THE ROLES OF DATA MANAGEMENT AND ANALYTICS IN INDUSTRY 4.0 ECOSYSTEMS

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Part I
ABOUT US

ABOUT JACOBS UNIVERSITY

<https://www.jacobs-university.de/campustour/>

- International, interdisciplinary, and research-innovation oriented university
- 1500 students from 120 countries
- 251 professors, lecturers, and researchers

Part II

INDUSTRY 4.0 TECHNOLOGIES, ECOSYSTEMS, AND BUSINESS 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 and
Machine Learning

Reasoning and
Searching

Infrastructure and
Interconnection

IoT

Blockchain

Cloud
Computing

(Wicaksono 2018)

WHAT IS ARTIFICIAL INTELLIGENCE?

The sub-field of computer science / informatics that discusses mechanisms that can mimic intelligent human behavior.

(Wicaksono 2020)

THE PILLARS OF INDUSTRY 4.0 ECOSYSTEM SOLUTION

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 BUSINESS MODEL: 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

Product - Service Business Model: Physical product (local) + digital service (global)

Part III

DATA MANAGEMENT AND ANALYTICS IN INDUSTRY 4.0

DATA MANAGEMENT THROUGH LINKED DATA

Source: PoolParty Semantic Suite

LINKED DATA APPROACH: THE INSPIRATION

Semantic Data Linking: Knowledge Graph

Heterogenous Data Sources: Interoperability Problem

<http://semarangkota.go.id/>

<https://www.undip.ac.id/>

https://en.wikipedia.org/wiki/Association_of_the_Universities_of_Asia_and_the_Pacific

SIMPLIFIED EXAMPLE IN AGRICULTURE 4.0 ECOSYSTEM

Linked data changes data integration paradigm from data exchange to data linking

WHAT IS DATA ANALYTICS?

DATA ANALYTICS IN AGRICULTURE 4.0

■ What?

- Prediction and simulation which crops and where to plant and how much fertilizer is needed (**Product**)
- Predictive supplier selection (**Process**)
- Machine health monitoring/diagnostics and *predictive* maintenance (**Resource**)

■ Which data?

- Machine activities and probes in the soil
- Weather data
- Financial data
- Supplier data

■ How?

- Sensors on machines
- Data analytics platform, e.g. SAP's HANA
- Interaction portal, eg. <https://myjohndeere.deere.com/>

Source: Oklahoma Farm Report

■ Challenges

- Who owns the data?
- Data privacy
- Reduce employment opportunities

Part IV

PROJECT EXAMPLES

THE PROJECT 1: SMART CITY

Cambridge, UK

Seville, Spain

Lizzanello, Italy

DAREED PLATFORM

A platform for main actors of energy management in cities and communities

Citizen

Policy maker

Energy provider
and related industry

Platform = Data sharing + Integrated GUI and Single Sign-on + continuous/integrated process + individualized applications

Information

Simulation

Implementation

District Monitoring

Trending

Computational Tool

Awareness tool

RES Introduction
Simulation

Energy Tarif Simulator

Best Practice Tool
(BPT)

Energy Performance
Tool (EPT)

Marketplace

Active Demand
Management

DAREED ARCHITECTURE

Application layer

REST

Integration layer
(linked data/ DAREED knowledge graph)

Routing/ locator

Microservice layer

Data source layer

Sensor data,
energy
consumption

CAD
energyPlus

Statistical/
open data

Geodata

Renewable energy
data

SCREEN SHOTS OF THE APPLICATIONS

PROJECT 2: USING LINKED DATA FOR PATIENT CENTRIC HEALTHCARE

PROJECT 3: ECOBALANCE AND DELFINE

Development of a knowledge-based dynamic demand response system and machine control systems to achieve balanced load distribution and reduction of energy load peaks.

THE DELFINE ARCHITECTURE

Research

Industry

StromDAO

PROJECT 4: HELENA

Holistic assessment and guideline framework
for data-driven integrated smart energy
system

Part V

IMPLICATIONS FOR INDONESIA

WHAT SHOULD BE IMPLEMENTED IN INDONESIA?

1. Wider impacts especially for people living in villages
2. Optimizing the value and efficiency of key natural resources of Indonesia.
3. Focusing on *human skill*, not *human strength*
4. Optimizing the roles of all societal elements through ecosystems (villagers + start-ups+ SME+ government + researchers/academia).
5. Bringing Indonesia to be *leader*, not *follower*.

Empower people from rural areas

Agriculture 4.0

Aquaculture 4.0

Mining 4.0

Energy 4.0

Healthcare 4.0

(Wicaksono 2019)

TAKEAWAYS

- An industry 4.0 ecosystem consists of four pillars: **Smart PPR and data-driven service**, the implementation sectors may vary
- Industry 4.0 **enables global access to a local product** through data-driven services
- Data management (**linked data**) and **data analytics** play central roles in industry 4.0 since data is the enabler of the ecosystem
- Shift of data integration paradigm from data exchange to data linking through knowledge graph
- The focus of industry 4.0 should **optimize the value and efficiency of human and key natural resources** not just technological values and financial profits => empowering all people, especially from rural area

**THANK YOU FOR
YOUR ATTENTION.**

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