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AIM Advancing Innovation in Manufacturing

Digital Training Resources (AIM Centre)

Concept to Factory: Enabling Smart Manufacturing with the Digital Thread

Project

TRANSFORM – Training and Re-skilling for Smart Manufacturing
Erasmus+ KA210-VET – Small-scale Partnerships in Vocational Education and Training
Project Reference: 2024-2-IE01-KA210-VET-000281740

Delivering Partner

AIM Centre – Sligo Leitrim ITS Regional Development Projects DAC (Ireland)

Activity Reference

Activity #2 – Collaborative Development

Resource Set Overview

This document presents **two complementary digital training resources developed by the AIM Centre**, derived from the AIM-led webinar:

"Concept to Factory: Enabling Smart Manufacturing with the Digital Thread"

The resources focus on the practical implementation of smart manufacturing concepts, with particular emphasis on **the digital thread**, **MES**, and **connected systems** in SME manufacturing environments.

RESOURCE 1

Digital Training Resource – Concept to Factory: Enabling Smart Manufacturing with the Digital Thread

Resource Type

Modular Digital Training Resource (Reusable Learning Module)

Target Group

- Adult learners and job seekers
- Manufacturing employees (SMEs)
- VET trainers and educators

EQF Level (indicative)

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EQF Level 4–5 (Introductory to intermediate)

1. Purpose of the Resource

This digital training resource introduces the concept of the **digital thread** and its role in enabling **smart manufacturing from concept to factory execution**. It explains how data flows across design, planning, production, and operations, and how systems such as **Manufacturing Execution Systems (MES)** support real-time decision-making on the shop floor.

The resource reflects AIM Centre's applied, SME-focused expertise in digital manufacturing and supports the project objectives related to **digital skills**, **connected systems**, and **Industry 4.0 implementation**.

2. Learning Objectives

After completing this resource, learners will be able to:

1. Explain the concept of the digital thread in smart manufacturing.
2. Describe how data flows from design and planning to factory execution.
3. Understand the role of MES within a connected manufacturing environment.
4. Identify practical digital thread use cases relevant to SMEs.
5. Recognise key benefits and challenges of implementing smart manufacturing systems.

3. Structure and Content

Module 1 – Smart Manufacturing from Concept to Factory (Context & Motivation)

Purpose: Establish relevance and urgency for SMEs and adult learners

Focus:

- Smart manufacturing challenges for SMEs
- Why disconnected data limits productivity and agility
- Overview of the concept-to-factory lifecycle
- Where digital transformation typically fails in SMEs

Module 2 – The Digital Thread as a Practical Framework

Purpose: Clearly position the digital thread as an enabler, not a theory

Focus:

- Digital thread explained through data continuity, not IT architecture
- Difference between:
  - -Digital thread
  - -Digital twin
  - -Isolated digital tools
- Visual lifecycle walkthrough (design → production → improvement)

Module 3 – MES and Connected Systems at the Factory Level

Purpose: Make MES the operational backbone of the learning resource

Focus:

- MES as the bridge between planning and execution
- Role of machines, sensors, operators, and systems
- Real-time data capture and decision support
- Interaction with ERP, PLM, AI (high level, SME-friendly)

Module 4 – Digital Thread Use Cases in SME Manufacturing

Purpose: Translate concepts into operational value

Focus:

- Production visibility and performance tracking
- Quality, traceability, and compliance
- Change management and engineering updates
- Incremental adoption pathways (start small, scale later)

Module 5 – Data, Skills, and Organisational Readiness

Purpose: Explicitly link technology to people and capability

Focus:

- Data literacy for shop-floor and management roles
- Required technical, analytical, and process skills

- Collaboration across functions (IT, OT, operations)
- Workforce implications of connected systems

Module 6 – Benefits, Challenges, and Decision Readiness for SMEs

Purpose: Support informed decision-making

Focus:

- Operational and business benefits
- Common SME challenges:
  - -Data silos
  - -Legacy systems
  - -Skills gaps
  - -Change resistance
- Readiness checklist and decision prompts

4. Learning Activities

1) Reflection exercise

Activity: Identify one "data handover point" in your organisation (or a typical SME workflow) where information is currently lost, duplicated, delayed, or manually re-entered (e.g., design-to-production, production-to-quality, maintenance-to-planning).
Prompt questions:

- What data is handed over (e.g., BOM, work order, quality result, machine status)?
- Who sends it, who receives it, and how (email, Excel, verbal, system)?
- What is the impact when it goes wrong (delay, scrap, rework, downtime)?
  Output: 3–5 bullet notes describing the problem and impact.

2) Knowledge check (short quiz)

Activity: Complete a short quiz (5–8 questions) to confirm understanding of key concepts.
Suggested quiz areas:

- Digital thread definition and purpose
- Digital thread vs digital twin (one question)
- Where MES fits in concept-to-factory flow
- Examples of connected systems/data sources (IoT, PLM, ERP, sensors)

- Typical benefits and challenges (data silos, change management)
  Output: Score + review of incorrect answers (self-check or trainer-led).

3) Optional practical task (mapping exercise)

Activity: Map a simple product or process lifecycle and identify digital thread touch-points.
Instructions:

- Choose one product/process (real or example): e.g., assembly line, machining job, medical device component.
- Draw 5 stages: Design → Planning → Production → Quality → Continuous improvement
- For each stage, note:

  -What data is created/used (e.g., CAD file, routing, batch record, inspection result)

  -Which system/tool could hold it (e.g., PLM, ERP, MES, spreadsheet)

  -One "thread connection" needed between stages
  Output: One-page map (hand-drawn is fine) + 3 improvement opportunities.

5. Format and Accessibility

This resource may be delivered and reused in multiple digital formats, including:

- Slide deck with trainer notes
- PDF learning pack
- Online learning module hosted on partner websites

All formats support reuse, adaptation, and dissemination in line with Erasmus+ open-access principles.

RESOURCE 2

Recorded Webinar Learning Module – Concept to Factory: Enabling Smart Manufacturing with the Digital Thread

Resource Type

Recorded Webinar Learning Module (Digital Training Resource)

Delivery Context

Derived from the **AIM-led project webinar**:

"Concept to Factory: Enabling Smart Manufacturing with the Digital Thread"

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1. Purpose of the Resource

This resource transforms the AIM-led live webinar into a **structured and reusable digital learning module**, allowing learners and trainers to explore smart manufacturing concepts on demand and independently of the live session.

2. Learning Objectives

After completing this learning module, learners will be able to:

1. Describe the role of the digital thread in smart manufacturing.
2. Explain how MES and connected systems support factory execution.
3. Identify practical examples of digital thread implementation discussed in the webinar.
4. Reflect on opportunities for adopting smart manufacturing approaches in their own context.

3. Core Learning Content

3.1 Recorded Webinar

- Format: Video recording (webinar replay)
- Duration: Approx. 60 minutes
- Delivery mode: Online / on-demand

3.2 Webinar Slides

- Digital thread concepts and diagrams
- MES and connected systems examples
- SME-focused implementation insights

4. Structured Learning Guide

Key Topics Covered

- End-to-end digital continuity
- Factory execution and real-time data
- Incremental adoption strategies for SMEs

Reflection Questions

1. Where could a digital thread add the most value in your organisation?
2. What data sources would be needed to enable this?
3. What challenges might arise during implementation?

5. Learning Activities

- **Individual reflection:** Identify one smart manufacturing improvement opportunity.
- **Group discussion (optional):** Facilitated discussion using webinar examples.
- **Practical task (optional):** Sketch a simple digital thread for a product or process.

6. Alignment with Erasmus+ Commitments

Alignment with Approved Application

- Supports digital skills and competences
- Addresses digital thread, MES, and connected systems
- Contributes to the modular digital learning programme

Alignment with Partnership Agreement (Annex IV)

- Supports collaborative development of digital training content
- Contributes to dissemination and reuse of project outputs

7. Licensing and Reuse

Both resources are made available as **Open Educational Resources (OER)** for non-commercial educational use, with appropriate attribution to the TRANSFORM project, AIM Centre, and the Erasmus+ Programme.

This document constitutes digital training resources developed by the AIM Centre under the Erasmus+ KA210-VET project TRANSFORM and may be used as evidence of project outputs in interim and final reporting.