

Module 14

Digital Transformation and Innovation for Enabling Reconfigurable Production Systems

Welcome to Module 15, Digital Transformation and Innovation for Enabling Reconfigurable Production Systems. This module consists of 5 parts as follows:

1. Manufacturing Digital Transformation
2. Modapto under the lens of Digital Transformation
- 3. Innovations in Manufacturing Business Models**
4. Assessment Questionnaire for Reconfigurable Manufacturing Maturity of SMEs
5. Business Models of MODAPTO
6. References – Extra Reading Material

Each has its own set of slides and accompanying explanations that you can read in parallel. To do so in this series of accompanying texts the Reference Slide is presented in line with the supportive text.

14.3. Innovations in Manufacturing Business Models

[Slide #4]

To uncover the potential of a solution for modular manufacturing (as MODAPTO) the "10 Types of Innovation" framework can act as a base guiding model. It was primarily developed by Larry Keeley and his colleagues at Doblin and categorizes innovation into three main areas: **Configuration** (how the business is structured), **Offering** (the product or service itself), and **Experience** (how customers interact with the company). The ten types are:

Configuration:

Profit Model: How you make money.

Network: How you connect with partners to create value.

Structure: How the company is organized and its talent developed.

Process: The unique methods and operations that help you outperform competitors.

Offering:

Product Performance: The features and functionality of the product.

Product System: Complementary products and services that create a system.

Experience:

Service: The support and value you provide after a purchase.

Channel: How you deliver your products and services to customers.

Brand: How you position and communicate your values to the market.

Customer Engagement: How you build compelling and lasting interactions with customers.

[Slide #5]

Indicative innovations in the manufacturing sector include Michelin, Airbus, Siemens, Tesla, GE,

[Slide #6]

Bosch, ABB Robotics, Caterpillar, Schneider Electric and Haier.

[Slide #7]

Once we critically examine both MODAPTO as well as a potential commercial vehicle for its exploitation, it is evident that it can innovate of course by definition in Product Performance as well as Product System, but not only there. As can be seen there is potential for innovation at Profit model, Structure and Process as well as in Service, Channel, Brand and Customer engagement at different degrees.

[Slide #8]

Of course innovation at a product / service level also adheres to the overall drivers of innovation and business modelling formulation from the Sector.

As such this table summarizes how Industry 4.0 affects the business model elements of manufacturing SMEs across three pillars—value creation, value offer, and value capture—

with specific implications for equipment, workforce, partnerships, products, services, customers, and payment systems.

- Value creation – Industry 4.0 enhances productivity, energy efficiency, fault detection, and data access in production equipment, while enabling self-controlled production and predictive maintenance. Workforce effects include new job profiles, technology-based training, and better integration of underrepresented groups, but also risks of skill shortages and job reduction. Partnerships become more interconnected, collaborative, and data-driven, with higher transparency and standardization.
- Value offer – Products become more flexible, tailored, and higher in quality, often incorporating manufacturing data and human-machine interfaces. Services expand to include retrofitting, remote maintenance, data analytics, simulations, and virtual product development, offering customers greater customization and operational support.
- Value capture – Digital platforms and communication tools enhance customer interaction, co-design, and value chain integration, though anonymity may challenge loyalty. Payment systems evolve towards automation, subscription models, and pay-per-use arrangements, improving reliability and flexibility.

[Slide #9]

The framework depicts the effect of Industry 4.0 on the business model element and the innovation pathways followed by manufacturing firms. This framework expands Müller, Buliga and Voigt's framework, creating a novel one that combines the Industry 4.0 effect on business model elements and the primary innovation pathways that industrial companies follow, such as servitization, digital servitization, mass customization and personalization, AI-driven, and sustainability/circular business models. The proposed framework can guide manufacturers' strategic investment decisions to integrate Industry 4.0 technologies to innovate and adapt their business models as a part of their digital transformation efforts. In other words, this approach can be used to assess the impact of these technologies on various business model components and identify possible innovation pathways. It delineates strategic avenues for manufacturers to shift from traditional, production-centric models to advanced models that enhance customer experience and value delivery. Such practical guidance is critical for industry leaders to maximize the digital transformation outcome and achieve innovation in the business model parallel to process transformation.

