Week one Recap

MECHENG 754

**Industry 4.0 Smart Manufacturing
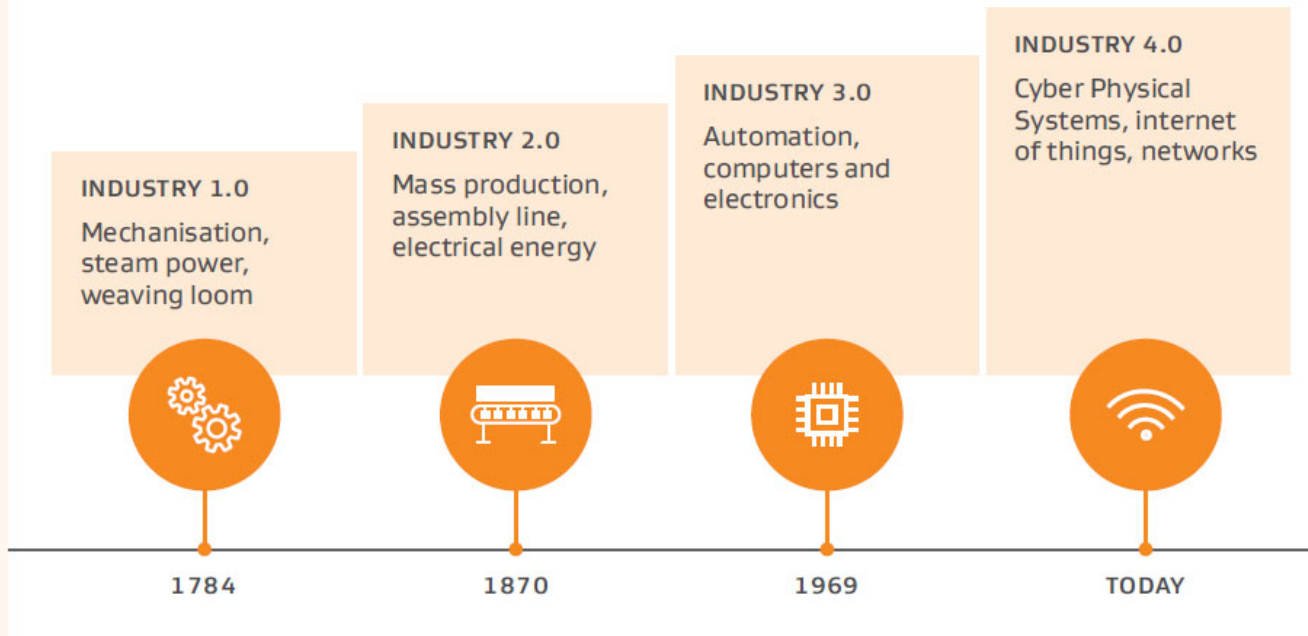(2022)**

MECHENG 753

**Advanced Industry 4.0 Smart Manufacturing
(2022)**

INDUSTRY REVOLUTION

Transforming industries and innovation

INDUSTRY 1.0
Mechanisation, steam power, weaving loom

INDUSTRY 2.0
Mass production, assembly line, electrical energy

INDUSTRY 3.0
Automation, computers and electronics

INDUSTRY 4.0
Cyber Physical Systems, internet of things, networks

1784   1870   1969   TODAY

MINISTRY OF BUSINESS, INNOVATION & EMPLOYMENT
HĪKINA WHAKATUTUKI

GROWING INNOVATIVE INDUSTRIES IN NEW ZEALAND

Advanced Manufacturing Draft Industry Transformation Plan

CONSULTATION DRAFT
JUNE 2022

In practice Industry 4.0 allows advanced manufacturing processes to be optimised by being digitally connected (the "internet of things"), improving use of data including sensors, incorporating automation and robotics, digital manufacturing (e.g. 3D printing and additive manufacturing), as well as digital twins, artificial intelligence and virtual reality. It is important to appreciate that it also includes advances in business and production processes, often with small changes yielding significant benefits.

https://www.mbie.govt.nz/have-your-say/advanced-manufacturing-industry-transformation-plan/

Learning Outcomes

- Understand the fundamentals of Industry 4.0 for smart manufacturing
- Understand some of the tools and models for measuring Industry 4.0 Readiness
- Gain appreciation of some specific tools for SMEs
- Demonstrate an understanding of the tools of the Industrial Internet of Things and data analytics
- Understand and apply digital twin technologies in manufacturing settings

Topics in Weeks 1-4

- Introduction to Industry 4.0

- Industry 4.0 Technology Readiness Assessment

- Digital Manufacturing Solutions for SMEs
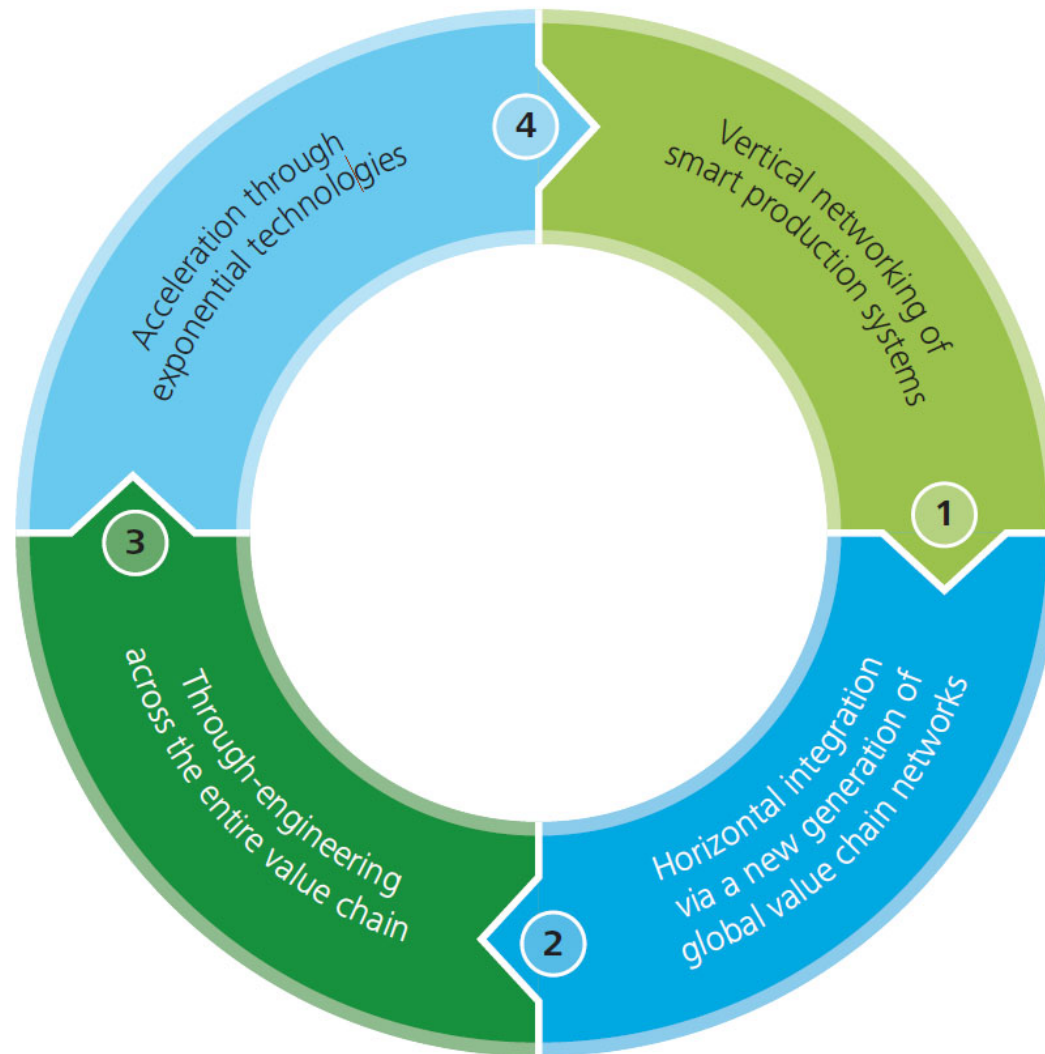
- Basics of Industrial Communications

Introduction to Industry 4.0

Transformation of manufacturing approaches
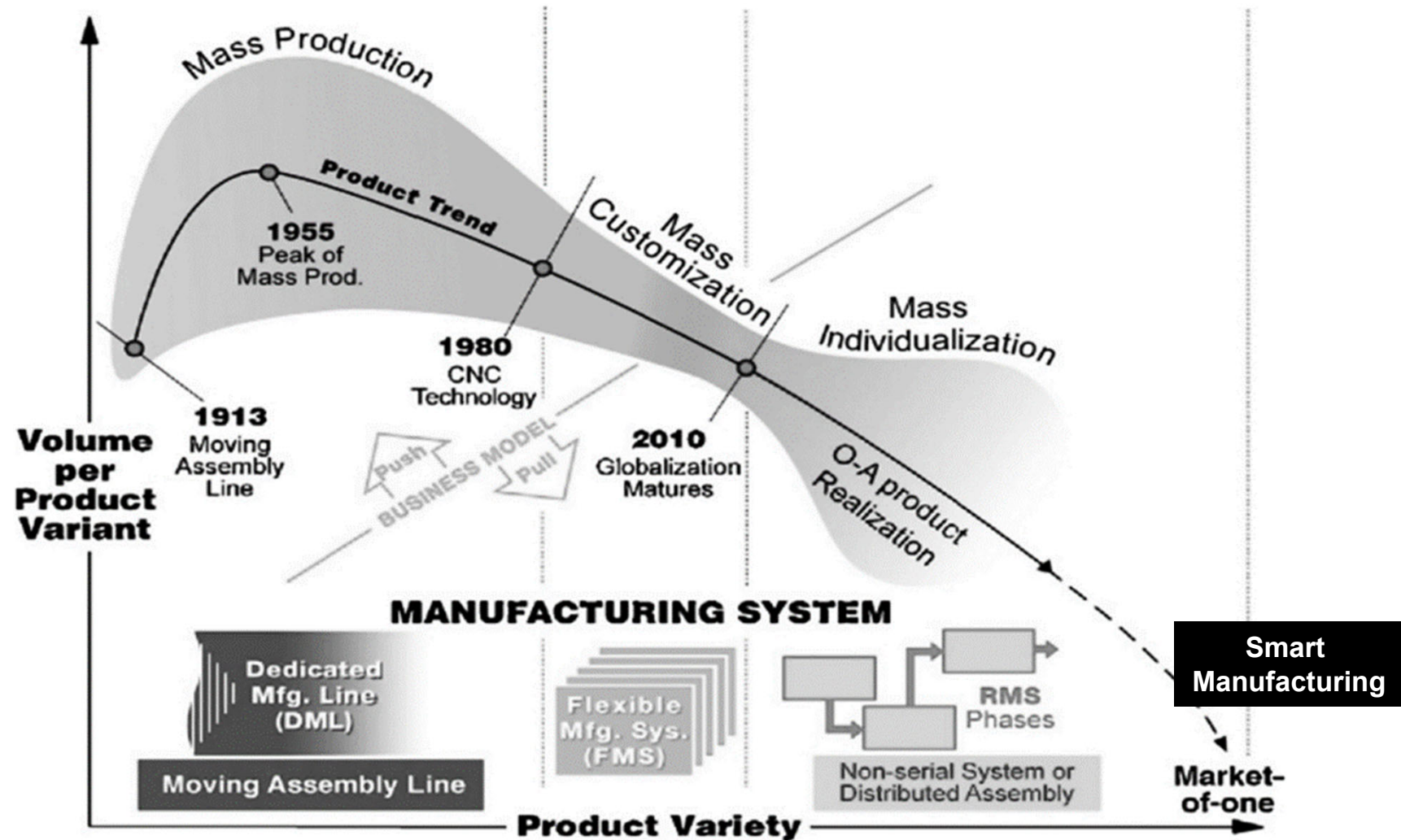
Koren, Y. 2010 The global manufacturing revolution: product-process-business integration and reconfigurable systems: John Wiley & Sons, Inc.

Four main characteristics of Industry 4.0

The four characteristics shown in the circular diagram:

1. Vertical networking of smart production systems
2. Horizontal integration via a new generation of global value chain networks
3. Through-engineering across the entire value chain
4. Acceleration through exponential technologies

Arbeitskreis Industrie 4 .0: Umsetzungsempfehlungen fur das Zukunf tsprojekt Industrie 4.0. April 2013. Eric Openshaw, Craig Wigginton, John Hagel, John Seely Brown, Maggie Wooll and Preeta Banerjee: The Internet of Things Ecosystem: Unlocking the Business Value of Connected Devices. Deloitte, 2014

Digitalization and Integration

Depending on the level of data integration between the physical and digital counterpart, we can have

- Digital Model

- Digital Shadow

- Digital Twin

Cyber Physical System (CPS) -- What is it?

- Marry the *virtual digital (cyber-twin)* world with the *real physical* world
- Total connectedness with intelligence
- Semantic machine-to-machine (M2M) communication
  - closed embedded systems
  - self-monitoring, self-healing, proactive communications with other machines and/or operators
- Cyber-physical production systems (CPPS)
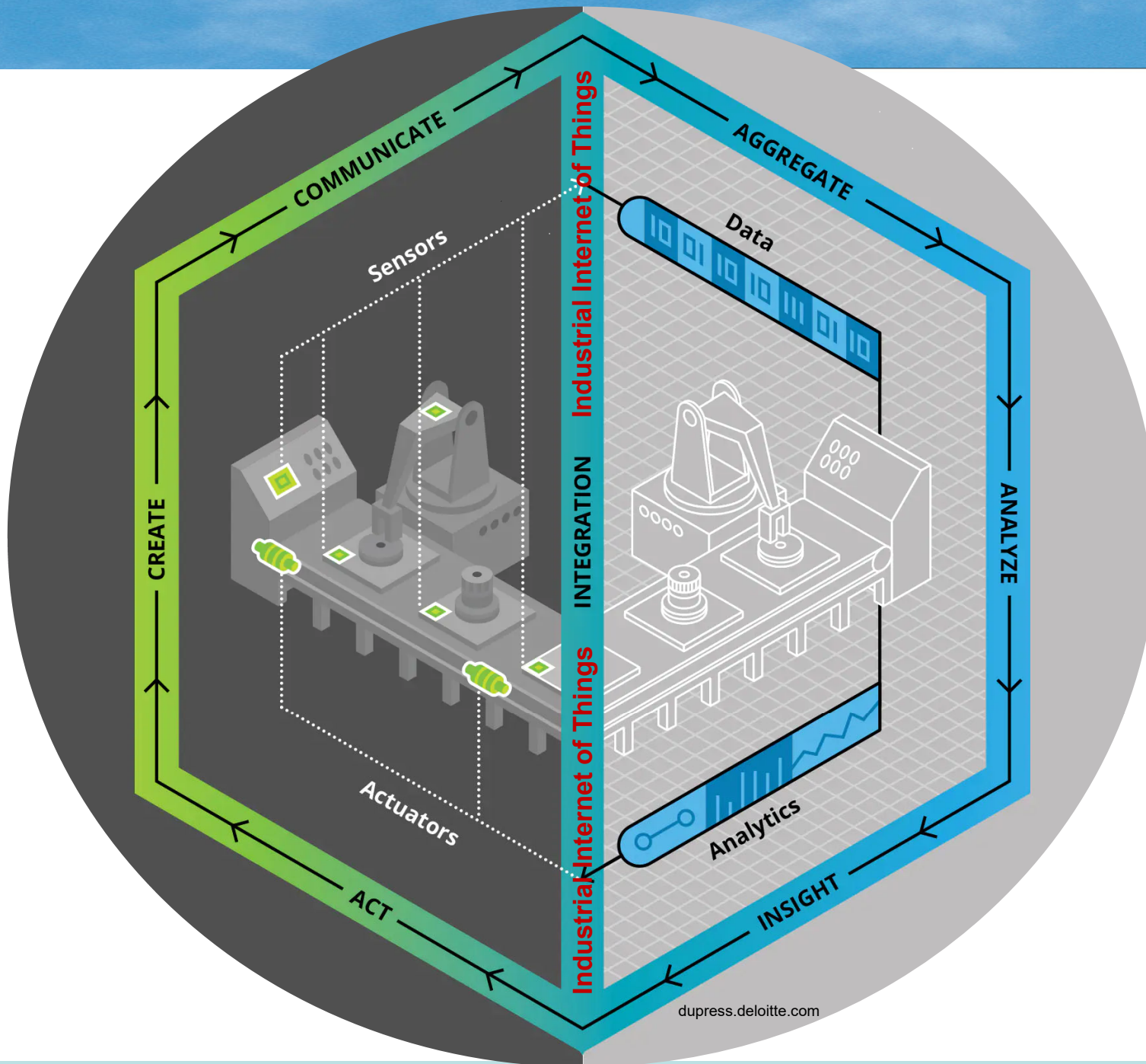
Examples …

Topics in Weeks 1-4

- Introduction to Industry 4.0 – **WHAT IS IT?**

- Industry 4.0 Technology Readiness Assessment – **WHERE AND HOW TO START?**

- Digital Manufacturing Solutions for SMEs

- Basics of Industrial Communications