Datan ja tekoälyn hyödyntäminen teollisuusprosesseissa - Horisontti Eurooppa t&i-kumppanuudet

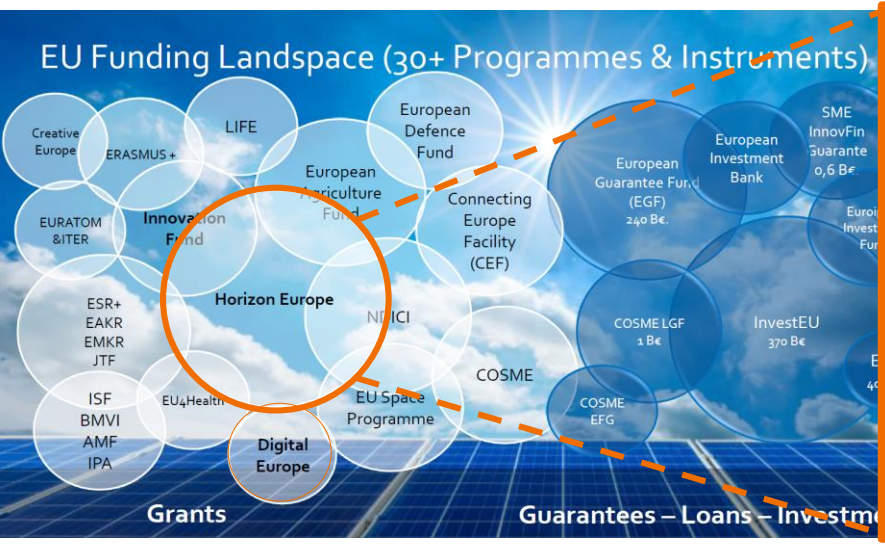
Riikka Virkkunen
työelämäprofessori, VTT
@VirkkunenRiikka

04/03/2022

Outline

- Horizon Europe partnerships
  - Partnership landscape
  - How do partnerships work
- Key partnership exploiting data and AI for industry
  - Made In Europe
  - AI, Data and Robotics
  - Other
- Examples

Horizon Europe (HE)



Pillar 1
EXCELLENT SCIENCE

- European Research Council
- Marie Skłodowska-Curie Actions
- Research Infrastructures

Pillar 2
GLOBAL CHALLENGES & EUROPEAN INDUSTRIAL COMPETITIVENESS

Clusters
- Health
- Culture, Creativity and Inclusive Society
- Civil Security for Society
- Digital, Industry and Space
- Climate, Energy and Mobility
- Food, Bioeconomy, Natural Resources, Agriculture and Environment

Joint Research Centre

Pillar 3
INNOVATIVE EUROPE

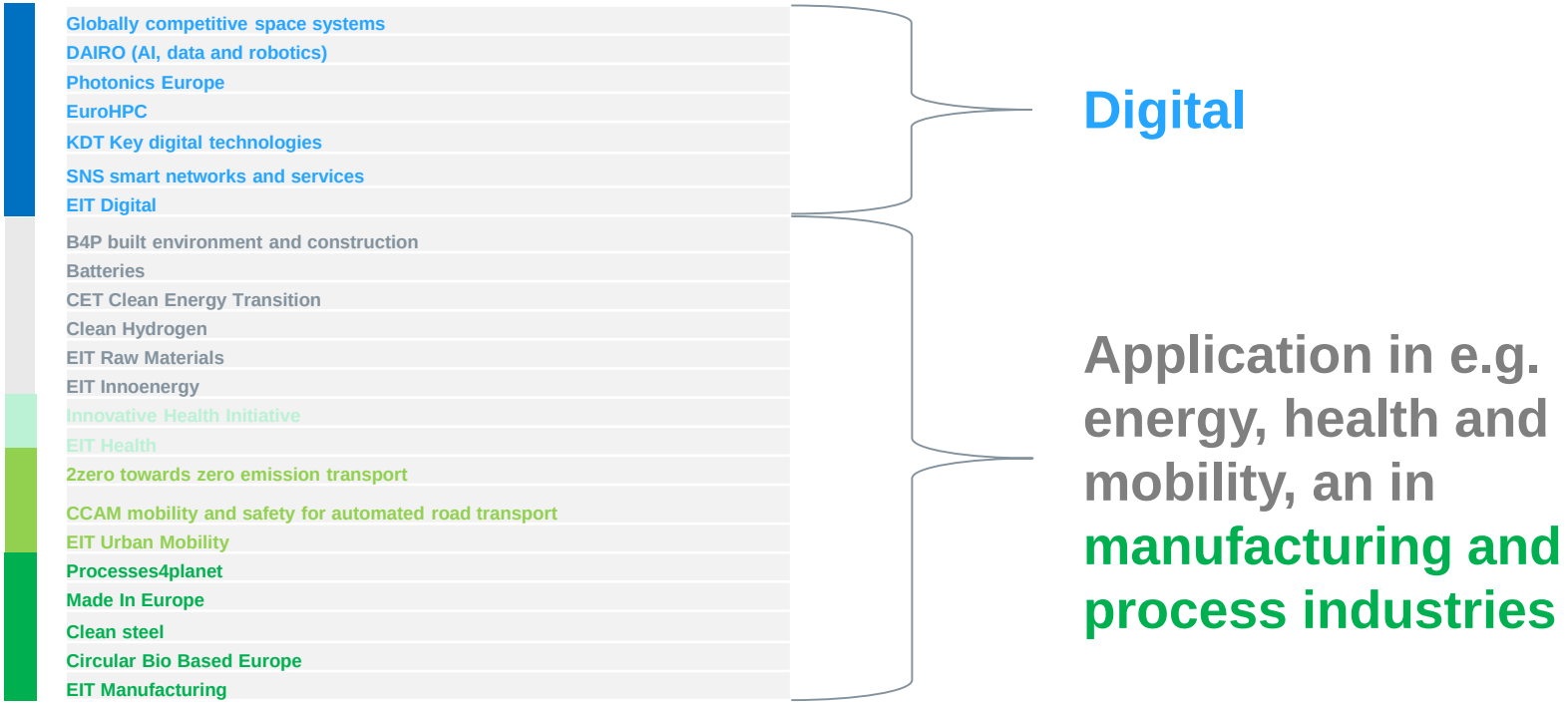
- European Innovation Council
- European innovation ecosystems
- European Institute of Innovation and Technology

WIDENING PARTICIPATION AND STRENGTHENING THE EUROPEAN RESEARCH AREA

- Widening participation and spreading excellence
- Reforming and Enhancing the European R&I system

Source “EU Funding for Twin Transition” 17.11.2021
Pekka Rantala, Business Finland

Many partnerships exploiting data and AI



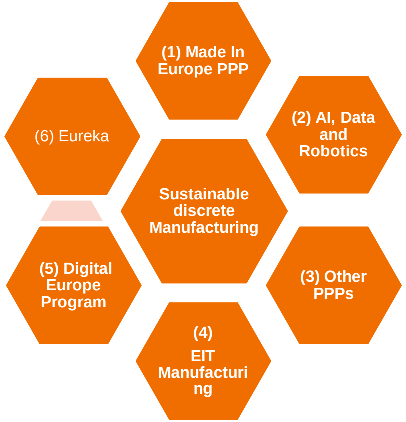
How do partnerhips work?

Partner of the EU institutions, but also:

- common agenda setting
- networking between members/actors
- source of information and feedback for actors incl. the Commission and MSs
- platform for bringing together national and regional initiatives (coherence)
- platform to meet and cooperate – opportunities beyond the Partnership
- evaluate performance
- take different forms (co-programmed, co-funded, institutional)

More effectively achieve EU policy objectives than Horizon Europe alone

Partnerships creating impact



KUMPPANUUS TAI ALOITE	KUVAUS	TAVOITE	KOTIMAAN OHJELMAT JA ALOITTEET (esimerkkejä)
(1) Made In Europe	Kappaletavrateollisuuden kumppanuus - Älykkäät tehtaat ja arvoketjut - Kiertotalous ja vihreys valmistamisessa - Tuote-palveluinnovaatiot ja liiketoimintamallit - Ihmislähtöisyys (human-tech) - Biomanufacturing	Yritykset mukaan vaikuttamaan, verkstoitumaan ja saamaan rahoitusta. Kytketään BF ohjelmiin (SuMa, veturit jne) ja erilaisiin pk-yrityksiä tukeviin toimiin kuten (alueelliset) [illegible]	• Tekoäly 4.0 • BF Sustainable manufacturing (SuMa) • SIX Manufacturing & Smart Machines • SA Sustainable Industry Ecosystem • Reboot IoT Factory • FAMN
(2) AI, Data and Robotics	Tekoälyn, datan ja robotiikan kumppanuus	Datatalouden ja [illegible] edistäminen [illegible] kotim[illegible] aloitteisi[illegible]	• AI 4.0 program • BF AI Business ja SuMa -ohjelmat • Gaia-X and IDS hubs in Finland • FCAI • Suomen EDIH kandidaatit
(3) Key Digital Technologies	Key Digital Technologies (KDT, entinen EXCEL[illegible] - Elektroniikan ja softan kumppanuus - BF osarahoittajana	Suomalist[illegible] konsortioiden [illegible] yritysten [illegible]	• Gaia-X and IDS hubs in Finland • FCAI
(4) EIT Manufacturing for business, education & innovation	Liiketoiminta, innovaatiot ja [illegible] valmistavan teollisuuden tarpeisiin - Korkea TRL, ratkais[illegible] markkino[illegible] - Fokumarkki[illegible] - Joust[illegible], data [illegible], kestävä [illegible] kiertotalous,	[illegible] suomalaisia yrityksiä osallistumaan (valmistava teollisuus ja heille palveluja tarjoavat yritykset)	• SIX manufacturing • Veturi and Reboot yritykset •
(5) Digital Europe • EDIHs • AI TEFs • Data spaces	Digita[illegible] Eurooppa [illegible] - Dig[illegible] kyvyyk[illegible] parantaminen (pk) - Teko[illegible] suurteho[illegible], kyberturva ja digita[illegible] taido[illegible] - Eur. digi[illegible] innovaatiohubit (EDIH) - Tekälyn [illegible] editävät infrat (AI TEFs) - Datatalous ja data-alustat (data spaces)	Suomen EDIH verkosto toimii ja on kytkeytynyt tehokkaasti kansallisiin painopisteisiin ja EU verkostoon.	• SIX manufacturing • FAMN • FCAI • AI4.0 program • Finnish GAIA-X & IDS hubs
(6) EUREKA	EUREKA SMART valmistavalle teollisuudelle ja ITEA ohjelmistoteollisuuden innovaatioille		

DRAFT

- **Voice of industry**
- **Winning consortia**
- **Strategic approach** (timely, protfolio planning)
- **Funding**

Impact!

HE Cluster 4 Digital, Industry and Space partnerships are relevant for industry

Made in Europe (MIE)

Process4Planet (P4Planet)

AI, data and robotics (ADR)

Key Digital Technologies (KDT)

High Performance Computing

Smart Networks and Services

Photonics Europe

Clean Steel - Low Carbon Steelmaking

European Metrology

Global competitive space systems

The Made in Europe Partnership transforming manufacturing eco-systems

Watch the Video

https://www.effra.eu/news/future-manufacturing-made-europe

Made In Europe

“Ensuring **competitiveness & sustainability and supporting resilient and adaptive manufacturing ecosystems**, able to cope with external disturbances and rising environmental and social requirements”

“Europe to be the leading ´**solution provider** ´ in production technology, digitalisation, resource efficiency and circular economy implementation.”

Activities and investments need to focus on:

- Resilience of European Industry
- Sovereignty of European Industry
- Environmental sustainability of Europe Industry

EFFRA
EUROPEAN FACTORIES OF THE FUTURE RESEARCH ASSOCIATION

MADE IN EUROPE

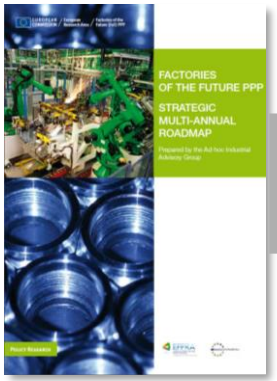
Factories of the Future and Made In Europe

Factories of the Future 2009

Factories of the Future 2013

Factories 4.0 and Beyond 2016

Horizon Europe: Made In Europe



Building on the vision of the FoF 2020 roadmap and public consultation in 2016 → **Key priorities for FoF 18-19-20**

Vision of the factories of the future: the challenge perspective

Vision of the factories of the future: the technology perspective

Agile value networks: Lot-size one - distributed manufacturing

Excellence in manufacturing: Advanced manufacturing processes and services for zero-defect processes and products

The human factor: Human competences in synergy with technological assets

Sustainable value networks: Manufacturing in a circular economy

Interoperable digital manufacturing platforms: connecting manufacturing services

EFFRA
EUROPEAN FACTORIES OF THE FUTURE RESEARCH ASSOCIATION
www.effra.eu

MADE IN EUROPE

MIE General objectives

- Ensuring European Leadership & manufacturing excellence; generating new products and markets
- Achieving Circular and climate-neutral manufacturing
- Mastering the digital transformation of manufacturing industry
- Creating attractive added-value manufacturing jobs

MIE Specific Objectives

- Excellent, responsive and smart factories & supply chains
- Circular products & Climate-neutral manufacturing
- New integrated business, product-service and production approaches; new use models
- Human-centred and human-driven manufacturing innovation

Operational/R&I Objectives

1. Zero-defect and zero-downtime high precision manufacturing
2. Manufacturing for miniaturisation and functional integration
3. Scalable, reconfigurable & flexible first-time right manufacturing
4. **Artificial intelligence for productive, excellent, robust and agile manufacturing chains - Predictive manufacturing capabilities & logistics of the future**
5. Advanced manufacturing processes for smart and complex products
6. **Data highways and data spaces** in support of smart factories in dynamic value networks

1. Ultra-efficient, low energy and carbon-neutral manufacturing
2. De-manufacturing, re-manufacturing and recycling technologies for circular economy
3. Manufacturing with new and substitute materials
4. **Virtual end-to-end life-cycle engineering** and manufacturing from product to production lines, factories, and networks
5. **Digital platforms and data management for circular** product and production-systems life-cycles

1. Collaborative product-service engineering for consumer driven manufacturing VNs
2. Manufacturing processes and approaches near to customers or consumers
3. **Transparency, trust and data integrity** along product and manufacturing LC
4. Secure communication & IP management for factories in dynamic value networks

1. **Digital platforms** and engineering tools for creativity and productivity of manufacturing development
2. Improving human device interaction using augmented and virtual reality and digital twins.
3. Human & technology complementarity and excellence in manufacturing
4. Manufacturing Innovation and change management
5. Technology validation and migration paths towards industrial deployment of advanced manufacturing technologies by SMEs

Example: Project cluster exploiting data platforms and AI: Digital manufacturing platforms for connected smart factories

- **ZDMP** - Zero Defect Manufacturing Platform
- **QU4LITY** - Digital Reality in Zero Defect Manufacturing
- **eFactory** - European Connected Factory Platform for Agile Manufacturing
- **SHOP4CF** - Smart Human Oriented Platform for Connected Factories
- **DigiPrime** - Digital Platform for Circular Economy in Cross-sectorial Sustainable Value Networks
- **KYKLOS 4.0** - An Advanced Circular and Agile Manufacturing Ecosystem based on rapid reconfigurable manufacturing process and individualized consumer preferences
- **ConnectedFactories 2 CSA**
  - Creating digital pathways for manufacturing companies
  - cross-fertilisation across European and national R&D&I actions
  - supporting digital platform projects cluster

https://www.connectedfactories.eu/

CONNECTED FACTORIES

EFFRA
EUROPEAN FACTORIES OF THE FUTURE RESEARCH ASSOCIATION
www.effra.eu

Project example of exploiting data platforms and AI: Connected Factories 2 CSA

LEVEL 1

HUMAN CONTROL

No autonomy, human beings have full control without any assistance

LEVEL 2

AI ASSISTANCE

Partial autonomy in clearly defined areas, humans have full responsibility and make all decisions

LEVEL 3

AI RECOMMENDATION

System warns if issues occur, humans confirm solutions recommended by the system

LEVEL 4

COLLABORATIVE AI

System functions autonomously and adaptively, humans can supervise or intervene in emergency situations

LEVEL 5

AI in CONTROL

Autonomous operations in all areas, including in cooperation. Human presence is not always required

CONNECTED FACTORIES

Supported by the European Commission through the Factories of the Future PPP (Grant Agreement Number 873086)

Process for Planet (P4Planet) partnership

P4Planet

VTT

Process industries will develop and deploy sustainable circular business models through technological and non-technological innovations, cross-sectoral collaboration and engagement with the local ecosystem

RESOURCE AND WATER EFFICIENCY

Energy and resource efficiency IA9
including eco-design IA10

CIRCULARITY OF CARBON

CO_2 capture for utilisation IA6
CO_2 and CO utilisation in minerals IA7
CO_2 and CO utilisation in chemicals and fuels IA8

PRODUCTION PROCESSES

RESIDUAL CO/CO2 EMISSIONS

ENSURING FULL CIRCULARITY & OVERHAULING THE USE OF WASTE AND WATER

Circularity of resources IA10
Industrial-Urban symbiosis IA11
Circular regions (Hubs4Circularity) IA12

Minimized input of primary resources

Manufacturing industries

Society: regions, citizens

Recycling industries

CIRCULAR VALUE CHAINS

ACCELERATORS

Demo Plants & First Of A Kind plants (FOAK)

Hubs4Circularity IA12

Digitalisation of processes and products IA 13

- Digital material design
- Digital process development and engineering
- Intelligent material and equipment monitoring
- Autonomous integrated supply chain management
- Digitalisation of industrial-urban symbiosis

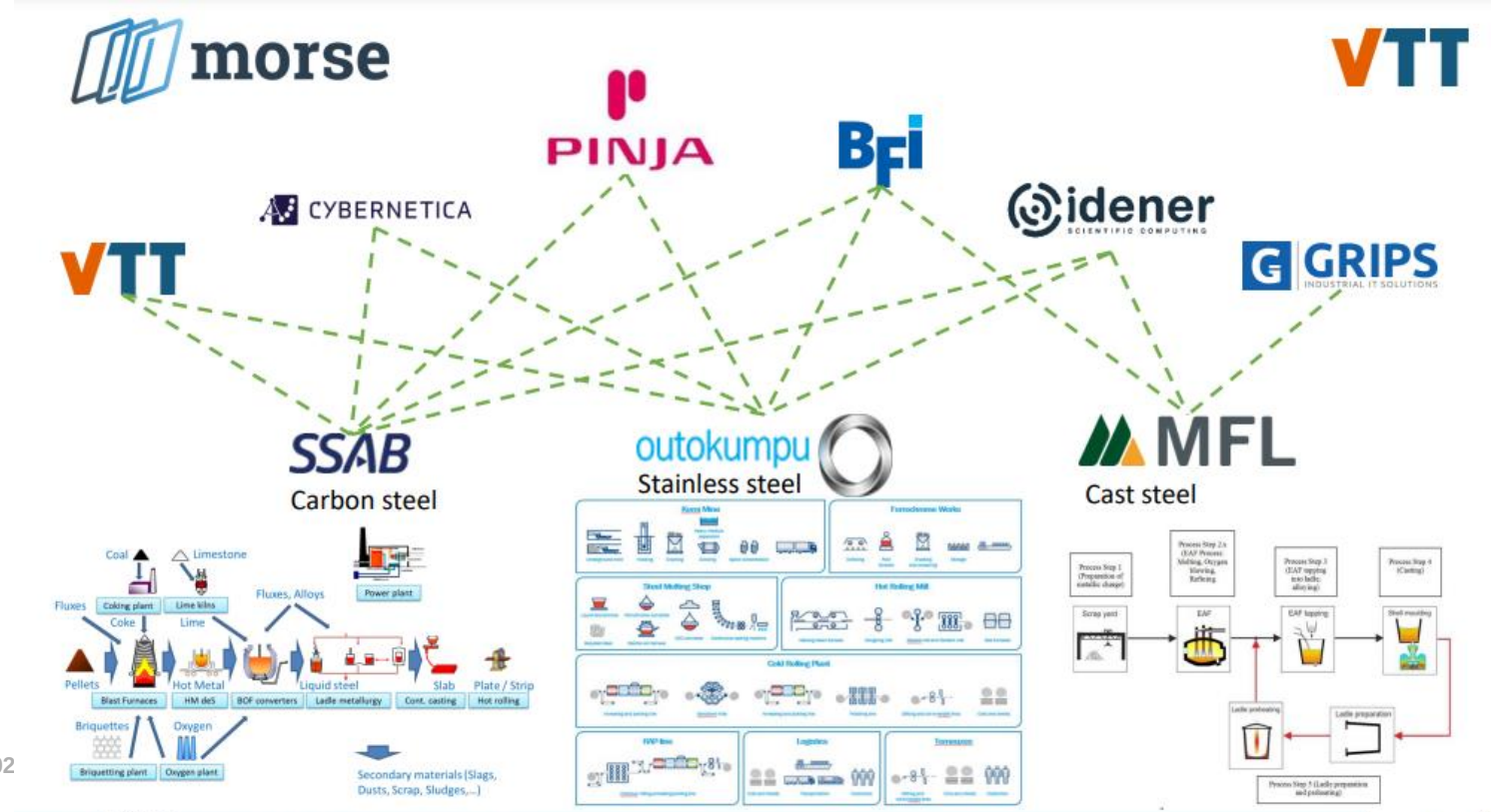
ENABLERS

Non-technological aspects IA14

- European, national and regional framework conditions
- Uptake and management of market and consumer demands and changes
- Effective common tools such as life cycle assessment, business models, new (digital) learning arrangements and methodologies
- Human resources, skills and labour market conditions

Example of exploiting data platforms and AI in process industries

MORSE to develop more advanced tools to improve steel quality and the management of complex processes



Example of AI and big data in process industries

AI Cube

AI, Data and Robotics Partnership

The AI Data Robotics Association

A joint initiative by

BDV BIG DATA VALUE ASSOCIATION · CLAIRE · ellis European Laboratory for Learning and Intelligent Systems · EurAI · eu ROBOTICS

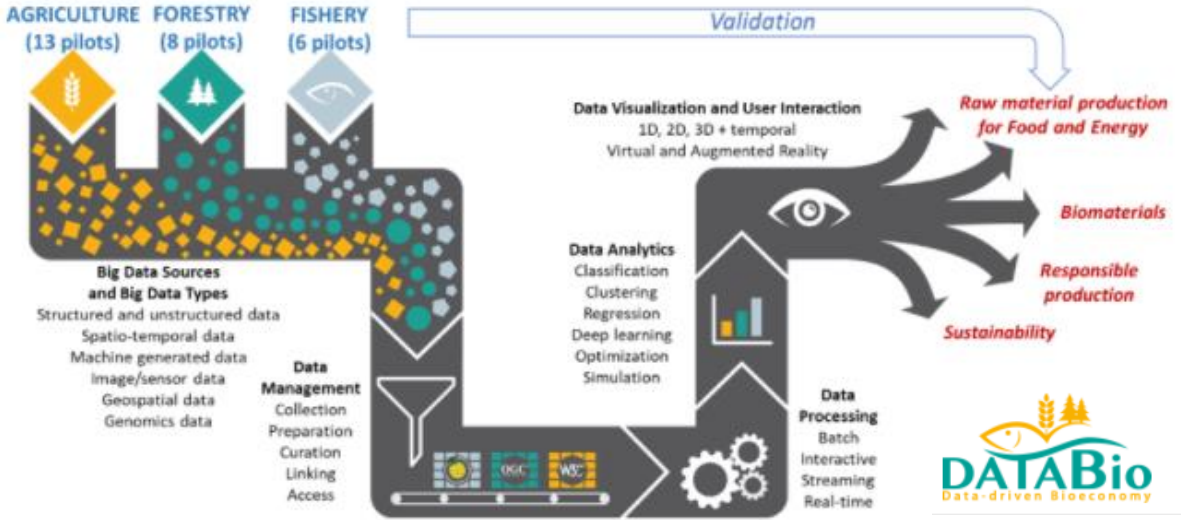
ADR general objectives

Secure **European's sovereignty over AI, Data and Robotics** technologies and knowhow

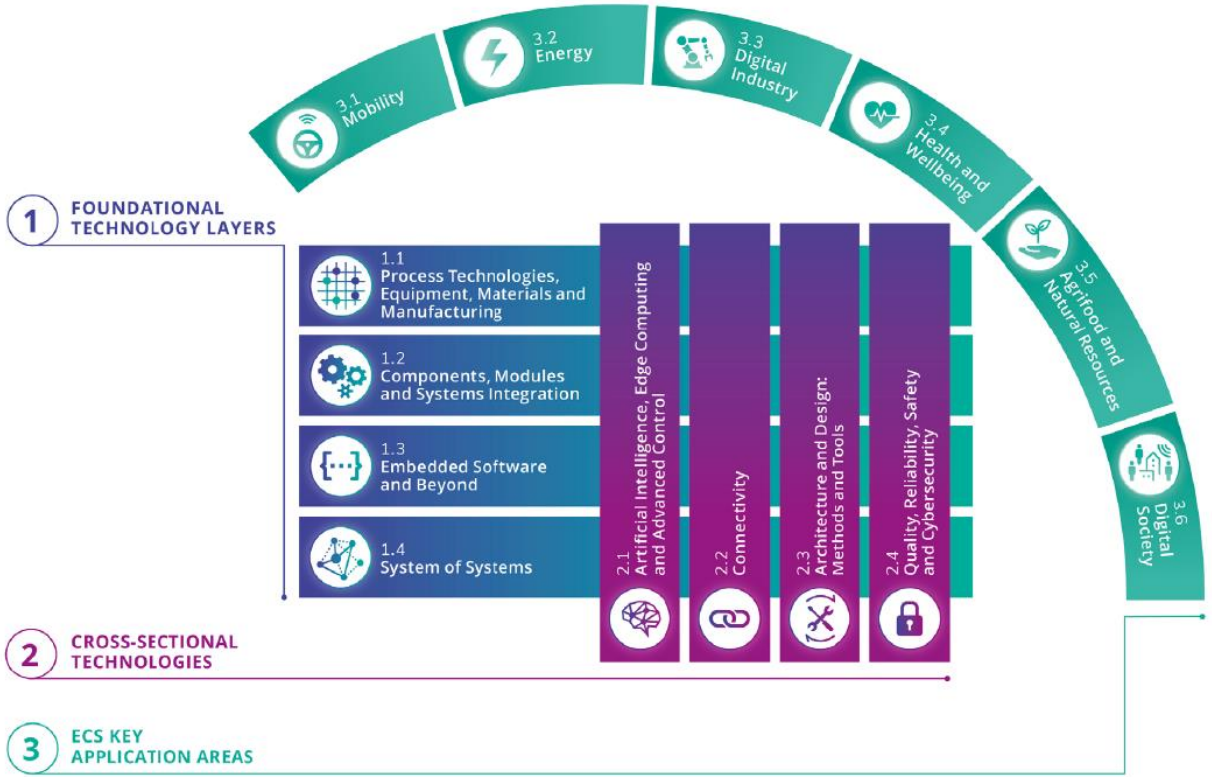
Establish **European leadership in AI, Data and Robotics** technologies with high socio-economic impact

Reinforce a **strong and global competitive position of Europe** in AI, Data and Robotics

Project example of exploitig Big Data DataBio

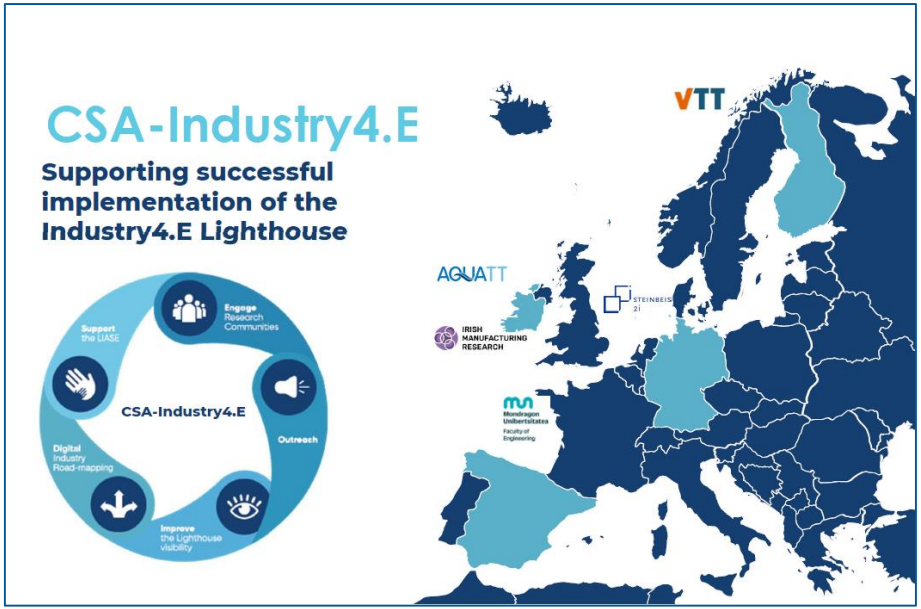


Key Digital Technolofgies (->Chips Act)



https://www.kdt-ju.europa.eu/sites/default/files/2021-12/2021_ECS-SRIA-final_1501.pdf

Project examples exploiting data and AI (ECSEL/KDT)

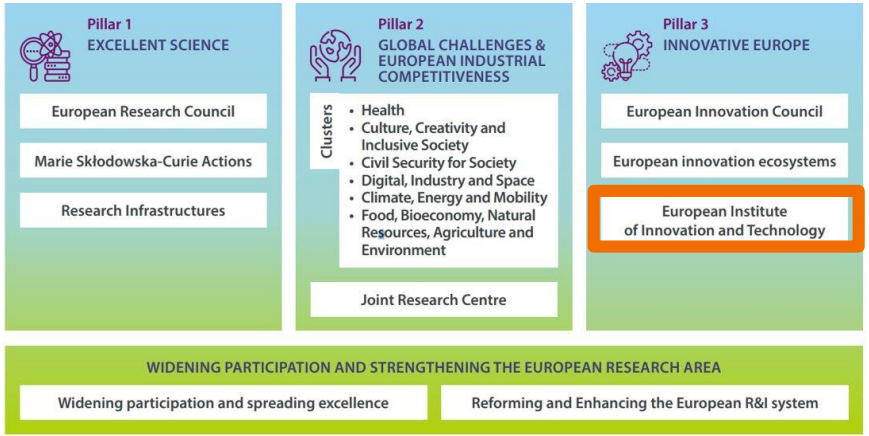


Arrowhead Tools

- to create engineering tools for the next generation of solutions in digitization and automation for the European industry.
- Arrowhead Framework with integration to legacy engineering process and associated tools as well as to other initiatives like e.g. FiWare, IDS, Eclipse, Apache and commercial cloud platforms
- 81 partners

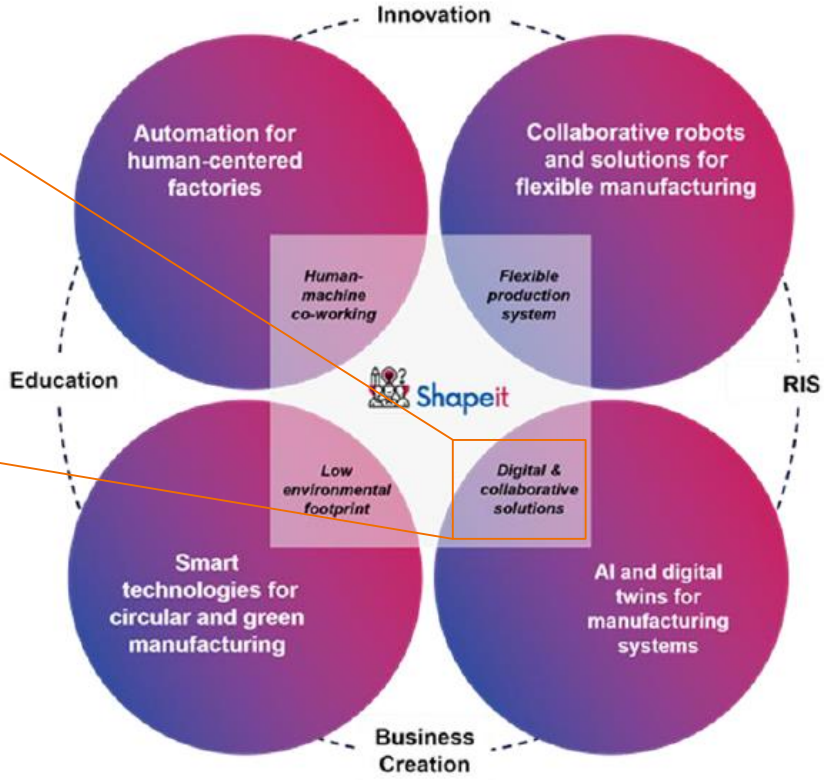
EIT KIC's

Innovation Communities within the European Institute of Innovations and Technology (EIT)



EIT Manufacturing Flagships and call topics

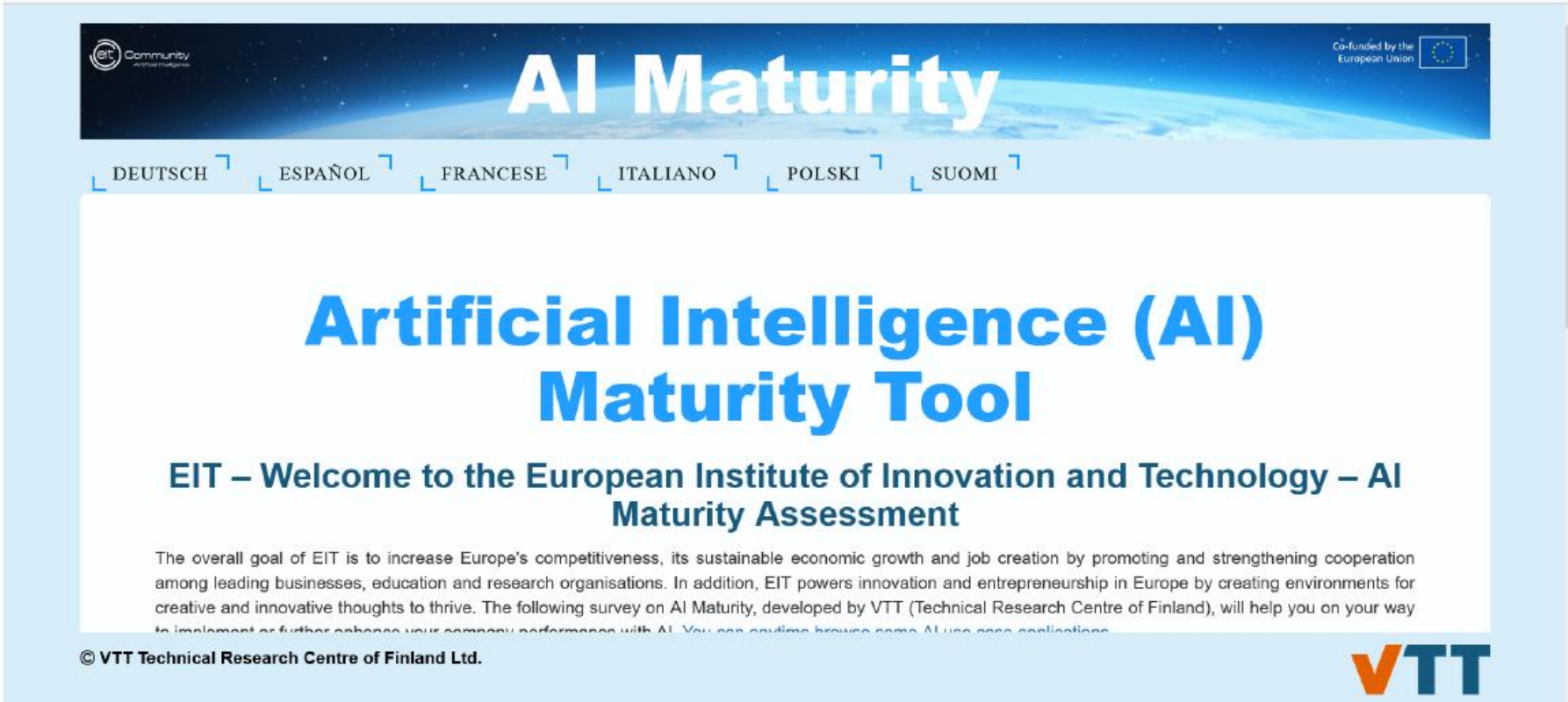
Digital and Collaborative Solutions for Innovative Manufacturing Ecosystems: Collaboration and business on **digital platforms** and value networks enables companies to create new and highly efficient value chains.



eit Manufacturing

EIT Manufacturing example: AI maturity tool

Cross-KIC activty on AI extended VTT's tool and translated it to 5 languages



Summary

Key partnerships exploiting data and AI for industry

- **Made In Europe**
- P4Planet

Application

- **AI, Data and Robotics**
- Key Digital Technologies

Technology development

Impact!

beyond

the obvious

Riikka.virkkunen@vtt.fi
+358 505202381

@VTTFinland
@VirkkunenRiikka

www.vtt.fi