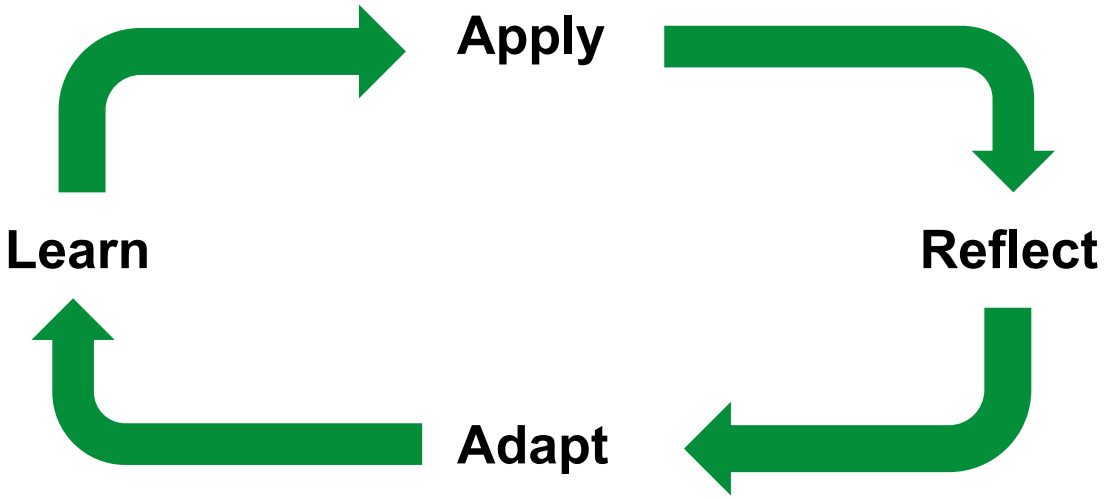


Growing the Capability



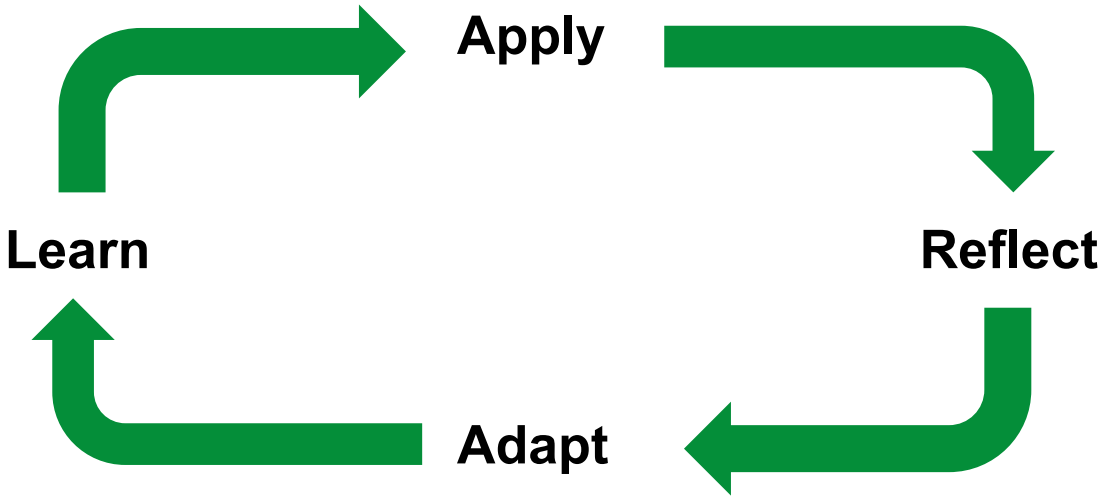


Growing the Capability





Growing the Capability





Scaling the Capability

Plant the seed.

Create conditions to grow.



Creating the Conditions

Shared language and navigation.
- SE Navigation Game

Better Human Support
- Mentor Foundation Program

Connection among peers.
- Community Lab

Accessible digital support
- AI SE Navigator



Cultivating the ecosystem

Capability is not built in a course.

It is cultivated in an ecosystem.





nxtgenhightech.nl

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Casper Voogt - Head of Discipline Systems Engineering



> 2017-present Thales

- **Now:** Head of Discipline Systems Engineering Naval
  - Leading 300+FTE / Proces Owner SE
- **Previous:**
  - HoD Systems Engineering Thales Germany
  - Teamlead IVVQ Thales Germany
  - Test Manager Thales Netherlands

> Background:

- Motorsports – Motorcycle Road Racing
- Education: MBA Utwente and Aerospace Engineering TU Delft

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The Markets We Serve

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About **Thales**

85.000
Employees worldwide

65
Countries

Over
€4bn
Self and Customer – Funded R&D

€22.1bn
Sales

€25.3bn
Order Intake

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About **Thales in the Netherlands**

+/-3000
Employees

€900M
Revenue

€160M
Research & Technology Development



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System of Systems Engineering @ Thales

- **Complex and big system of systems**
- **HW and SW Development and Integration**
- **Large development teams (20-500FTE)**
- **Complex requirements for:**
  - Cyber Security
  - Safety
  - Serviceability
  - EMC



© Jorn Urbain

Traits of a great Systems Engineer and… how do we learn?



Systems Engineers have real domain knowledge and experience

The Naval Academy teaches our engineers in all domain specifics in the Naval Sector



Strong knowledge and experience in the fields of SW ,HW and Testing is essential



During our Traineeship new engineers can experience different disciplines



Good systems engineers know the theory, great systems engineers show leadership



In our Top Classes and Personal Empowerment Programs we develop leadership skills

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Together with TNO-ESI and the NextGEN initiative we:



Align the definition of systems engineering between Universities and industry



Share best practices between industries in the Dutch High-Tech sector



Extend training and learning from universities into industry

- *CAFCR*
- *System Integration*

NXT GEN hightech

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Recommendations:

> Merge Work and Education into a single harmonious Pathway

> Systems Engineering is not standalone starting field

> Treat leadership as an applied, field-based competency

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