S4M SUSTAINABLE MATERIAL MANAGEMENT MATURITY MODEL

Sustainable Material Management Maturity Model

Project period
1.10.2024–31.12.2026

Coordinator
Turku University of Applied Sciences

S4M Co- Innovation Project Presentation

Seminar 24.11.2025

Principal Investigator (PI)

Dr(Tech) Heli Aramo-Immonen

heli.aramo-immonen@turkuamk.fi

Project period
1.10.2024–31.12.2026

Coordinator
Turku University of Applied Sciences

Industrial partners
Meyer Turku Oy (in-kind)
Merima Oy (BF-project)
Lautex Oy Ab (BF-project)
E.U.-Adhoc Project Oy (BF-project)
ProVerse Interactive Oy (in-kind)
Carina Solutions Oy (in-kind)

Research organisations
Turku University of Applied Sciences
University of Exeter Business School, UK
Northeastern University London, UK
BI Norwegian Business School, Norway
Örebro University, Sweden
University of Borås, Sweden
University of Las Palmas de Gran Canaria, Spain
Hamburg University of Technology, Germany
University of Inland Norway, Norway

The focal research questions in whole project are *"How to turn green transition actions in material management to competitive advantage for network?"* and *"How to make business from network sustainability development?"*

> *Virtual space can be implemented from various components, and it can also be a collaborative environment. The implementation can exploit internet of digital twins, dashboards, or metaverse environments. Access to the system will be provided to partnering companies for ecosystem status checks, and digital authentication may serve as proof of maturity levels. Finally, a pilot and testing phase will be conducted to validate the S4M system's functionality.*

University partners

Simulations & Operations Management
Exeter University UK

Resource Interaction
Norwegean BI, Oslo

Data visualisation
Northeastern University, London

Corporate performance
University of Las Palmas

Sustainable and circular production
Örebro University, BC

Textile Value Chain
University of Borås

Supply chain management
Hamburg University of Technology

Digitalization and Sustainability
University of Inland Norway

TURKU AMK

TUAS Co-Innovation research project **S4M**

WP1 Sustainable material management maturity model construction

WP2 Digital solutions' evolution for networked material management

WP3 Material Management of Innovate to Order (ITO) shipbuilding ecosystem

WP4 Dissemination & exploitation

WP5 Coordination & Project Management

Company network

Case Company A
- KPA Customer communication

Case Company B
- KPA Change management
- KPA Product Lifecycle Management

Case Company C
- KPA Contracting
- KPA Organisational learning

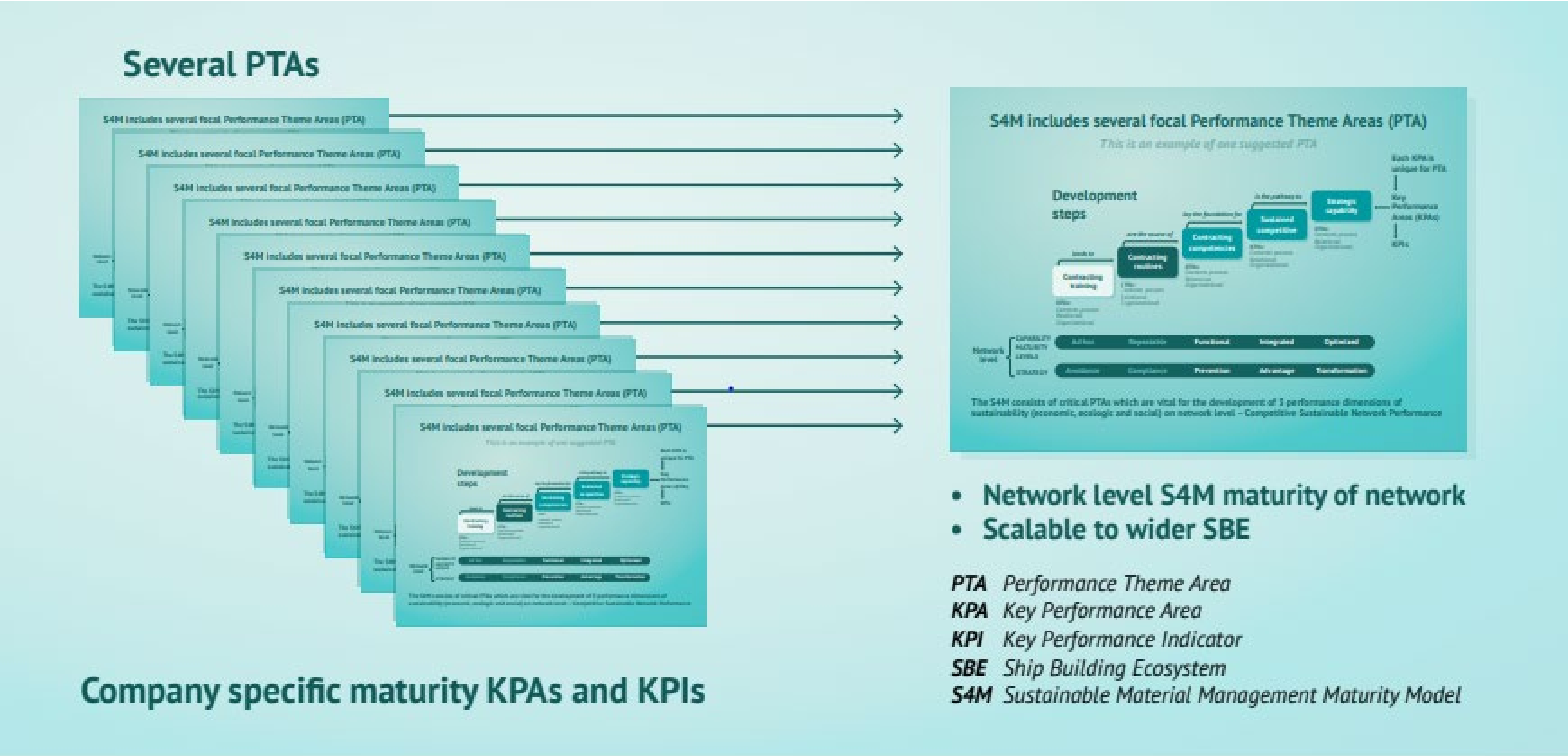
Case Company D
- KPA Data visualisation Industrial metaverse

Case Company E
- KPA Tacit knowledge transfere
- KPA Process productivity

Case Company F
- KPA Sustainability & Maturity of supply network
- KPA Competitive production

Case Company G
- KPA Digital supply chain solutions

Maturiteettimallin rakenne

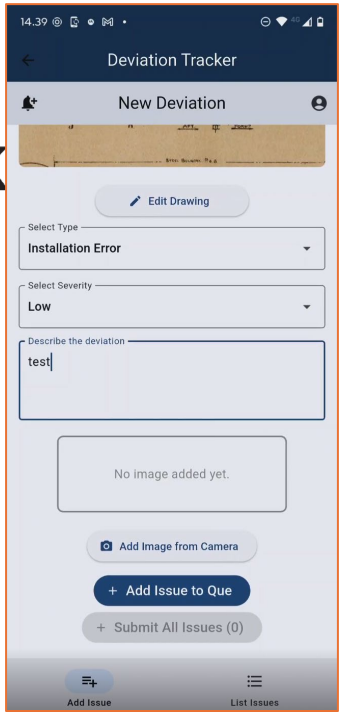


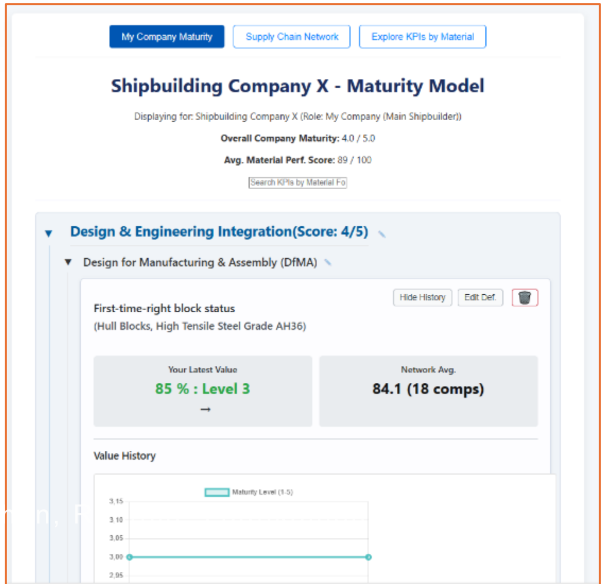
Ulottuvuus	Perustutkimus	Soveltava tutkimus	Tuotekehitys
Tavoite	Ymmärryksen lisääminen	Käytännön ratkaisujen kehittäminen	Markkinavalmiin tuotteen tai palvu n luominen
Luonne	Teoreettinen, pitkäjänteinen	Monitieteinen, keskipitkä aikaväll	Strukturoitu, aikarajoitettu
Tulos	Uusi tieto, tieteellinen edistys	Käytännön sovellukset	Konkreettinen tuote täi palvelu
Riskinsietokyky	Korkea	Kohtalainen	Matala
Ajurit	Uteliaisuus	Ongelmien ratkaisu	Asiakastarpeet ja markkinakysyntä
Yhteys	Luo perustan soveltavalle tutkimukselle	Pohjautuu perustutkimukseen, tukee tuotekehityst	Ratkaisut hyödyntävät tutkimukse tuloksia
Avoimuus	Korkea	Kohtalainen	Matala

Digital solutions

- Digital version of the S4M maturity model
  - UI, back-end, and database running on Docker for demo purposes
  - Excel import & export of S4M model structure and data values
  - Next steps: Test environment, User access and data sharing
- Mobile app for deviation tracking
  - Pilot in December 2025
  - Next steps: VTT LCA-calculator integration, Waste calculations and analytics
- Agent-based simulation and optimization of material flow
  - Conceptual specification phase

seminar_demo_deviation_tracker_s4m.mp4

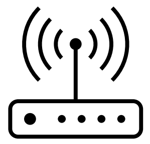




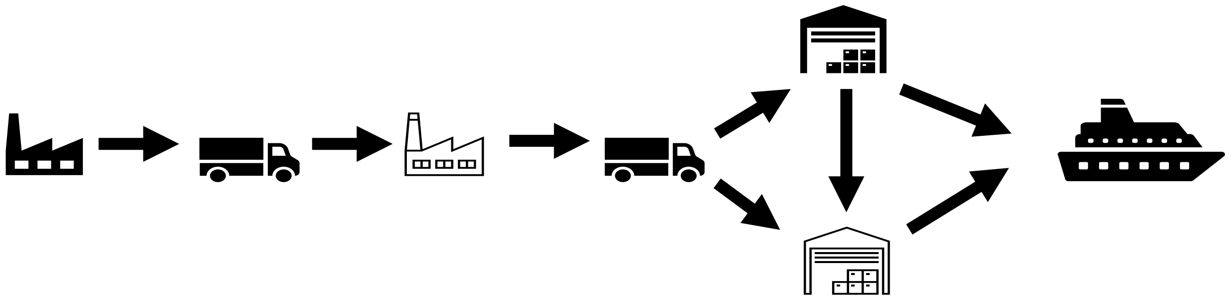
- Contact WP2 leader Kimmo.Tarkkanen@turkuamk.fi

Supply chain material tracking: Technology, Data, Information and Objectives,

Technology



LoRaWAN
NB-IoT, GPS-sensor
RFID-tags
Smartphone QR-code
Image recognition

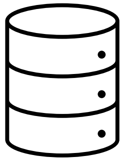


Questions

- How efficient are operations in term of cost /waste
  Denefits that can be achieved.

Contact Janne Siivonen

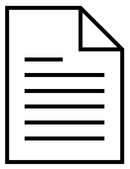
Raw data



Material:
location
time

+

Business process information



ERP- data/information
Transportation/logistic information
CO_2

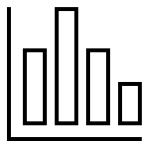
+

Objectives

Right materials
Right place
Right time, no waste
Deviations

→

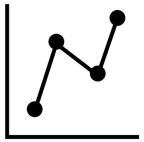
Statistics



Logistic efficiency
JIT, Inventory levels
Lead time

→

Analysis



Prediction models

Optimisation

Simulation

TURKU AMK

UNIVERSIDAD DE LAS PALMAS DE GRAN CANARIA

MEYER TURKU
SHIPYARD 1737

University of Exeter Business School

TUHH
Hamburg University of Technology

Merima

BUSINESS FINLAND

INN
University of Inland Norway

CREDS
Center for Research on Digitalization and Sustainability

E.U. -ADHOC PROJECT OY

BI Norwegian Business School

UNIVERSITY OF BORÅS

Lautex®

PROVERSE

ÖREBRO UNIVERSITY

Northeastern University London

CARINA FOUR

Funded by BF

- https://www.businessfinland.fi/en/for-finnish-customers/home