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ACCELERATING DIGITAL TRANSFORMATION THROUGH OPEN INNOVATION IN INDUSTRY 4.0 ECOSYSTEMS

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The industry 4.0, Digital Transformation and their Implications

II

The Open and Collaborative Innovation Model

III

Project Experiences in Open Innovation Model

Part I

THE INDUSTRY 4.0, DIGITAL TRANSFORMATION AND THEIR IMPLICATIONS

WHAT IS INDUSTRY 4.0?

(Ovtcharova & Wicaksono 2017)

INDUSTRY 4.0 TECHNOLOGIES

Advanced and
Multimodal
Interaction

AR, VR, MR

Advanced
Robotics

3D Printing

Intelligence

Big Data
Analytics

Artificial
Intelligence

Infrastructure and
Interconnection

IoT

Linked Data

Cloud
Computing

(Wicaksono 2019)

IMPLICATIONS ON INDUSTRIES: DIGITAL TRANSFORMATION AND DATA DRIVEN SERVICE

Airplane engine +
real time monitoring,
predictive maintenance,
optimization service

Farming machines +
Farm monitoring, social media
<https://myjohndeere.deere.com>

Sport shirt +
Health monitoring, early
warning system

Physical product (local) + digital service (global)

(Wicaksono 2019)

4 PILLARS OF INDUSTRY 4.0 SOLUTION IN MANUFACTURING

4 PILLARS OF INDUSTRY 4.0 SOLUTION IN AGRICULTURE

Smart Process/ Operation

Connected farmers,
suppliers, market

Smart Product

Self informing crop

Smart Resource/ Infrastructure

Automatic watering,
smart transport,
smart warehouse

INDUSTRY 4.0 IN DIFFERENT SECTORS

Industry
4.0

IMPLICATIONS ON ENTREPRENEURSHIP

Part II

THE OPEN INNOVATION MODEL

THE TRIPLE HELIX INNOVATION MODEL

Model 1

Model 2

Model 3

TYPICAL INNOVATION FUNNEL (CLOSED)

OPEN INNOVATION MODEL

(Tidd & Bessant, 2009)

TRIPLE HELIX IMPLEMENTATION IN GERMANY

2: OPEN RESEARCH AND INNOVATION PROJECTS

Research projects subsidized by government/public,
implemented by industry and university/research organizations

Project Examples

4: COLLABORATIVE INNOVATION LABS: ACCELERATING INDUSTRY 4.0 ECOSYSTEMS

- Small and Medium Enterprises
- University Research
- Research Outside University
- Large Companies

Testbeds

Source: Plattform Industrie 4.0

TRIPLE HELIX MODEL AND SUSTAINABILITY

(based on Carayannis et al 2012)

Part III

PROJECT EXPERIENCES IN OPEN INNOVATION MODEL

ecobalance

PREDICTIVE POWER PEAK LOAD AVOIDANCE IN PRODUCTION PLANNING

- **IoT and cloud** architecture, Raspberry Pi to collect sensor data
- Statistical analysis and **machine learning** approach to identify **energy profile of each industrial machine** and process
- **Forecasting of end-to-end costs and power consumption of customized product**
- **Hyper heuristics optimization** model for production planning and control with power peak avoidance, having lowest costs, and on-time lead time
- Applied in a metal processing SME

INTEGRATED SMART ENERGY SYSTEMS USING KNOWLEDGE GRAPH AND MACHINE LEARNING

- **District model** of smart energy system integrating local renewable energy source
- **Linked-data/ knowledge graph** to integrate heterogeneous datasources (open data, metering data, simulation data) on semantic level
- **Machine learning** to forecast power generation and building specific power consumption
- **Energy simulation** to estimate energy and heating demand
- **Hyper heuristic optimization** for optimal renewable energy infrastructure planning

- Changing the power demand side (manufacturing) to meet the availability of green energy through dynamic price and demand-response programs
- **Machine learning** for forecasting of power consumption and generation
- **Semantic middleware** based on knowledge graph as the „shared meaning“ for system **interoperability** and realtime communication between heterogenous systems
- **Dynamic price estimation**
- **3D simulation** for **manufacturing planning** and **renewable energy integration**

Image: CleanTechnica

CONCLUSIONS

- Smart PPR and data driven business are pillars in industry 4.0 ecosystem
- Triple helix model 3 is required to accelerate innovation
- Open innovation instead of closed innovation
- No interdisciplinary, no innovation
- Sustainability is both impulse and constraint of innovation

**THANK YOU FOR
YOUR ATTENTION.**

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