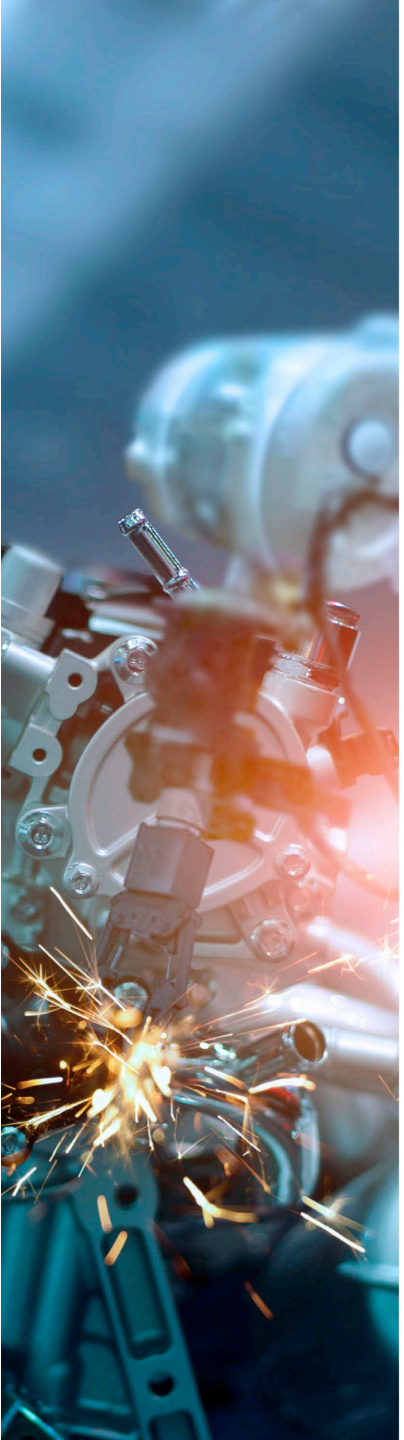
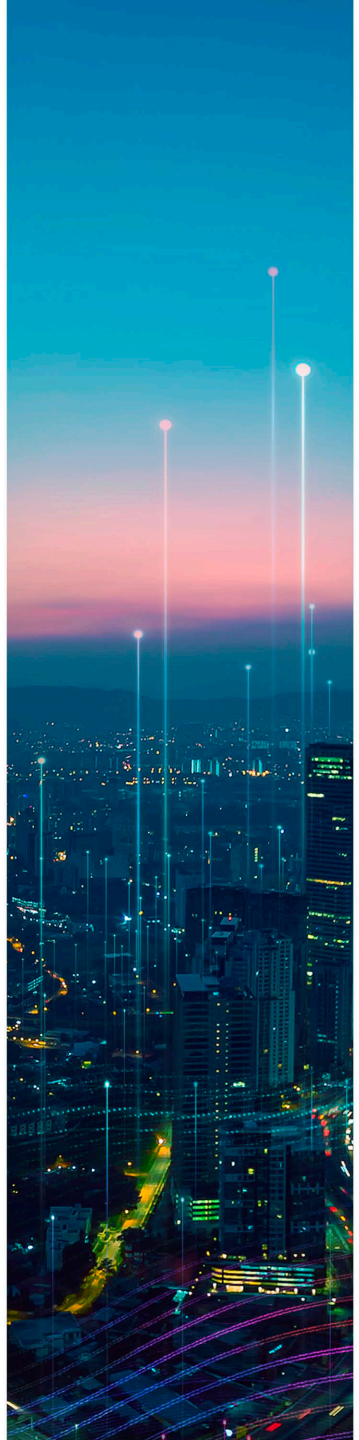
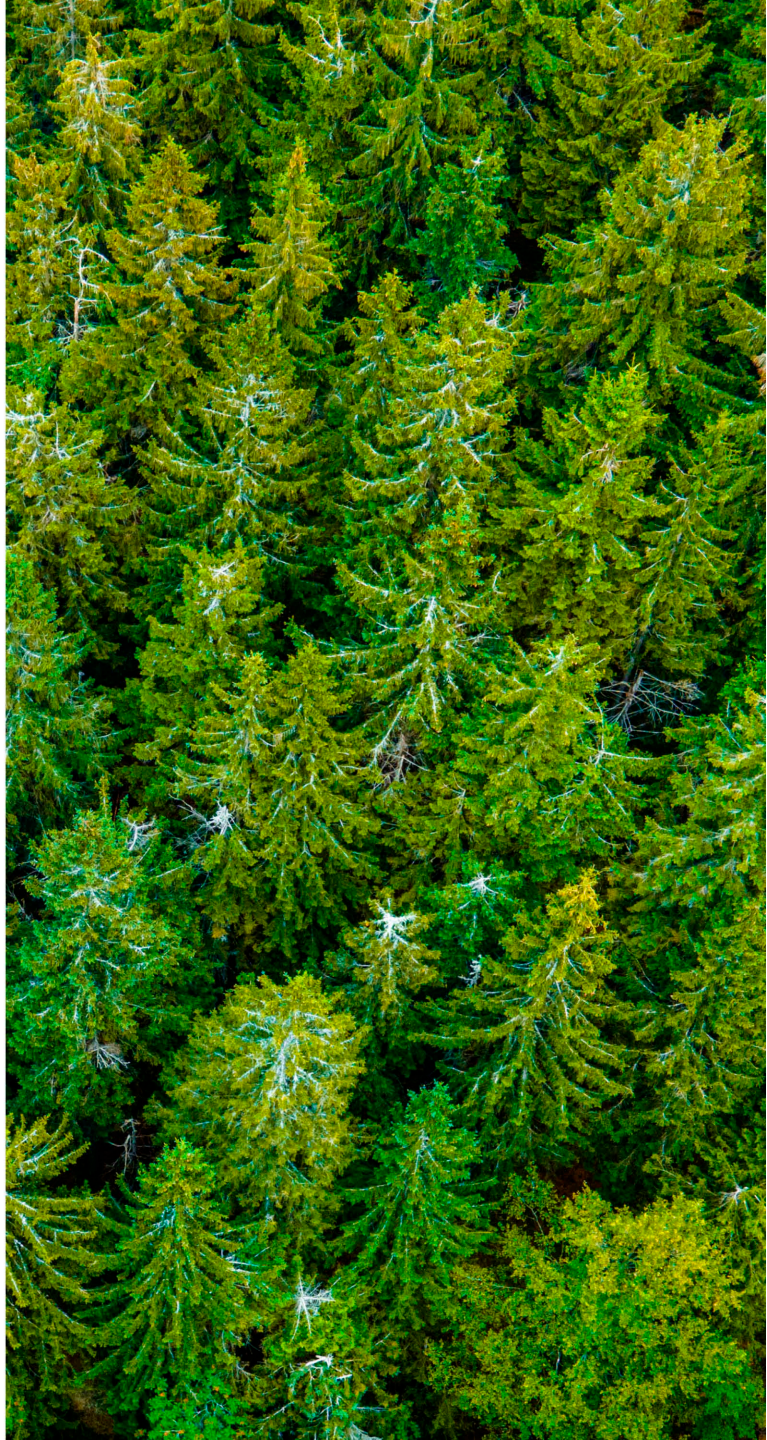




SIE Sustainable Industry Ecosystem

2021-2022

https://sites.tuni.fi/sie-en



ACADEMY OF FINLAND

Tampere University
Tampere University of Applied Sciences

VTT

LUT University

Vaasan yliopisto
UNIVERSITY OF VAASA

This project has received funding from the Academy of Finland research and innovation program under grant agreement No. 337722.

Sustainable Industry X Research Ecosystem (SIRE)

Sustainable Industry Ecosystem (SIE), project's closing seminar

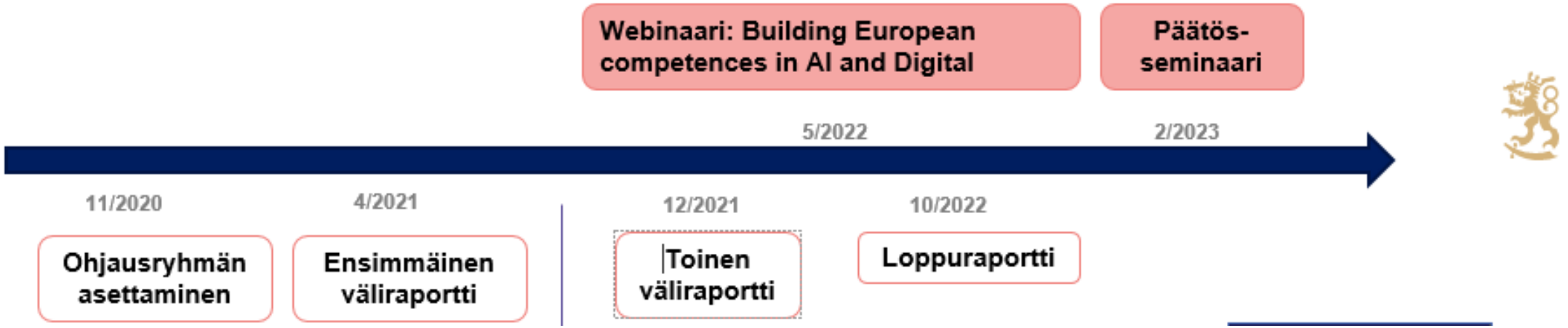
Tampere, 8.12.2022

Juhani Heilala, Jaakko Paasi, Riikka Virkkunen, Harri Nieminen, & SIE project consortium

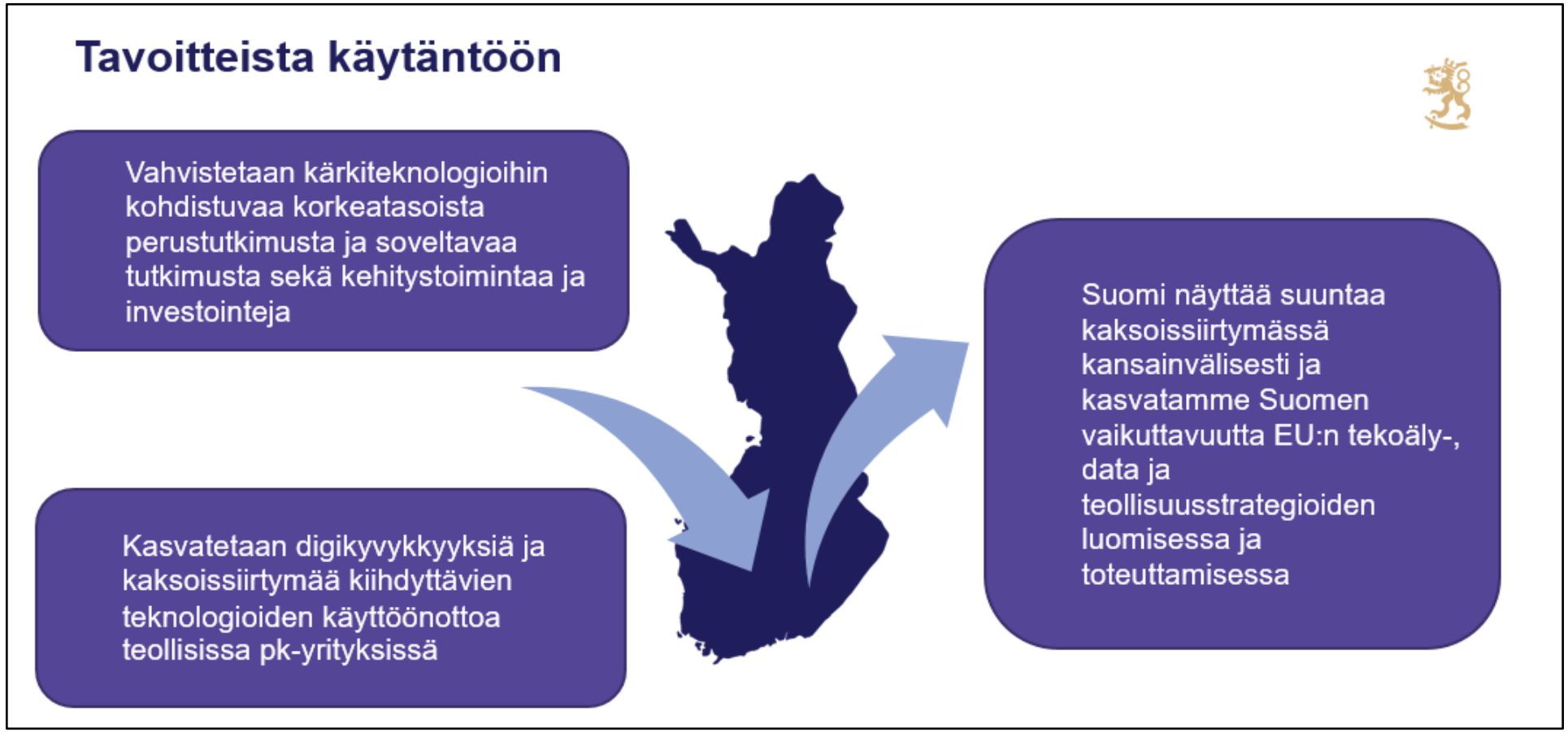
This project has received funding from the Academy of Finland research and innovation program under grant agreement No. 337722.

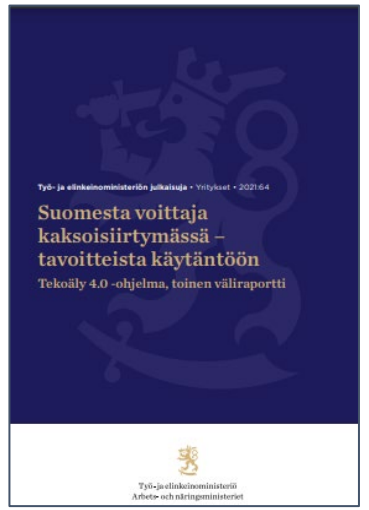
Tekoäly 4.0 -ohjelman taustaa

- Monilla EU-mailla on Teollisuus 4.0 ohjelma, Suomella ei
- Taustadokumentteja (VTT:n vahvalla tuella)
  - Smart Industry Finland 2018
  - Valmistavan teollisuuden kaksoiskäänne 2019 (ei julkaistu)
- Tekoälyaika: Suomi tekoälyn soveltamisen kärkimaaksi
- Tekoäly 4.0 vauhdittamaan liiketoiminnan digitalisaatiota ja vihreää siirtymää:



Vuonna 2030, kun Tekoäly 4.0 -ohjelma on onnistunut tavoitteissaan, suomalainen valmistava teollisuus on puhdasta, tehokasta ja digitaalista





https://julkaisut.valtioneuvosto.fi/handle/10024/164394

KEHITYSALUEET

TOIMENPITEET

Vahvistetaan kärkiteknologioihin kohdistuvaa korkeatasoista tutkimusta sekä kehitystoimintaa ja investointeja

1 Luodaan osaamisella ja pitkäjänteisillä panostuksilla edellytykset tuloksekkaille TKI-keskittymille

2 Vahvistetaan kärkiteknologioiden vaikuttavuutta luomalla kansallinen kaksoissiirtymää kiihdyttävä TKI -agenda

3 Lisätään ja suunnataan julkista rahoitusta digitalisaation hiilikädenjälkeä kasvattaville teknologioille, tuotteille ja palveluille

4 Varmistetaan, että suomalaisilla yrityksillä on parhaat mahdolliset edellytykset hyödyntää suurteholaskentaa liiketoiminnassaan

Kasvatetaan digikyvykkyyksiä ja nopeutetaan kaksoissiirtymää kiihdyttävien teknologioiden käyttöönottoa teollisissa pk-yrityksissä

5 Perustetaan pk-yrityksille digiagentti- ja digikehittämisen vertaisryhmätoiminta sekä yhteistyötä ja palvelukohtaantoa tehostava kehitysfoorumi

6 Käynnistetään pk-yrityksille suunnattu Teollisuus 5.0 -ohjelma

7 Tehdään datatalouden kasvuohjelma

8 Kehitetään mikrotutkintoja ja monialaisia oppimismateriaaleja kaksoissiirtymän mahdollisuuksista

Suomi näyttämään kansainvälisesti suuntaa kaksoissiirtymässä

9 Kannustetaan yrityksiä vahvistamaan rooliaan ja vaikuttavuuttaan EU-tason päätöksenteossa, TKI-hankkeissa ja verkostoissa

10 Vahvistetaan Suomen asemaa transatlanttisissa teknologia- ja kauppapoliittisissa keskusteluissa

11 Hyödynnetään kaksoissiirtymän avaamat liiketoimintamahdollisuudet niin, että yritystemme kädenjälki maailmalla kasvaa

TOIMEENPANO

Strategisen tason pyöreä pöytä huolehtimaan toimenpideohjelman etenemisestä

The big picture: Competitiveness by making good plans come true

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Sustainable Industry X (SIX): Implementation plan

OBJECTIVES

Unifying, national vision and agenda for industry renewal

- Continuous in time, jointly maintained
- Connects the foresight information, research agendas, industry agendas and strategic level initiatives.

IMPLEMENTATION

Collaborating, smartly specialized ecosystems and clusters implementing the agenda

- BF Veturis, BF growth engines,
- SIX clusters,
- FAMN, DIMECC and CLIC ecosystems,
- etc.

Utilization of existing structures

TOOLS

Appropriate, effective tools for agile implementation

- Infrastructures
- Competence development
- etc.

Utilization of existing structures

ORCHESTRATION

In time continuous orchestration in order to bring objectives and tools together with industry needs and operations

Round table

Secretary

SME development forum

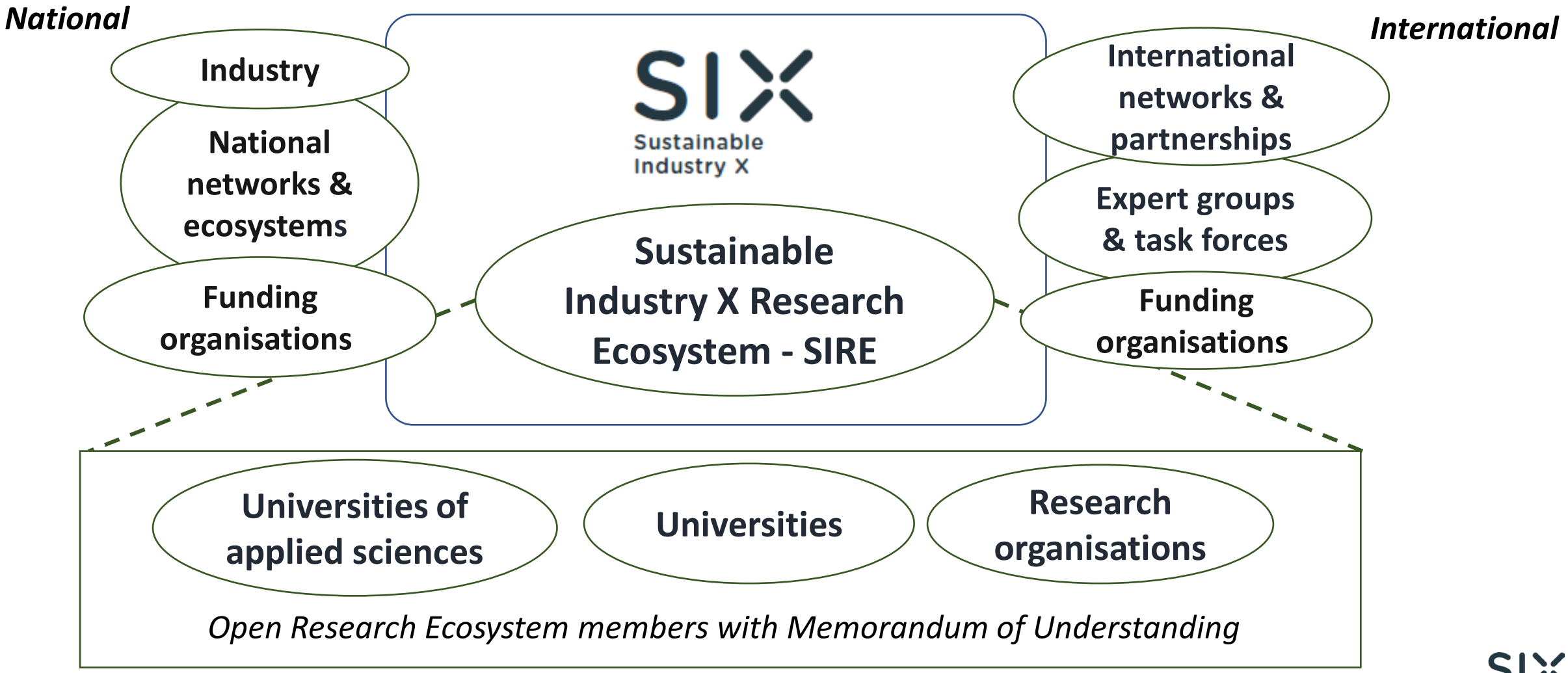
SIRE research ecosystem (SA –initiative)

SIX Sustainable Industry X

Sustainable Industry X Research Ecosystem (SIRE)

- The SIE project will continue in the form of Sustainable Industry X Research Ecosystems (SIRE), the partners of SIE being the founding members of SIRE
- SIRE will be an autonomous part of the Sustainable Industry X (SIX), a national bottom-up initiative for the green and digital renewal of Finnish industry
- The purpose of SIRE is to promote dialogue between industry and research on strategic research needs of Finnish industry and, under this theme, to enhance collaboration between the member organizations of SIRE
- SIRE puts together and updates a Strategic Research and Innovation Agenda (SRIA) for Finnish industry
- SIRE will be an open ecosystem where all Finnish research organizations (universities, universities of applied sciences, public research institutes, private research organizations) can become members of SIRE

SIRE is an open research ecosystem with National and International Networking



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SIRE's Strategic Research and Innovation Agenda SRIA (2022)

Sustainable Industry Ecosystem (SIE), project's closing seminar

Tampere, 8.12.2022

Juhani Heilala, Jaakko Paasi, Riikka Virkkunen, Harri Nieminen, & SIE project consortium

This project has received funding from the Academy of Finland research and innovation program under grant agreement No. 337722.

SIRE SRIA (2022) – SIE project deliverable

- Strategic Research and Innovation Agenda supporting the digital and green renewal of Finnish industry
- Includes a medium to long term (>5 years) road map serving the strategic research needs of industry
  - Not a project roadmap. It operates on an upper level of targeted programs etc.
- SIRE SRIA 2022 is the first version to be updated annually (minor or major updates depending on theme)
- Updates covers themes defined by the SIRE steering group, in collaboration with industrial ecosystems and clusters and specific working groups of Sustainable Industry X (SIX).
- SRIA is used for influencing
  - In the creation of national R&D programs of BF and SA by setting a groundwork for the establishment
  - Long term plans of EU research and innovation

From international goals to national Strategic Research and Innovation Agenda

International

United Nations Sustainable Development Goals SDG	A new industrial strategy for Europe	The European Green Deal	Europe Fit for the Digital Age	An Economy that work for people
Economy, Society and Biosphere	Ensure technology leadership, resilience and competitiveness	Achieve circular and climate-neutral industry	Mastering the digital transformation of industry	Create attractive added-value jobs

National

Artificial Intelligence 4.0 Programme (2022)
Finland's industry will be clean, efficient and digital by 2030 and beyond
Finland as a leader in the twin transition
- Industrial productivity and international competitiveness trough digitalization,
- Ethically sustainable solutions that accelerate the twin transition to the global markets

SIX National Renewal Agenda (2022)
Focus areas
Substance spearheads
1. Pioneer the Green Transition
2. Accelerate the digital transition

Enabling actions
3. Increase investments
4. Ensure the availability of skilled labor

SIRE SRIA (2022)
Identify medium to long term R&D&I themes, key emerging technologies, enablers and actions in collaboration with industry

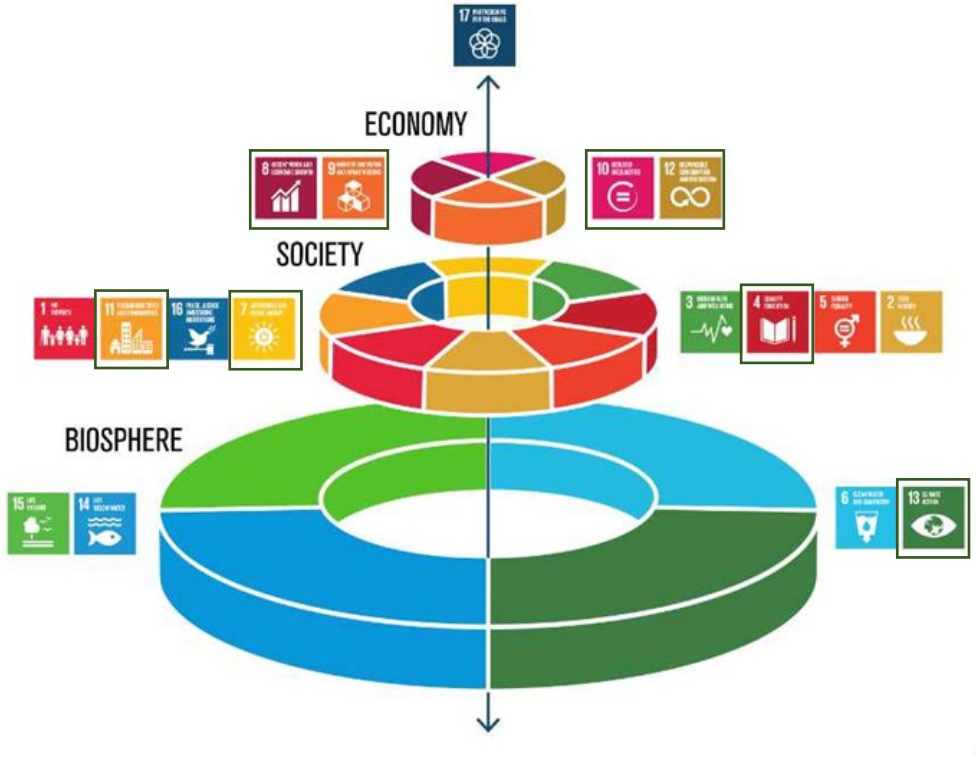
Finnish technology policy in 2020s – A global leader through technology and information
New directions - The strategic programme to promote a circular economy
Other strategic documents and roadmaps such as sectorial low carbon roadmaps

United Nations Sustainable Development Goals (SDGs) – 2030

There are 17 SDG, 169 associated targets and 232 indicators.
SIRE aims to contribute and improve sustainability in industry from multiple points of view, Economy, Society, Biosphere, in particular to the SDGs:

- SDG 4 (Quality Education),
- SDG 7 (Affordable and Clean Energy),
- SDG 8 (Decent Work and Economic Growth),
- SDG 9 (Industry, Innovation and Infrastructure),
- SGD 10 (Reduced Inequality),
- SDG 11 (Sustainable Cities and Communities),
- SDG 12 (Responsible Consumption and Production), and
- SDG 13 (Climate Action).

https://sdgs.un.org/goals



UN SDG wedding cake (Stockholm Resilience Centre, Stockholm University)
The illustration describes how economies and societies should be seen as embedded parts of the biosphere.

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European Commission strategies & Horizon Europe partnerships, networks …

EU's strategic objectives: Accelerating the transition towards **a green, climate neutral, and digital Europe while strengthening the resilience and competitiveness of European industry** (European Industrial Strategy (COM/2020/102 final).

- A European Green Deal, Circular Economy Action Plan, EU Taxonomy Regulation,…
- An Economy that works for People
- A Europe fit for the digital age
- EU Key enabling technologies
- **Horizon Europe program -** partnerships and calls
- **Digital Europe program -** Testing and Experimentation Facilities, European Digital Innovation Hubs,…
- …

- 49 European partnerships, most relevant for SIRE are in **Cluster 4: Digital, industry & Space** and **Cluster 5: Climate, Energy & Mobility**
- Such as **Made in Europe, AI-Data-Robotics, Processes4Plant, Key Digital Technologies, Photonics, Batteries, …**
- EIT Knowledge & Innovation Communities such as **EIT Manufacturing, EIT Raw Materials, …**
- European Technology Platforms such as **MANUFUTURE** and multiple research associations, such as BDVA, IDSA, …
- European Laboratory for Learning and Intelligent Systems (**ELLIS),** AI TEFs and EDIH,…

Follow the strategies, actions, regulations, visions, roadmaps, SRIAs, collaborate

Apply for international funding, influence to future strategies and call topics

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National: Artificial Intelligence 4.0 Programme (2022) and SIX National Renewal Agenda (2022) "Finland a leader in the twin transition"

Artificial Intelligence 4.0 Programme

Three areas of development:

A. Strengthening **high-level research on key technologies** as well as **development activities** and **investments**

B. Increasing the **adoption of digital capabilities** and technologies that **accelerate the twin transition in industrial SMEs**

C. Making **Finland an international frontrunner in the twin transition**

https://tem.fi/tekoalyohjelma
https://tem.fi/en/artificial-intelligence-4.0-programme
https://julkaisut.valtioneuvosto.fi/handle/10024/164394

SIX National Renewal Agenda

Four focus areas (must-win battles):

1. **Pioneer the Green Transition:** Sustainable production: Finnish industry must lead the way to sustainable production and business
2. **Accelerate the digital transition:** Digitalization: Finnish industry must remain at the vanguard of the digital transition
3. **Increase investments:** Finnish industry must get production and R&D&I investments up
4. **Ensure the availability of skilled labor:** Finnish industry must have access to the required amount of competent workforce

https://www.six.fi/
https://publications.vtt.fi/pdf/technology/2022/T410.pdf

SIX Sustainable Industry X

SIRE Research & Development & Innovation focus areas and themes – road mapping

Long term target

National strategies 2030
- AI 4.0 & SIX

National roadmaps 2030

Academia & Research

Horizon Europe & partnerships 2022-2030

European Commission strategies, action plans

UN SDG 2030

SIRE – roadmap beyond 5 years 2027 - ?

Basic and applied research

- Objective-driven research
- Technology-driven research
- Upstream-swimming research

- Breakthrough technologies
- Industry 4.0 and 5.0 technologies
- Key enabling technologies

Finland's industry will be clean, efficient and digital by 2030 and beyond
Finland as a leader in the twin transition

- industrial productivity and international competitiveness trough digitalization,
- ethically sustainable solutions that accelerate the twin transition to the global markets

Twin transition	Digitalization: Competitiveness, resilience, agility, productivity, Green transition: Resource balanced economy, circular economy
Change drivers & megatrends	Turbulent dynamic market, demographic change, resource scarcity, climate & environmental change, disruptions, emergencies, geopolitics, acceleration of technical innovations, evolving regulations,

“Finland a leader in the twin transition” - How SIRE actors can help industry?

SIX National Renewal Agenda: SIRE R&D&I focus & enabling actions

Substance spearheads

1. Pioneer the Green Transition: “environmental handprint” Clean-tech solutions, carbon and environmental neutrality, clean energy, **eco-, resource- and energy-efficiency, electrification**, circular economy, re-manufacturing, re-X, smart sustainable production, advanced manufacturing technologies, additive manufacturing, new materials, biotechnology, Industry 5.0 …

2. Accelerate the digital transition: “ AI & Digitalization, Automation” Industry 4.0 & 5.0, big data, data spaces, horizontal and vertical integration, connectivity, IIoT, digital twins, Cyber Physical Systems, decentralized technical intelligence, edge/cloud, automation, robotics, human robot collaboration, HMI, connected operator, **industrial metaverse,** AR/VR/XR, wearable technologies, AM, cyber security, wireless communication, 5G/6G, **quantum technology,** …

Enabling actions

3. Increase investments: Enhance industrial collaboration, apply national and EU R&D&I funding, provide low risk test environment, test beds and learning factories, science-based investment decision making support, …

4. Ensure the availability of skilled labor: Education, skilling, up-skilling, re-skilling, at work training, operator physical and cognitive supporting technologies, **attractive workplace creation**, human centric manufacturing, automation and digitalization,...

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Industry X

Research & Development & Innovation focus areas and wanted impact

SIRE Research themes: cutting across the different stages of R&D&I and value chain, from **basic science, fundamental and applied research** to market uptake, including **education and training**, …

Leadership in the **key enabling technologies**

Digitalisation: Leadership in digital transformation and new business models **AI**

Leadership in mastering complexity of products, processes, systems and services

Green transition: Leadership in resource efficiency and sustainable development **Environmental handprint**

Leadership in **competitive sustainable, resilient manufacturing, services and solution provision**

Finland a leader in the twin transition

Industrial productivity and international competitiveness trough digitalization
Ethically sustainable solutions that accelerate the twin transition to the global markets

Adapted from MANUFUTURE SRIA 2030

Leadership in the innovation ecosystems

Industrial ecosystems encompassing all players operating in a value chain: from the smallest start-ups to the largest companies, from **academia** to **research**, service providers to suppliers.

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Q&A

SRIA was created by SIE project.
Updates will follow, you are welcome to contribute.

This presentation will be available

https://sites.tuni.fi/sie-en/
https://www.six.fi/

SIX Sustainable Industry X | SMART MANUFACTURING

Manufacturing 2030

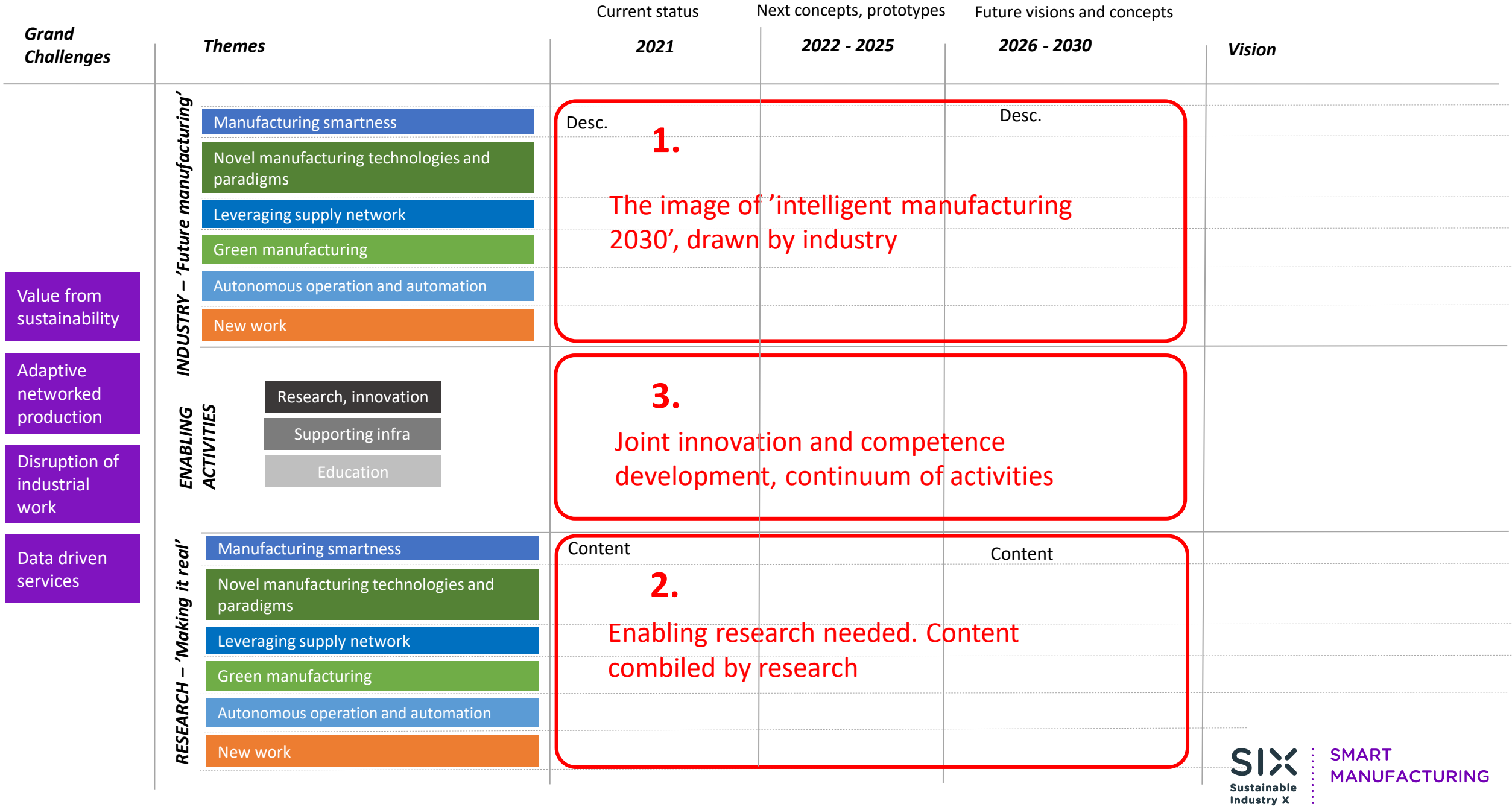
Introduction to Manufacturing roadmap

ABB 8760 Fastems NOKIA PONSSE SANDVIK

The roadmap – what and why?

The roadmap built, implemented and maintained in close industry – research collaboration. The goal is to increase the industry's competitiveness and resilience through manufacturing-linked innovation, competence development and joint influencing.

- Enables close industry-industry-research dialogue
- Enables planning and implementation over a long period of time instead of jumping from one project to another
- Enables the development of industry-relevant research and research itself
- Enables the industry-relevant competence development
- Helps in the proactive identification and utilization of EU opportunities
- As an agenda to be implemented in real life, it enables joint influencing and increases the industry's positive visibility


Grand Challenges
Themes
Current status
2021
Next concepts, prototypes
2022 - 2025
Future visions and concepts
2026 - 2030
Vision
Value from sustainability
Adaptive networked production
Disruption of industrial work
Data driven services
INDUSTRY – 'Future manufacturing'
Manufacturing smartness
Novel manufacturing technologies and paradigms
Leveraging supply network
Green manufacturing
Autonomous operation and automation
New work
Desc.
Desc.
1.
The image of 'intelligent manufacturing 2030', drawn by industry
ENABLING ACTIVITIES
Research, innovation
Supporting infra
Education
3.
Joint innovation and competence development, continuum of activities
RESEARCH – 'Making it real'
Manufacturing smartness
Novel manufacturing technologies and paradigms
Leveraging supply network
Green manufacturing
Autonomous operation and automation
New work
Content
Content
2.
Enabling research needed. Content combiled by research
SIX
Sustainable Industry X
SMART MANUFACTURING

Resilient manufacturing builds the future world

Sustainable smart products generate new value and answer precisely to the customer's needs.

Future products are manufactured using future methods and extensive utilisation of data.

Smart manufacturing 2030 themes

Manufacturing smartness

New work

Green manufacturing

Leveraging supply network

Novel manufacturing technologies and paradigms

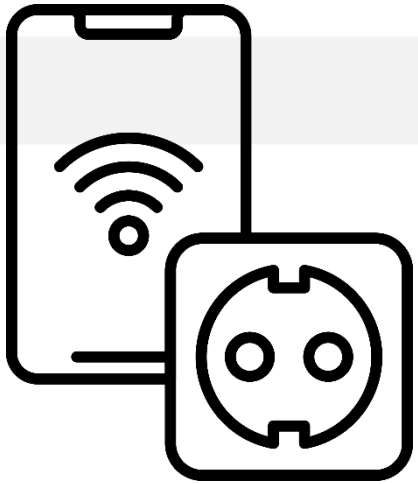
Autonomous operation and automation

A smart product generates new value

2030: A smart product helps to build and maintain itself during the lifecycle. Data collected throughout the product lifecycle from production to utilization brings new business opportunities, and feeds continuously the development of new products.

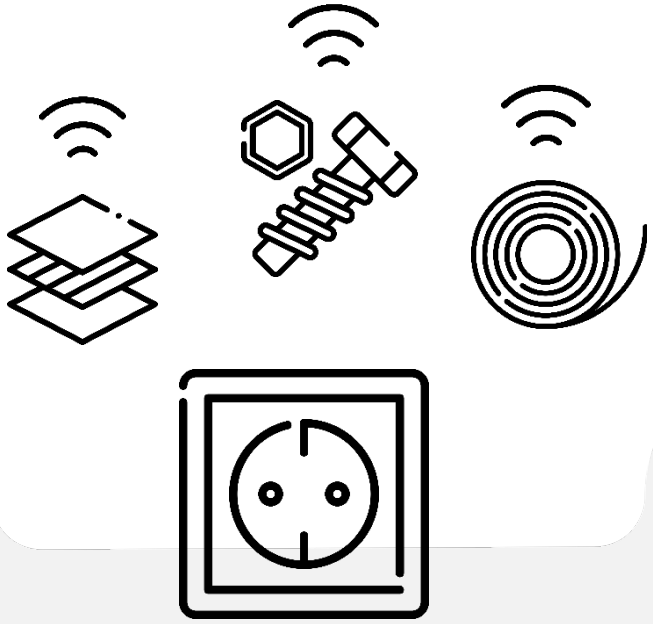
How: The manufacturer creates and maintains an identity for every product. Lifecycle data is connected to the product identity.

Manufacturing smartness



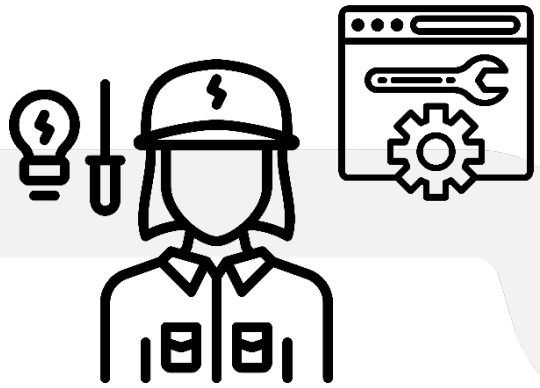
2022

A smart product has features for the end user.



2025

The manufacturer creates an identity for the product and its components.



2030

Individual products create new services over the life-cycle and value chain.

Keywords: smart product, electrification, identification, traceability, lifelong product data, life-cycle services, product-as-a-service.

SIX Sustainable Industry X | SMART MANUFACTURING

Smart manufacturing 2030 themes

Manufacturing smartness

New work

Green manufacturing

Leveraging supply network

Novel manufacturing technologies and paradigms

Autonomous operation and automation

Industry and research *together* will make Finland a leader in green manufacturing by 2030.

SIX Sustainable Industry X | SMART MANUFACTURING

Thank you!

Concrete actions workshop

Questions

1. *Bottom-up:* “Finland a leader in the twin transition” - How SIRE and its’ actors can help industry in real life?
2. *Top-down:* The role of SIRE in implementing national level strategies?

Supporting questions

- Concretia, the value proposition and most desired outcome of an actionable research ecosystem
- SIRE vs. the others, role of an research ecosystem
- Challenges to be tackled