WHAT IS THE VALUE OF YOUR DATA?

- The Harvest.

From a basket full of apples to premium juice.

It all starts with people.
Just as apples are harvested by farmers, data is collected, shared, and prepared by teams working together.

Collaboration starts the HSEIF2 journey.

Farmers that grow, harvest, and select the apples - just like the teams involved in collecting, preparing and sharing data.

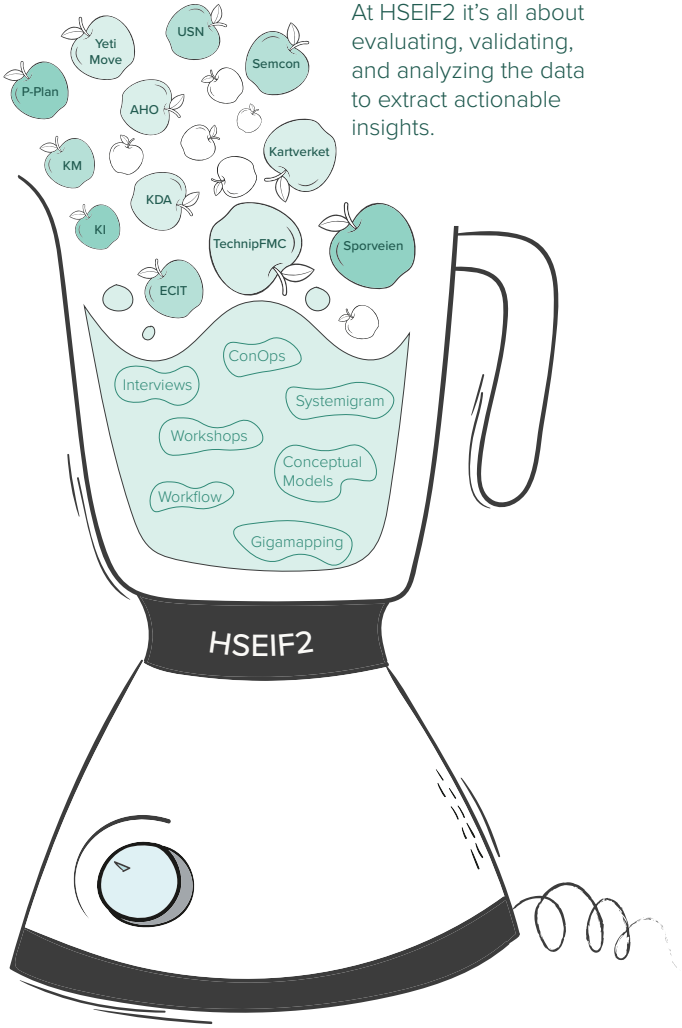
- The Essence.

THE JUICER -
The tools in skilled hands

The organization of HSEIF2 project is structured with Semcon as owner and project manager, and USN as academic lead, alongside 9 business partners and one academic partner. The focus is on developing innovative methods for handling complex systems through a combination of systems engineering, design thinking, and data analytics.

The juicer doesn't run itself - it needs skilled operators. HSEIF2 empowered people to collaborate and process data effectively, extracting the value.

At HSEIF2 it's all about evaluating, validating, and analyzing the data to extract actionable insights.



- The Outcome.

THE TASTING ROOM - Shared juice, shared success

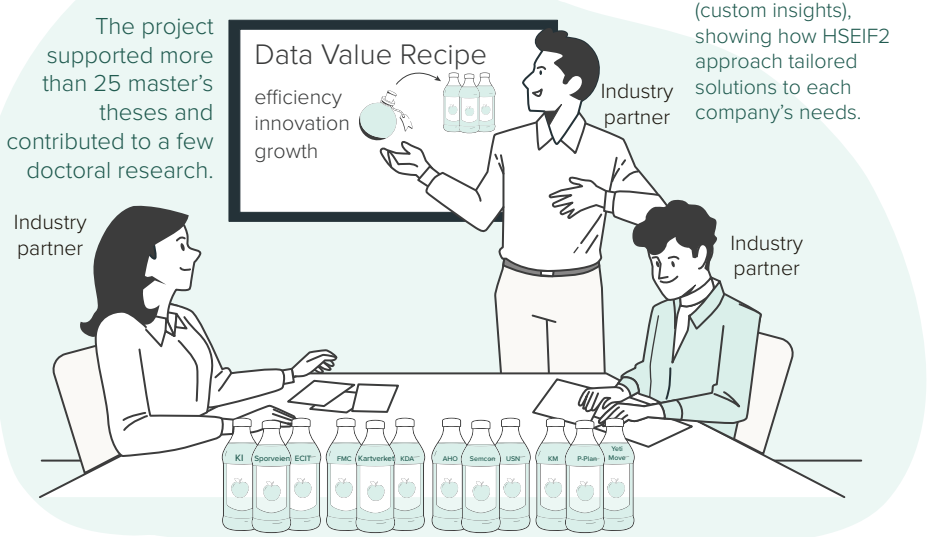
Juice is only valuable when shared and consumed - the same happens with data!

Insights gained from data are most impactful when distributed, discussed, and acted upon by the teams.

Customize your Juice

The project supported more than 25 master's theses and contributed to a few doctoral research.

Different apples (companies/data) can create unique flavors of juice (custom insights), showing how HSEIF2 approach tailored solutions to each company's needs.



Key outcomes of HSEIF2

Knowledge exchange

Bring together 2 Academic researchers and 10 industry partners to share expertise and co-develop practical solutions.

Long term impact

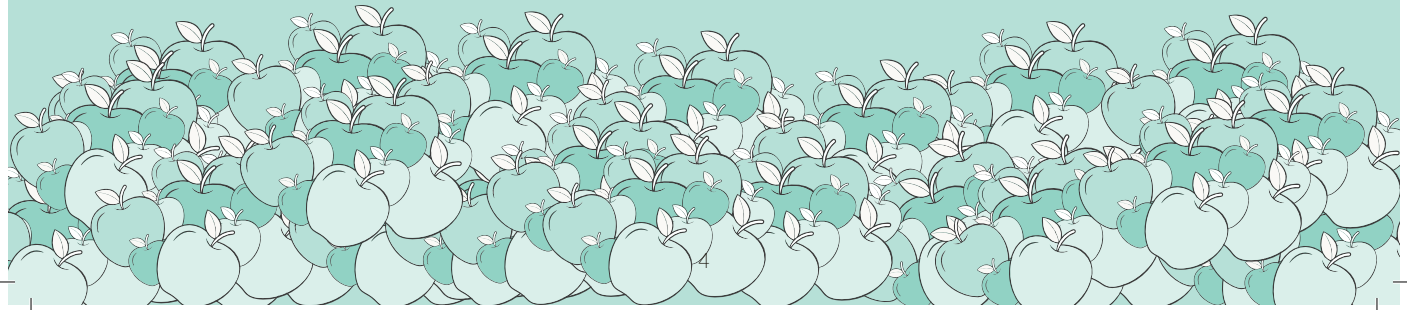
Demonstrate how systematic approaches to data management can drive efficiency, innovation, and strategic decision-making.

Focus on relevance

Helping organizations process and interpret vast datasets to identify and leverage the most critical and actionable information.

Unlocking the potential of data, embracing **collaboration**, and demonstrating the **practical value of research driven innovation**.

The progression from HSEIF to HSEIF2 represents a continuous journey towards optimizing **data-driven decision-making and innovation across industries**.



Meet the participating industries

Key collaborators within HSEIF2 project

KONGSBERG

ecit

semcon
Part of Knightec Group

YETIMOVE

sporveien

Kartverket

Kongsberg Innovation

PLAN
SMARTPARKING

University of
South-Eastern Norway

AHO

TechnipFMC

Semcon

Part of Knightec Group

Semcon is the owner and project manager of the HSEIF2 research project.

With USN as the academic lead, and AHO providing support in design thinking and System Oriented Design, together form the project management team.

Semcon in collaboration with academic resources, tested several cases and methods within **Systems Engineering** and **System Oriented Design**.

Semcon and the project management are convinced that the collaboration, sharing and aligned research give valuable insight and learnings on development and application of methods to get value from data.

HSEIF2 participation led to new insights, resulting in updates to Semcon's product development process with an enhanced focus on data, especially sustainability-related data.

Research was conducted both internally and in client projects within the areas of (a) simulation and digital twins; (b) energy management and IoT for informed energy decisions; (c) assessing management systems for information storing and sharing, (d) prolonged lifetime condition-based maintenance and (e) sustainable use of resources.

Curious?

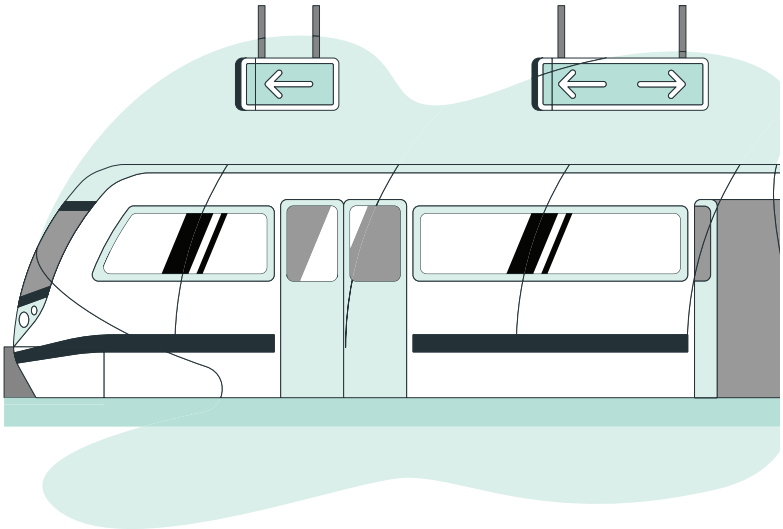
Sporveien

The main focus for Sporveien was to experience the use and processing of data in context of a digitalization process in an organization.

Sporveien welcomed a Master's student and a PhD candidate, who contributed valuable research and insights.

The benefit for Sporveien was having a theoretical angle to a very practical hands-on culture.

It was both beneficial and challenging because the "language" did not always correlate and resonate.
However both candidates were conscious about this, and communicated very intelligently with the technicians and the worker in the maintenance base.



The Master's thesis focused on assessing data maturity, exploring available data, and analyzing how it is utilized. The student also examined the organization as a whole, working on communication strategies and suggesting improvements.

The PhD candidate used **conceptual models** and data to **enhance corrective maintenance**, linking fault data with weather patterns.

Curious?

Kongsberg Defence & Aerospace

KONGSBERG

KDA's key focus has been to develop processes and methods for the development and verification of good user interfaces, especially for their use in stressful situations.

KDA's scenario in the project is a system of systems where one or more operators must be able to relate to several systems when moving in the terrain.
It is essential to ensure good situational awareness for the operator and a user interface that facilitates well-informed decisions as much as possible.

During the project, KDA investigated how testing in a simulated environment can be used to iterate and improve the user experience (UX) in current and future systems.

This knowledge led to the creation of an UX laboratory aimed at testing, iterating, and verifying design options.

KDA collaborated with **four master students and one PhD student throughout the project**. The students experienced a **combination** of **academia insights with real-world industrial problems**.

The students conducted literature reviews, experiments, and interviews with numerous KDA employees to explore specific issues.

Curious?

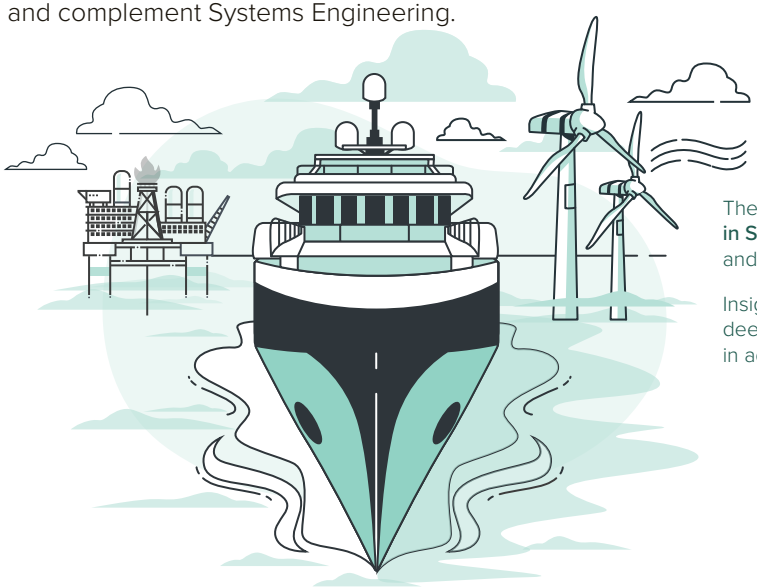
Kongsberg Maritime

Kongsberg Maritime explored System-Oriented Design (SOD) to address sociotechnical complexity, focusing on early-phase processes and long-term perspectives for new technologies and operational methods. Using Gigamapping, they visualized, and explored relations between humans, technologies, and systems.

Kongsberg Maritime adopted a multi-case learning approach to refine SOD capabilities, providing methods to navigate high complexity and complement Systems Engineering.

This has contributed to a holistic process from early-phase to operation. Their aim is to further integrate SOD with Systems Engineering, strengthening their approach to complex sociotechnical maritime systems.

KONGSBERG

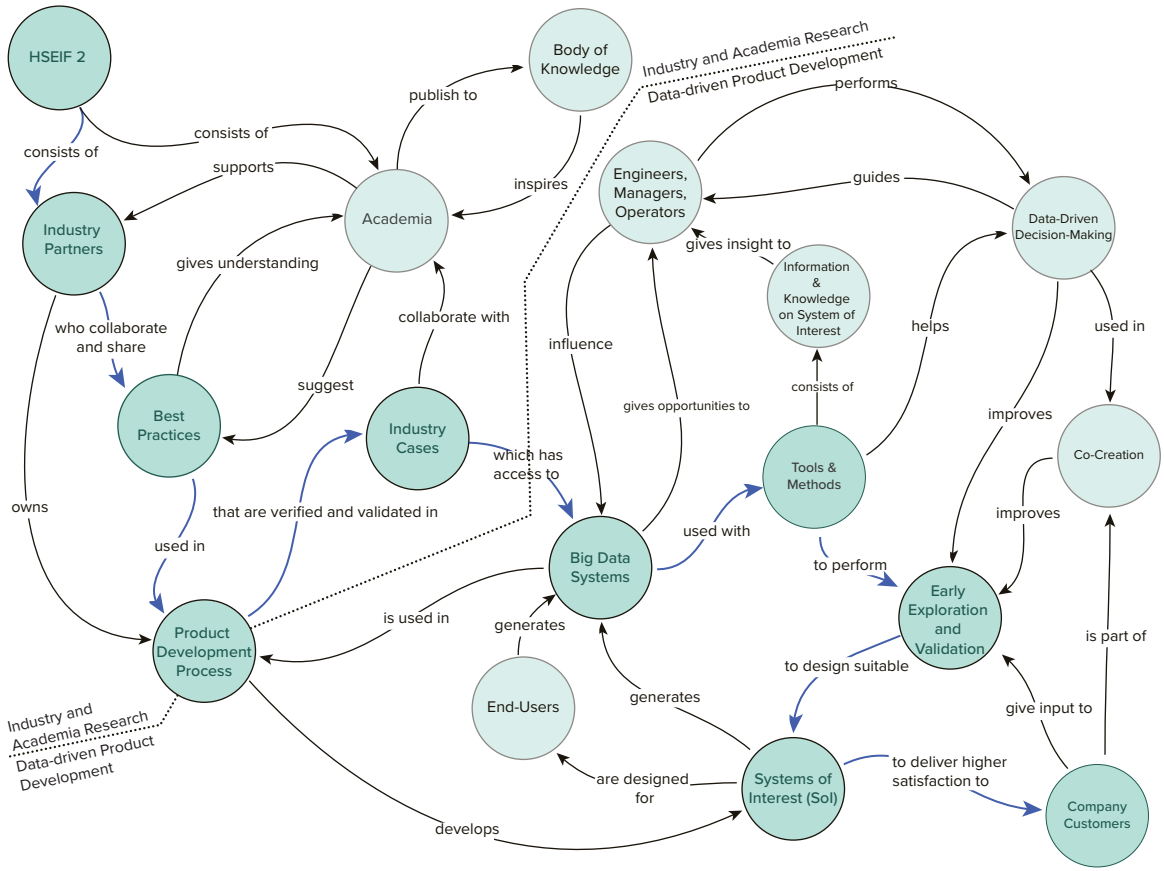


The project was closely tied to an **Executive Master in SOD** at **AHO**, with **Workshops** improving learning and developing methods to navigate complexity.

Insights from HSEIF2 and the master thesis deepened their understanding of SOD's role in advanced digitalization.

Curious?

HSEIF 2 Systemigram



Langen et al. (2022). Systems Thinking Approach to Data-Driven Product Development. Proceedings of the Design Society

Yeti Move

Yeti Move offers a service for airport operators to digitally plan and execute snow removal using autonomous (self-driving) vehicles.

The HSEIF2 contribution has been within collection of data from the systems in the piloting operations and through interactions with customers and users.

Yeti Move used **conceptual models** to understand customer requirements and implement them effectively.

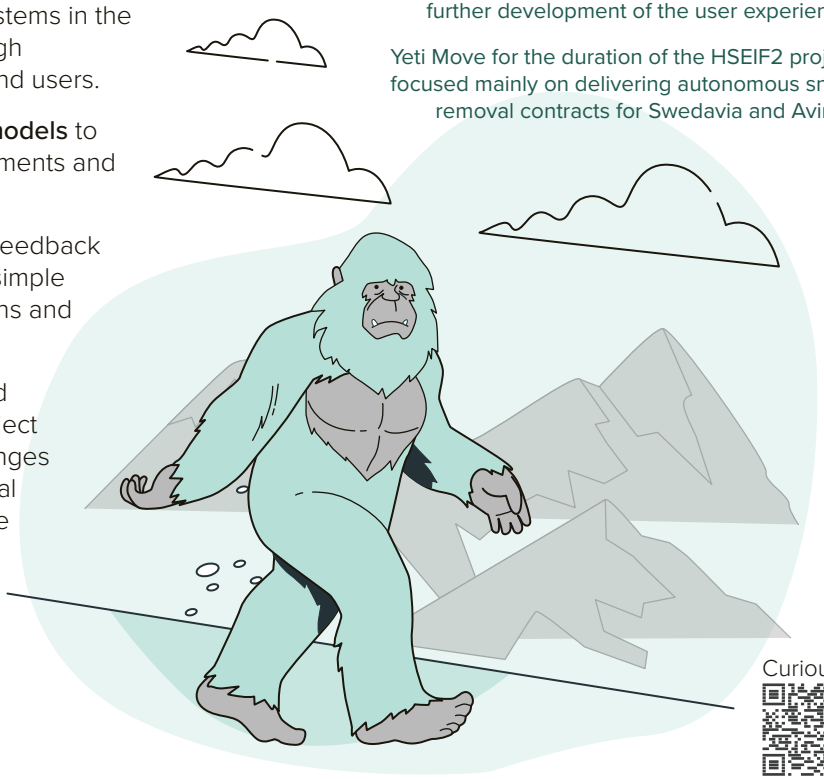
Yeti Move received valuable feedback from external partners using simple informal models for discussions and documentation.

These (HSEIF2) results helped Yeti Move view the entire project holistically, addressing challenges without getting lost in technical details, thereby enhancing the competitiveness of their autonomous product.

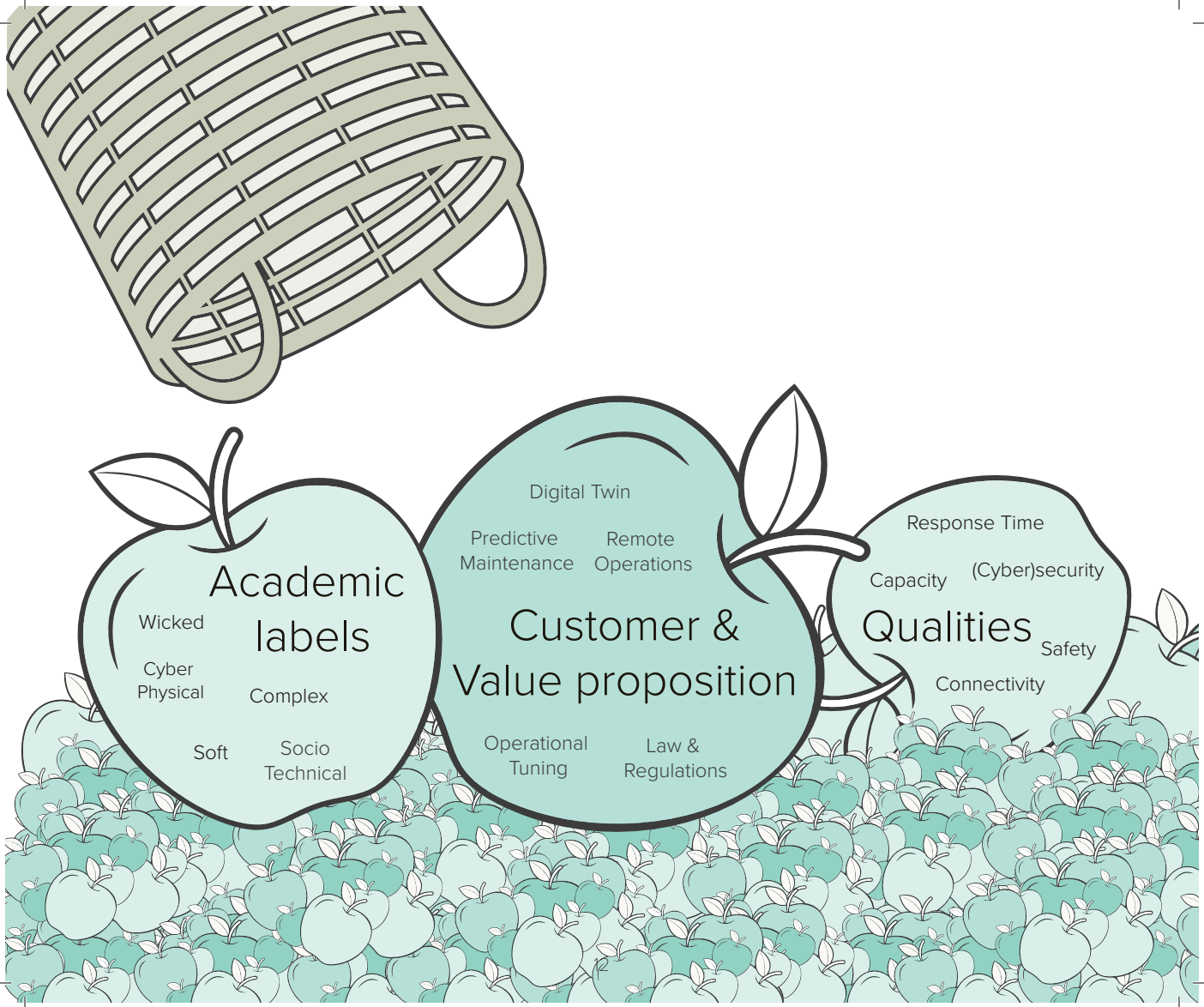
YETIMOVE

There are many end user interfaces in the Yeti Move user experience.
Yeti Move seeks to gather data that will support them in further development of the user experience.

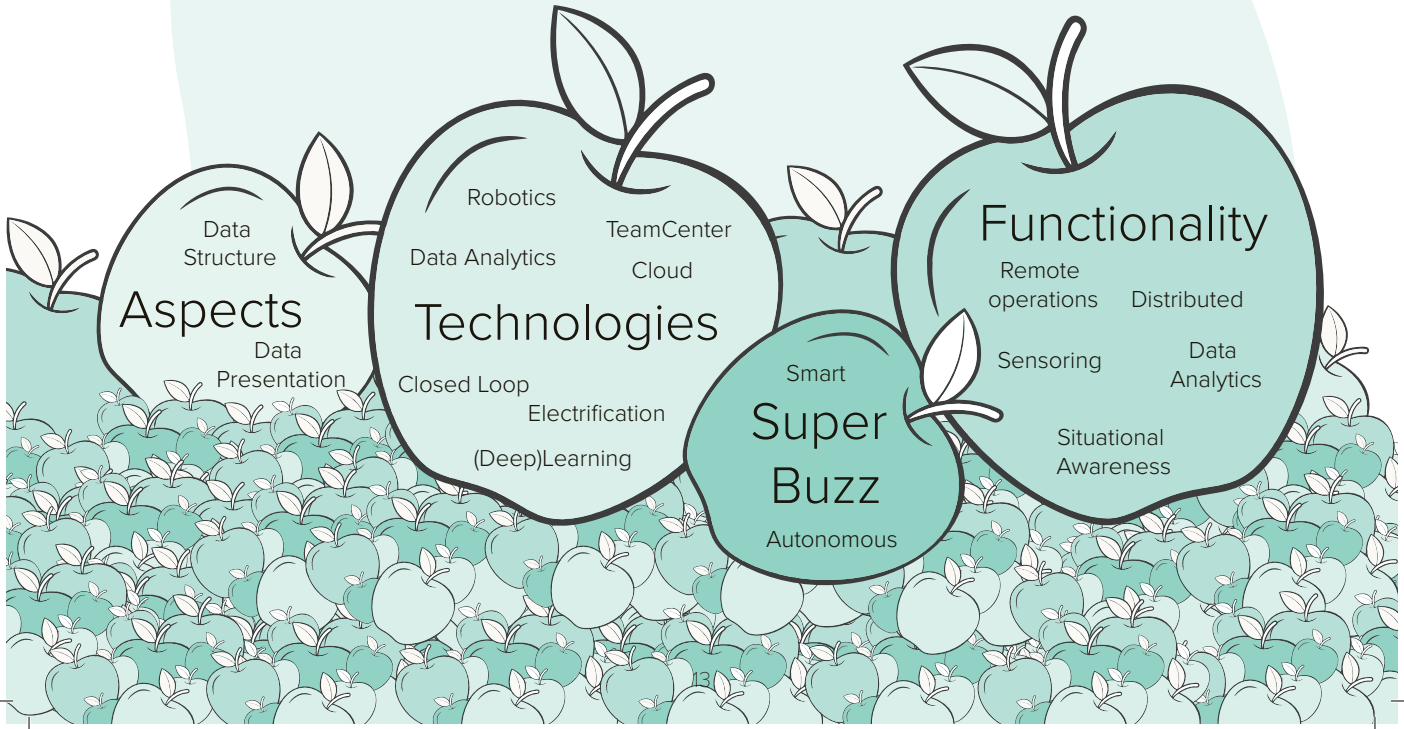
Yeti Move for the duration of the HSEIF2 project focused mainly on delivering autonomous snow removal contracts for Swedavia and Avinor.



Curious?


Academic labels
Wicked
Cyber Physical
Complex
Soft
Socio Technical
Digital Twin
Predictive Maintenance
Remote Operations
Customer & Value proposition
Operational Tuning
Law & Regulations
Response Time
Capacity
(Cyber)security
Qualities
Safety
Connectivity

Digitalization Buzzword Cloud



Kongsberg Innovation

Kongsberg Innovation aimed to use **data-driven methods** for early-stage innovation in HSEIF2. The goal was to help small and mid-sized companies by customizing their development processes with data.

A **multi-case study research method** was used, comparing multiple startups to explore data usage in early validation.
This iterative approach improved problem understanding, research questions, and realistic solutions.

Our study explored the benefits of data for early-stage high-tech startups using a market pull strategy in a Business-to-Business model. Startups often lack structured validation and face challenges like limited data and resources. Key factors include reluctance, lack of process, and team experience.

As a result, they developed an Early Validation User guide (EVU) to help integrate big data and decide when to pivot or scale.

Participation in HSEIF2 has significantly benefited Kongsberg Innovation by providing a deeper understanding of the types of projects, R&D challenges, and outcomes associated with data-driven product development among the industrial partners.

Curious?

Kartverket

The Norwegian Mapping Authority has diverse roles across four divisions: Land, Maritime, Geodesy, and Land Registry.
Kartverket collaborate extensively with public agencies, universities, and the private sector.

Funding is a challenge, so they explore project funding beyond annual government appropriations.

Methods tested were **System Oriented Design** (SOD) and **Gigamapping** to generate new project ideas, which has improved employee engagement, opportunity identification, and project prioritization.

SOD and Gigamapping proved to be valuable tools in the process of developing new projects and increasing the possibility of securing financing.

By using these methods, several good opportunities were identified, such as to improve application quality, increase the likelihood of funding, and to strengthen their innovation capacity.

Kartverket

HSEIF2 has shown us that the challenges we face in the public sector are not unique, in the sense that the same tools and methods used in the private sector can be used successfully and consequently lead to higher efficiency and innovation.

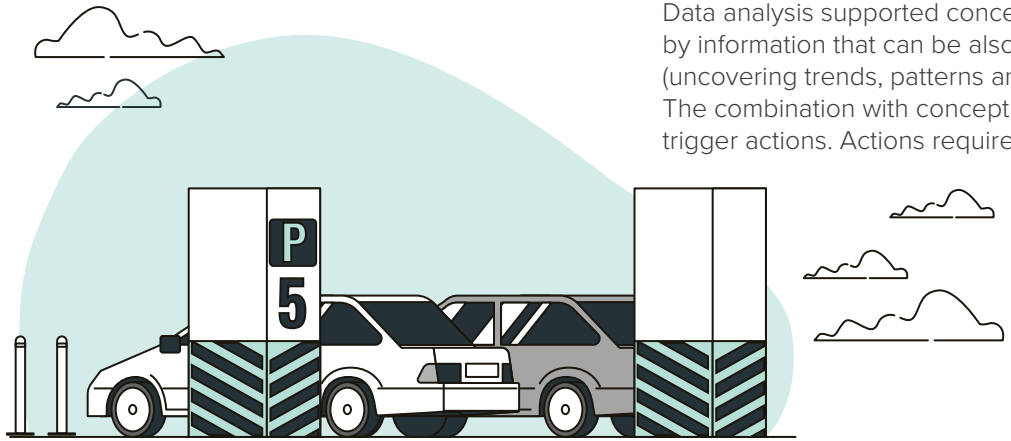
Curious?

P-Plan

As a medium-sized company operating Automated Parking Systems (APS), the company aims to increase market share by introducing Condition-Based Maintenance (CBM).

P-Plan conducted a feasibility study, which reveals that combining **conceptual modeling** and **data analysis** is essential to achieving this goal.

Implementing a combination of data analysis and conceptual modeling is recommended as a short-term strategy to enhance APS reliability.
This approach also supports the long-term vision of successful CBM implementation.



Key Findings

Conceptual Modeling
Enabled stakeholders to align on the core goal of improving APS reliability.

Data Collection
Six years of failure and weather data revealed trends and correlations.

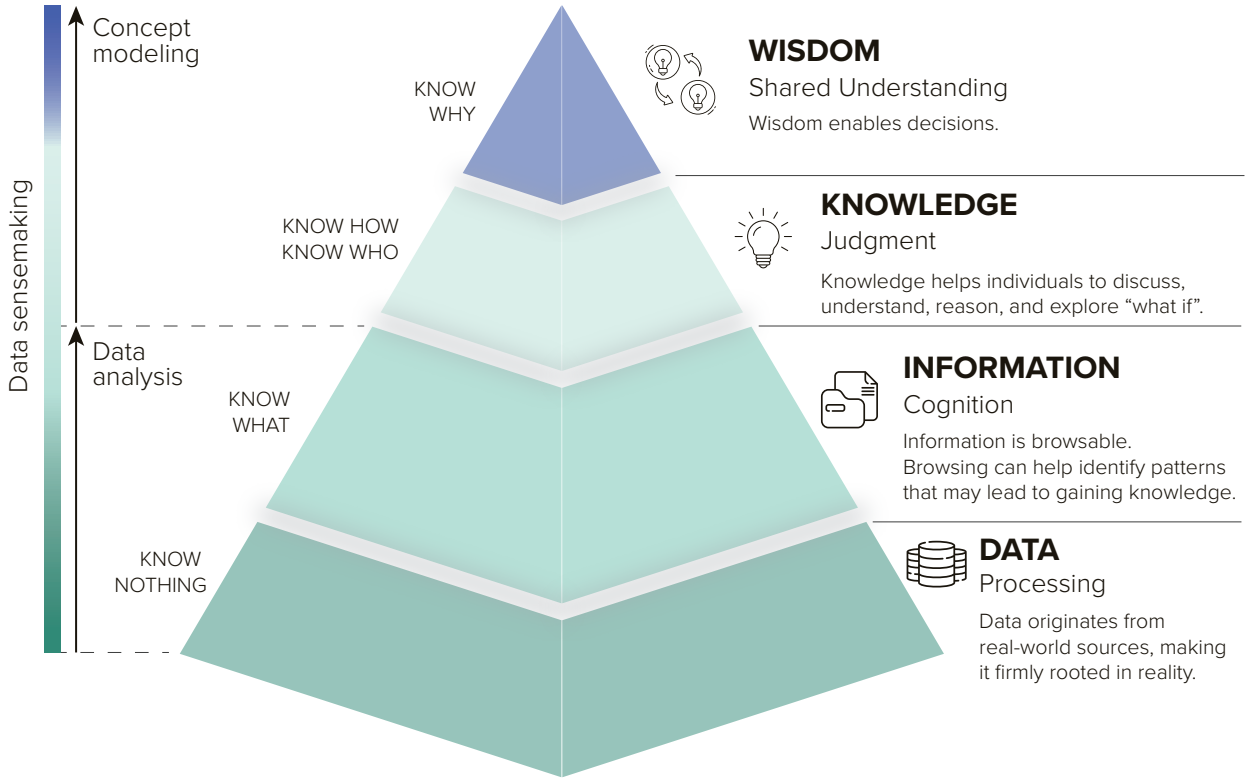
Data Analysis
Internal data identified reliability patterns; weather data highlighted environmental impacts on failures.

Integration of Methods
Conceptual modeling improved communication and shared understanding, transforming information into knowledge and wisdom.

Data analysis supported conceptual modeling by information that can be also be knowledge (uncovering trends, patterns and information). The combination with conceptual models trigger actions. Actions require wisdom.

Knowledge Wisdom

Pyramid



ECIT

ECIT focused on sustainability in the HSEIF2 project. They identified opportunities to improve the environmental impact of their services. Among them, data centers play an important role as they are responsible of large consumption of energy.

Through the HSEIF2 project ECIT had an opportunity to go deeper into what kind of data is available to be able to map areas ECIT can contribute to, and how the contribution is measured.

ECIT participated in **Workshops** and **research**.

Through workshops, ECIT have learned about how to break up large amounts of data and to get the needed data for a good decision-making.

Along with the researcher, it was investigated how data centers may affect the environmental performance of the SoS and which parameters have to be in place to make a more sustainable decision-making process. Interviews, identification of operations and workflows were adopted in the research.

Through HSEIF2 project, ECIT is now better prepared to meet the upcoming regulatory requirements for reporting purposes.

ECIT also contributed to working with the researcher to share the gained knowledge via research articles and sharing knowledge on environmental requirements in tenders.

Curious?

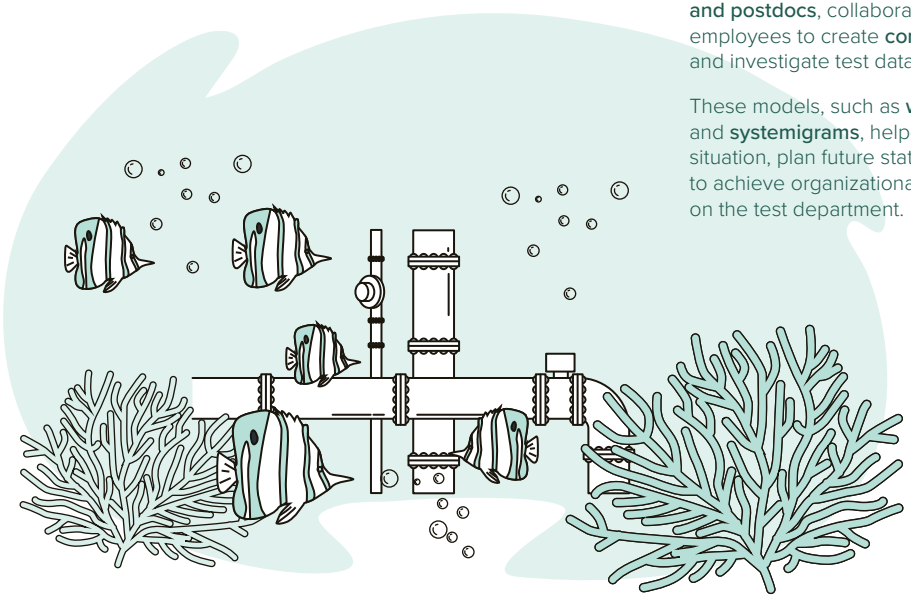
TechnipFMC

TechnipFMC has gained valuable insights from the H-SEIF2 research project, particularly regarding data quality in tests (emergent events).

Improving this data quality will enhance analysis and facilitate sensemaking, crucial for closing feedback loops within the test department and early product development.

The project also fostered knowledge exchange and value creation through active involvement of PhD and master students, regular monthly workshops, and semester-based seminars.

These initiatives have strengthened industry-academic partnerships, allowing TechnipFMC to leverage academic research and add value to its operations.

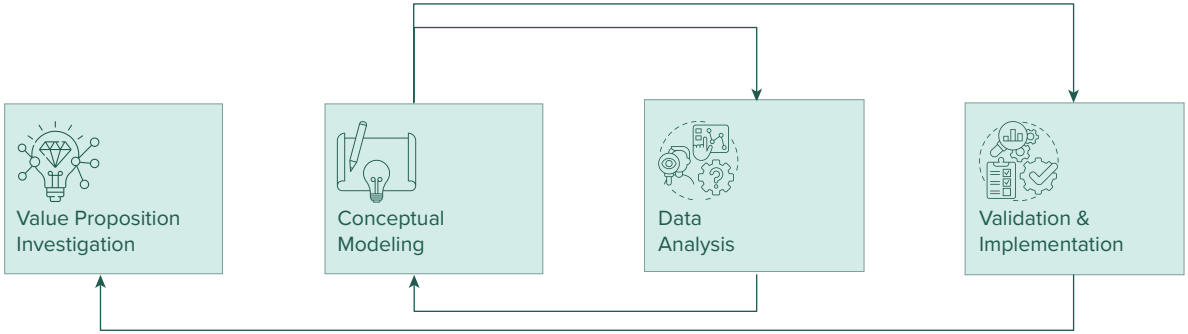


Researchers, including **PhD candidates and postdocs**, collaborated with TechnipFMC employees to create **conceptual models** and investigate test data.

These models, such as **workflow analyses** and **systemigrams**, helped describe the current situation, plan future states, and outline steps to achieve organizational goals, focusing on the test department.

Curious?

Conceptual framework for data sensemaking



Recommendation

- Explore the context of the case study.
- Apply Systems Thinking tools.
- Collect and analyze data.
- Develop fitness-for-purpose diagram.

Recommendation

- Visualize main processes.
- Interactions and dependencies.
- Time and cost estimation for main processes.
- Software system, and departement interoperability.

Recommendation

- Conduct explorative data analysis bottom-up and top-down approach.

Recommendation

- Visualize the cause and effect relationships.
- Most significant variables.
- Fitness-for-purpose diagram.

Ali et al. (2024). Data sensemaking framework by applying conceptual modeling and data analysis. [submitted for publication].

Arkitektur og Designhøyskolen i Oslo

Through the HSEIF2 project, AHO aimed to maintain close dialogue with the Systems Engineering environment at University of South- Eastern Norway (USN) and their partners.

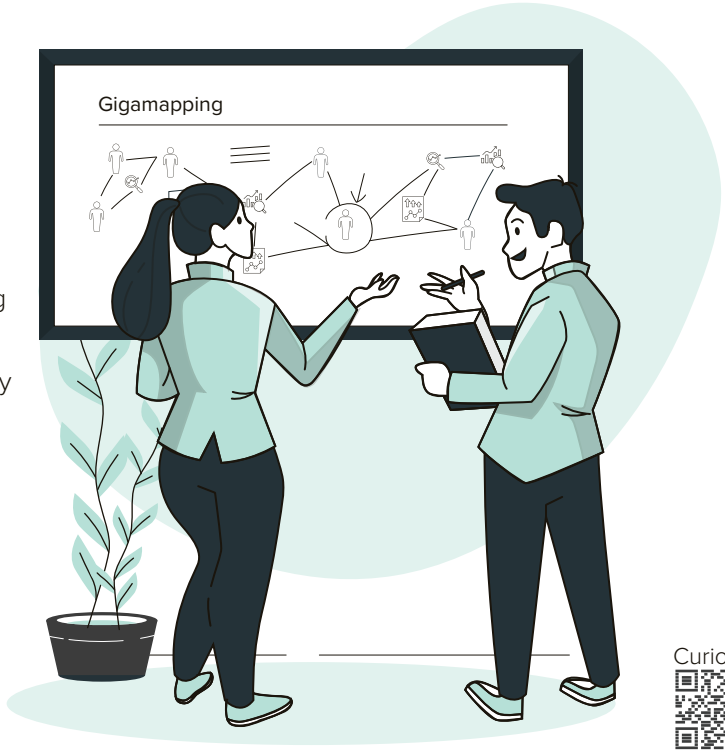
Exploring **System Oriented Design (SOD)** in technically complex projects, AHO gained deeper insights and tested their methodologies through workshops involving both USN and industry participants.

Collaboration with the industry confirmed the SOD value in early-phase innovation and provided ideas for further research on capturing and conceptualizing data.

AHO plans to continue working closely with USN to further develop SOD and influence Systems Engineering to integrate more design-oriented approaches.

AHO utilized SOD's practical, design-oriented approach, focusing on **Gigamapping** and its impact in interdisciplinary workshops.

AHO studied meta functions and discover **"Jumping Conversations"** useful through a design-oriented approach.



Curious?

USN

University of South-Eastern Norway

At USN, the Systems Engineering research is designed to advance systems innovation in the Norwegian industry.

Systems Engineering, rooted in systems thinking, offers a holistic perspective on complex challenges. It emphasizes understanding the interplay between different parts of a system and their impact on the whole, resulting in innovative solutions for today's fast-paced world.

With an “industry as laboratory” approach, HSEIF2 documents, validates and transfers knowledge and supports engineers working on the realization of industrial systems. Industry partners tell us about their needs, share their practices, and is used as a laboratory to validate our findings.

This collaboration results in practical, industry-relevant solutions.

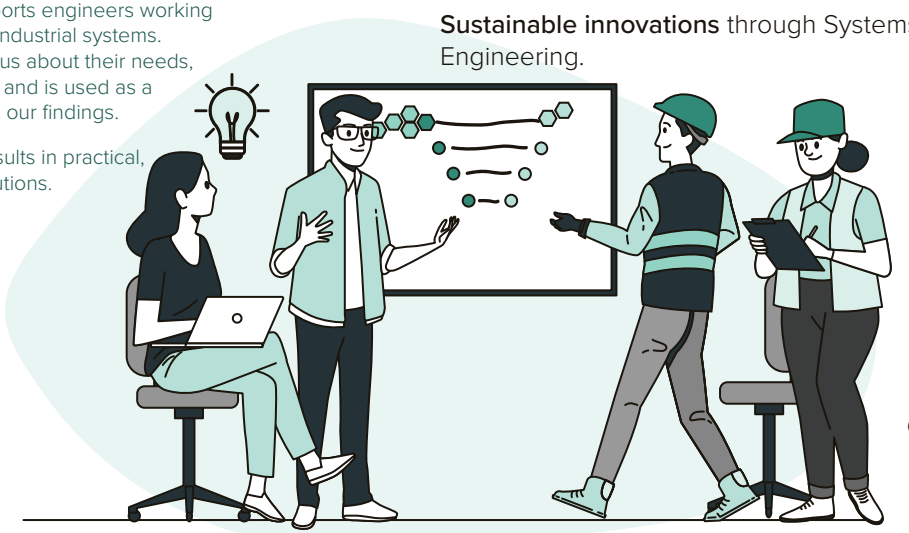
Outcomes from HSEIF2

The result is 20 master’s, 2 PhDs and over 20 papers and a framework promoting:

Conceptual models to fit autonomous systems into the larger context and help us understand how the systems should behave in relation to humans.

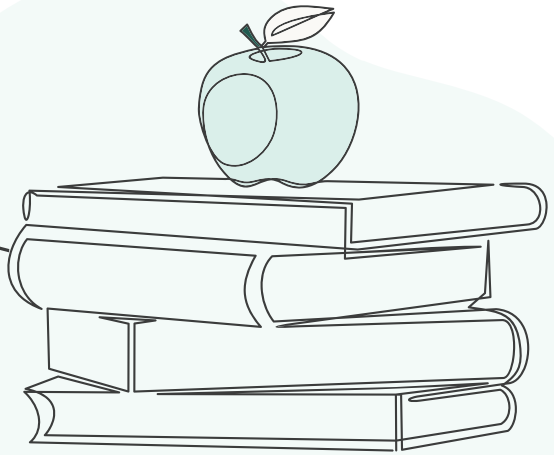
Digital transformation by exploringdata-sense making and realizing the need for cross-disciplinary communication and true collaboration.

Sustainable innovations through Systems Engineering.



Curious?

Fruit for Thought



Reflecting on the HSEIF2 project's journey, initiated before the latest Artificial Intelligence surge, we look ahead with confidence and excitement.

The project underscored the importance of a balanced approach, merging big data and digitalization's efficiency with personal insight and systems tools' effectiveness.
This blend is crucial for creating sustainable systems solutions that benefit industry, society, and the global community.

As we progress, we recognize the challenges ahead, including the growing scarcity of technologists and the difficulty companies face in finding and retaining talent.

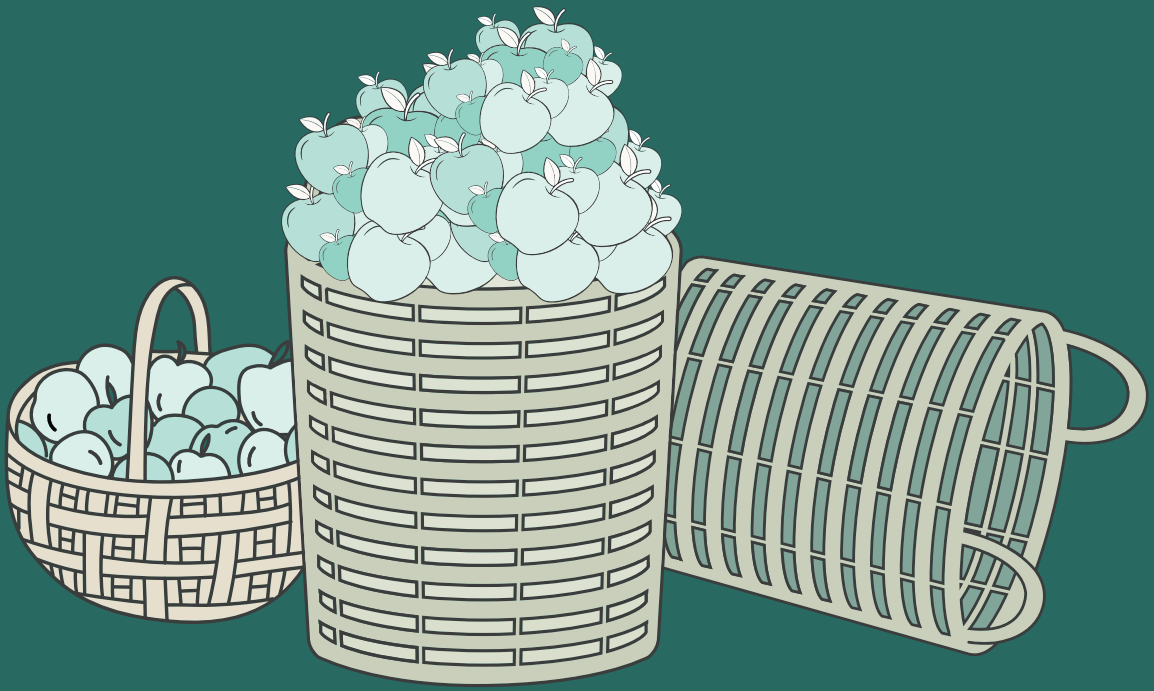
Fostering an effective, trans-disciplinary collaboration is priority.

By bridging different fields, we can develop robust methodologies for the development of sustainable systems.
Systems engineering and systems thinking techniques are promising to ensure humans are in charge when deploying systems containing Artificial Intelligence.

Yet, there is a need for further developing the next-generation product development approaches, seamlessly blending human insight and adaptive tools.

We see Artificial Intelligence's potential, in asset design to improve efficiency and foster a collaborative environment emphasizing human insight and participation.

Overall, we are excited to continue fostering innovation and sustainability in systems engineering, looking forward to a future where technology and human insight create meaningful, impactful solutions.



Created and Edited by Carla Gutterud (Semcon)
Project Management by Lars Ljosland and Kristina Hesjedal Schnell (Semcon)

Academia collaboration represented by Kristin Falk (USN), Haytham Ali (USN), Tommy Langen (USN), Henri Giudici (USN) and Andreas Wettre (AHO)

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