Technology and Innovation for the Future of Production

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Seoul Initiative on the 4th Industrial Revolution "Innovative Partnership for Inclusive Prosperity"

ASEM-EMM (Asia-Europe, Economic Minister's Meeting) Sept 21-22, 2017 Seoul Korea

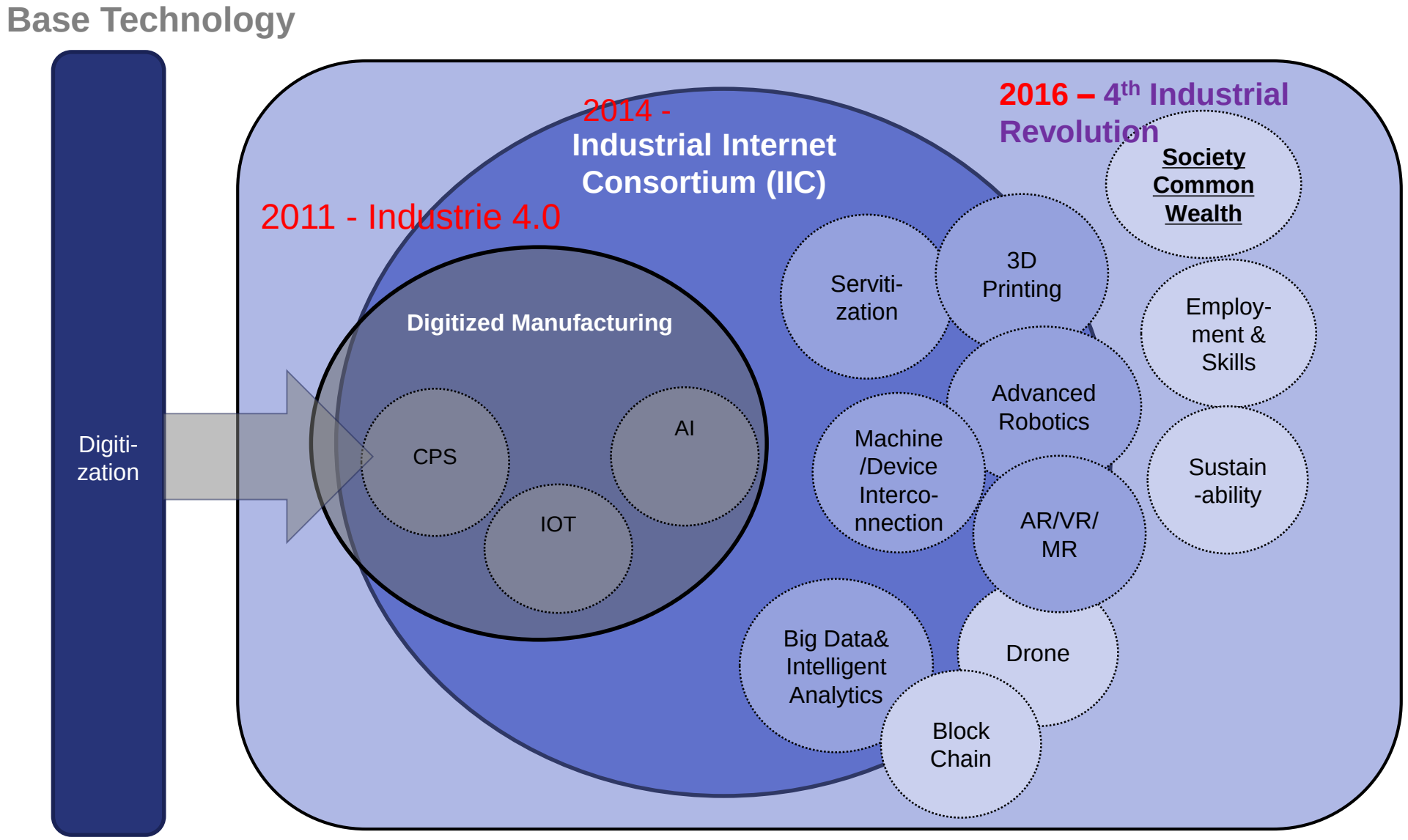
COMMON PRINCIPLES

- Sustainable growth through inclusiveness
- *Diffusion of creativity and innovation*
- Collaboration based on openness
- Fairness and transparency in competition

POLICY RESPONSES

- Cooperation for an innovation-friendly regulatory framework
- *Fostering favorable conditions for digital transformation*
- *Capacity building for MSMEs*
- *Facilitating R&D collaboration*
- Improving human capital and workplaces

Historical View on the 4th Industrial Revolution

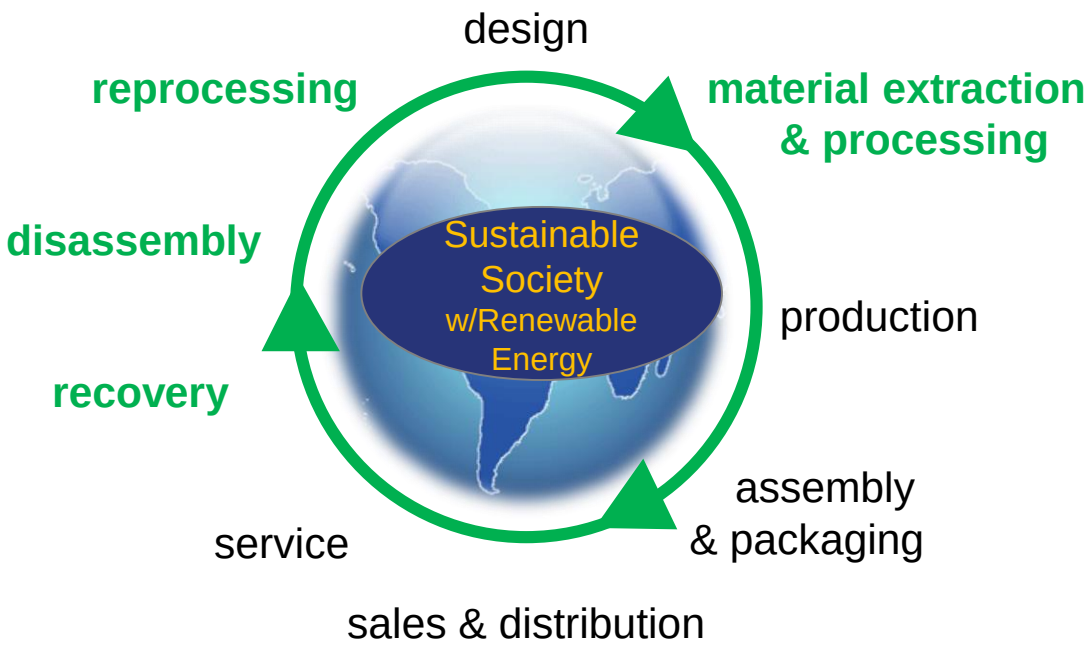


Transformation by Utilizing the 4th IR

Should focus on Technology & Innovation in the future!

Hardware-centric Development

Resources are limited



+

Software-centric Development

Creativity is unlimited

Man-oriented	➡	Man + IOT
Local, Sequential	➡	Global, Simultaneous
Physical space	➡	Physical + Virtual space
Technologies	➡	Convergence

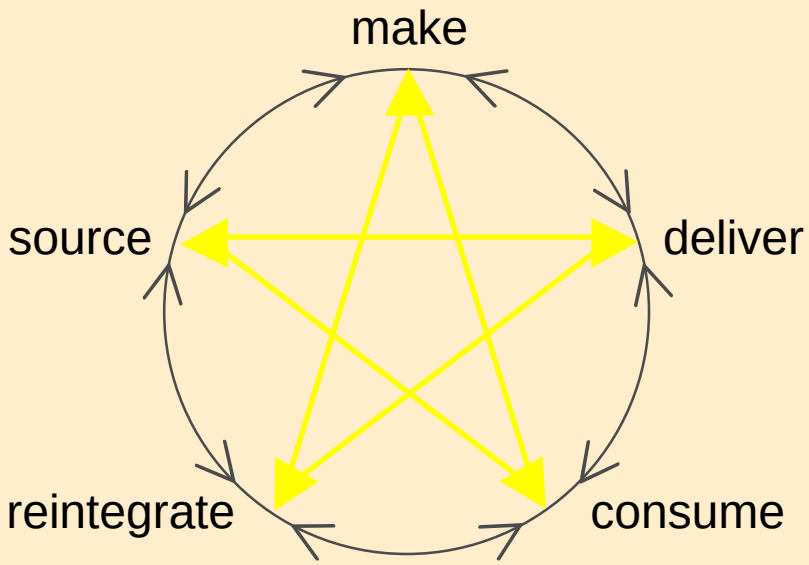
Transformation – Value Chain Smartization

Fully Integrated Production System

Current Production System

source → make → deliver → consume → reintegrate

Transformation

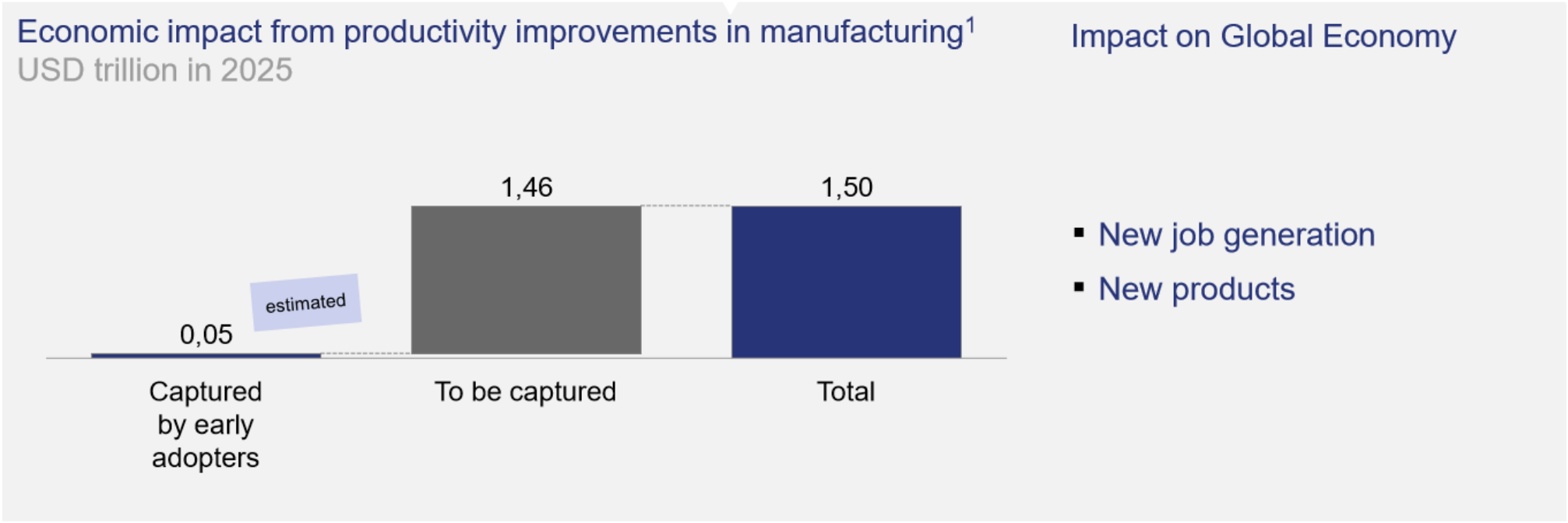


- Process Innovation
- Product Innovation

&

- Business Model Innovation

Economic Impact from Productivity Improvement could reach **$1.5 Trillion USD ($1.2- 3.7T) but only captured $0.05T so far**

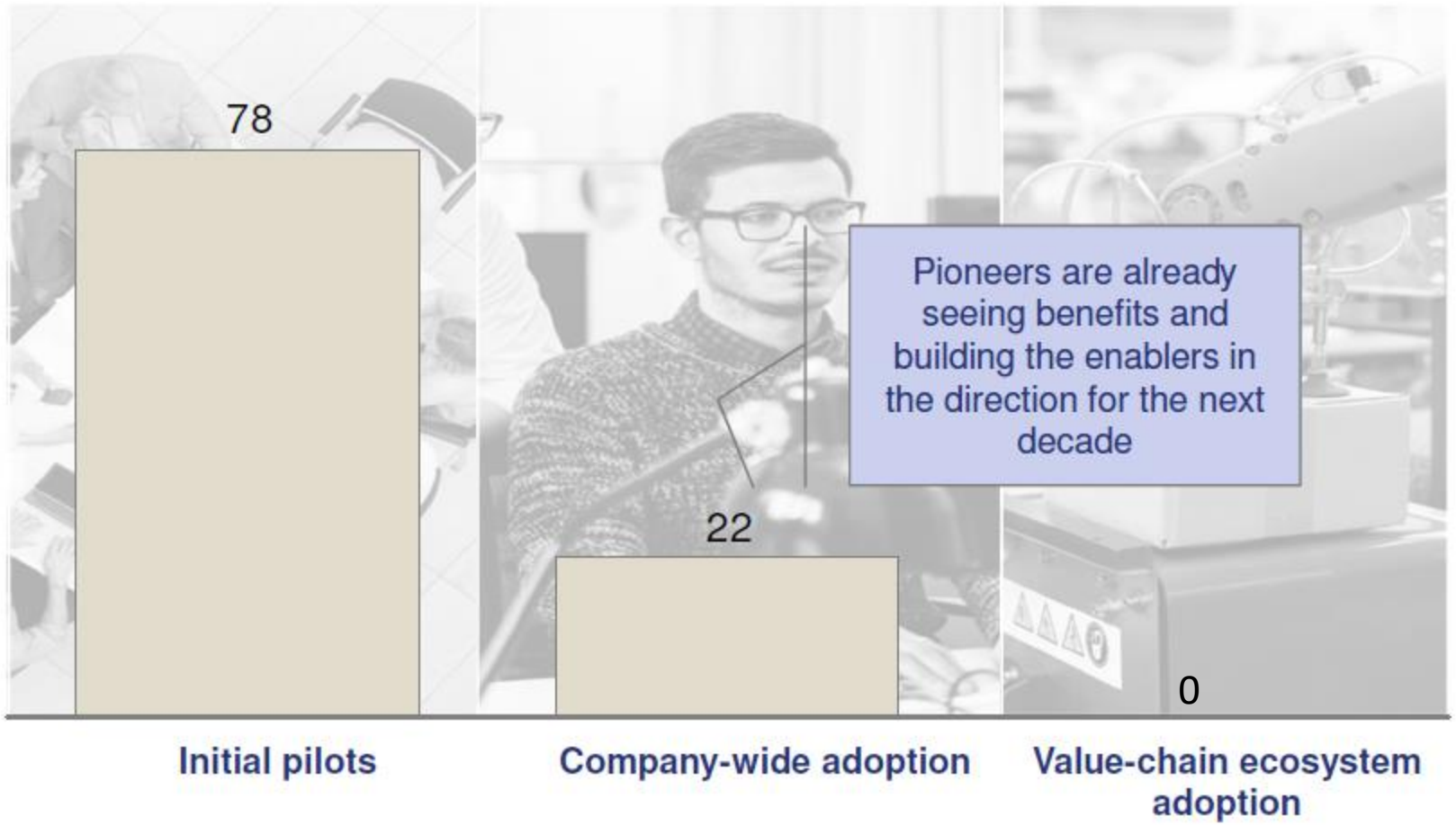


1 From McKinsey Global Institute, based on estimated 3-9% gross productivity increase per annum

Source: McKinsey Global Institue

Majority of companies (78%) are in “initial pilots” phase while pioneering companies are building a competitive edge

Percent of companies in the different stages of 4IR technology adoption in production



Key insights

- The lessons learnt from the 22% of pioneering companies **offer an opportunity for cross-industry dissemination and replicability**
- There is **no evidence of any experience of a completed transformation beyond company level**

Source: McKinsey’s Digital Manufacturing Global Expert Survey 2017

Adoption of technology at scale is still low as companies are facing different challenges in their journey; both at company-level and macro-economic

WORLD ECONOMIC FORUM

Company-level challenges

Macro-economic challenges

Top 5 challenges in the early adoption phase

- **Lack of courage** to push through radical transformation
- Lack of a clear **business case** that justifies **investments** in underlying IT architecture
- **Difficulty to coordinate** actions across different organizational units
- Concerns about **cybersecurity** when working with third-party providers
- Lack of necessary **talent,** e.g., data scientists

Additional challenges for scalability

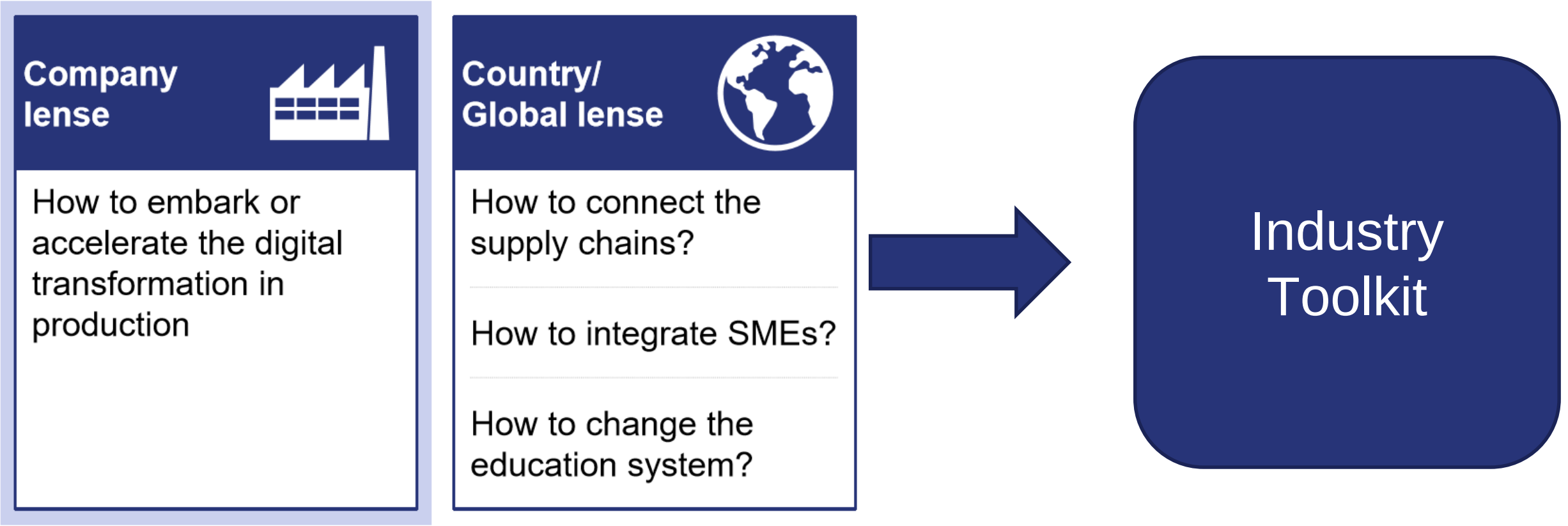
- **Difficulties at integrating data** from disparate sources
- **Uncertainty about in- vs. outsourcing** and lack of knowledge about **providers**
- Concerns about **data ownership** when working with third-party providers

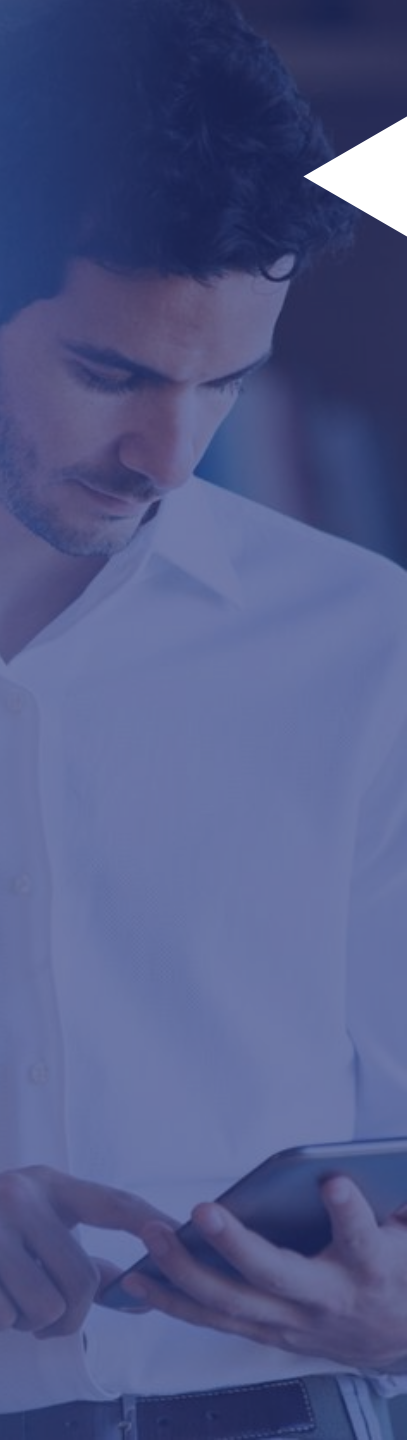
Challenges need to be overcome - "Wait and see" is no longer an option

SOURCE: McKinsey Industry 4.0 Global Expert Survey results, validated by interviews with constituents and tech pioneers

How to overcome these challenges?

To achieve new technology adoption at scale, actions are required at a company–level and at a country & global level.





An Industry Toolkit is being created to support companies in their digital transformation of production journey

Contents of the Industry toolkit

Industry toolkit

Digital transformation framework

A practical approach to digital transformation based on lessons learned and best practices

Use-case library

A live repository of use-cases, organized by value driver and industry, to demonstrate real examples of solutions

The digital transformation framework comprises of three key phases and the essential activities under them

0 *Value creating Proof of Concept*

- **Run low scale pilots on a particular business problem** - aimed to demonstrate value from digital technologies and build momentum
- **Train C-suite executives, decision makers and employees in digital production**

1 Strategy

1A Align business strategy to value drivers
- Define business drivers to embark on the digital transformation journey
- Identify the areas where technology will unlock significant value
- Set business objectives to the organization

1B Prioritize use-cases to be piloted based on its business case
- Understand the current level of technological maturity
- Choose the right technological partner to build the data platform
- Identify and select disruptive and incremental use-cases
- Build the business case

1C Develop the 2-3 year roadmap
- Create a framework to track impact and assess the scalability from pilots

2 Innovation

2A Launch test and learn pilot phase
- Re-engineer process to move from use-case adaptation to radical digital innovation

2B Reinforce the technological backbone
- Consolidate the data analytics platform
- Build a solid ecosystem of technological partners

2C Focus on capability building to establish an innovation-driven organization
- Acquire the new skills required
- Upskill the current organization

3 Scale up

3A Deploy the full roadmap to scale use-cases and embed into day-to-day production system
- Strength change management to overcome internal cross-functional barriers

3B Promote additional use-cases across the value chain

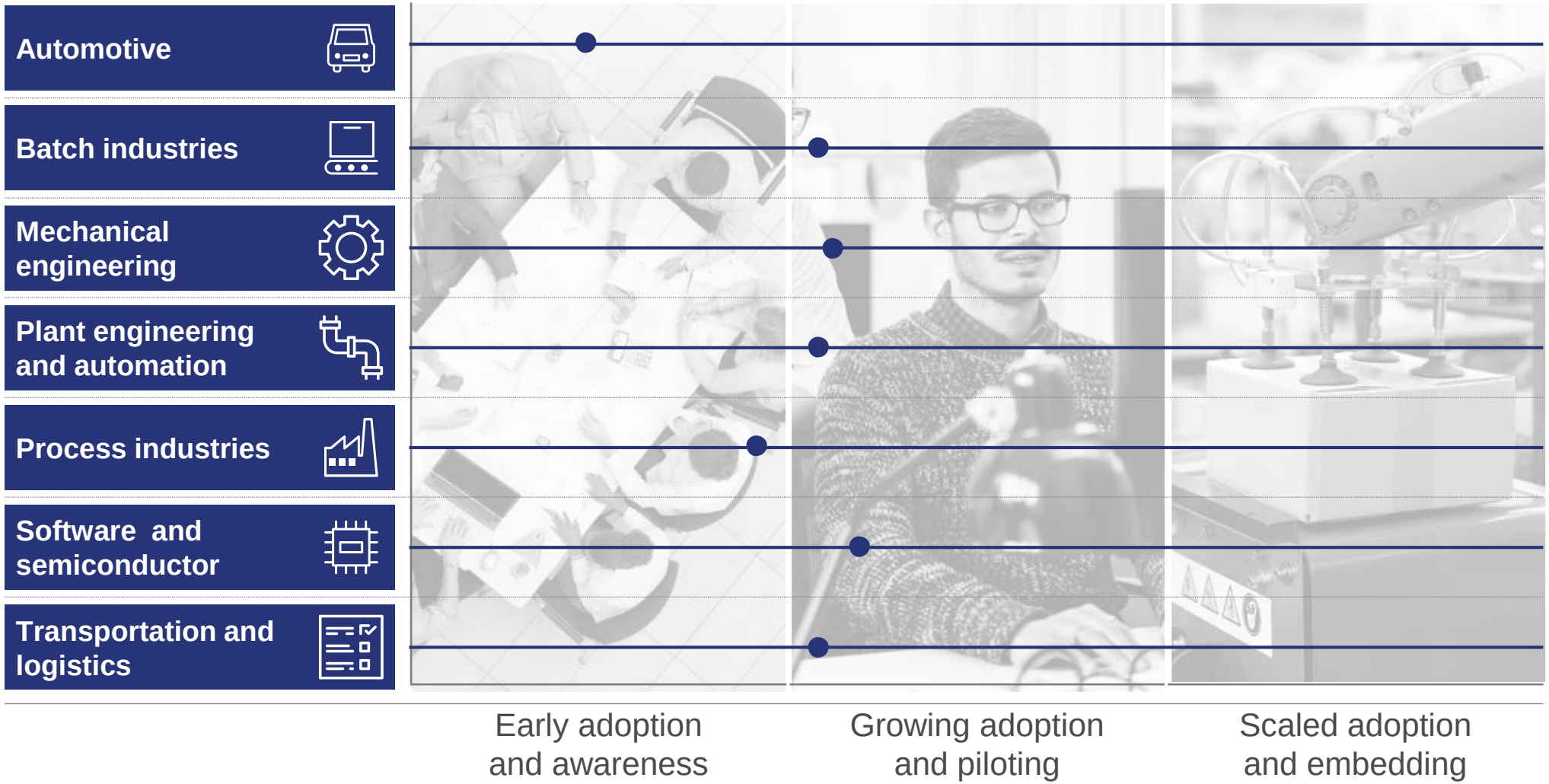
Each of these activities is being detailed – defining the key recommendations and industry-specifics based on the lessons learned

SOURCE: McKinsey

At an industry level, adoption is growing in most industries yet none has reached a significant scale in adoption

Average portion of industry-respondents on core industry 4.0 technology adoption

MNCS RESULTS ONLY



Key insights

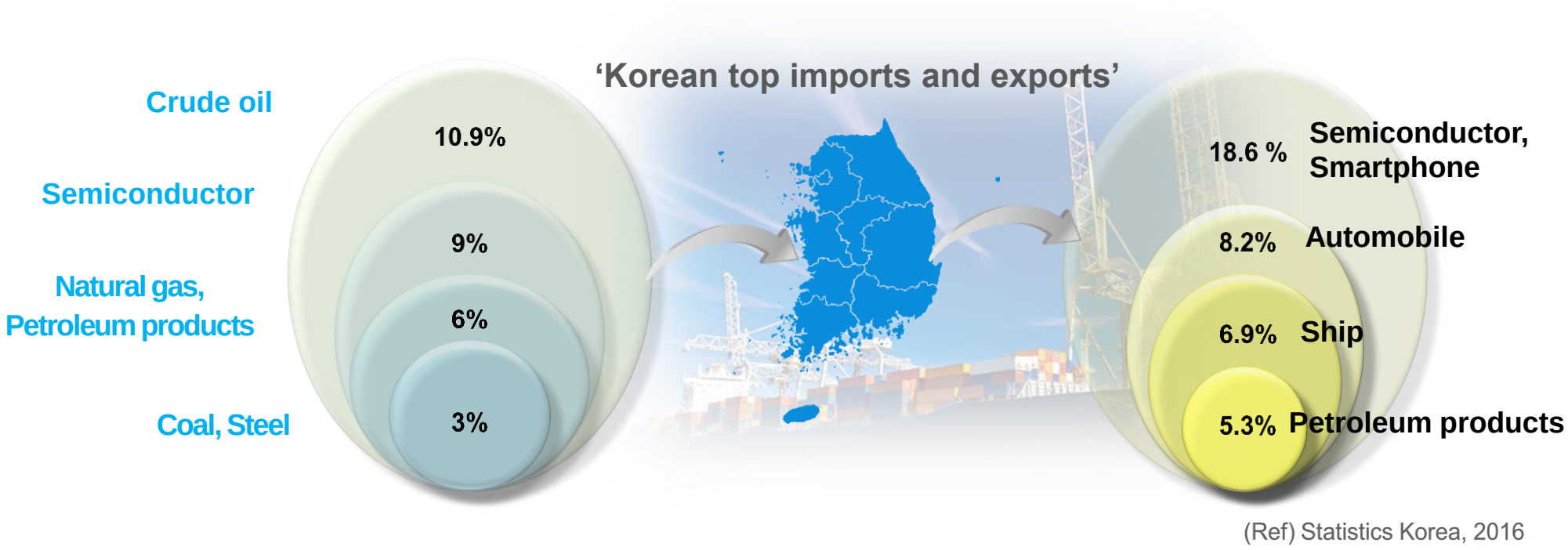
- Most industries have overcome the awareness/early adoption phase and are piloting the use-cases at relative scale
- Few players have successfully scaled use-cases across their production system

SOURCE: McKinsey's Digital Manufacturing Global Expert Survey 2017

Manufacturing Industry in Korea

Korean manufacturing industry's Business Model :

Import Raw Material → Export Product



(Ref) Statistics Korea, 2016

Industrialization based on Export-led, Value Creation/add Model

Korea's 4th IR Initiatives - Industry

대한민국정부
The Government of the Republic of Korea

01 Intelligent Innovation — Convergence of Intelligent Technology

Digital Innovation of Manufacturing Industry

Smart Factory
Advanced Industry Robot
Manufacturing Service Platform

↓

Accelerate Leapfrogging of Manufacturing by utilizing the 4th IR

Smart Mobility

Autonomous Vehicle
Next generation Drone
Smart Ship

↓

Traffic, Driving Safety

Smart Energy

Intelligent Power Grid using AI
Small & Distributed Renewable Energy

↓

New Business Model for Smart Energy

Use-Case in Korea

POSCO Smart Factory

Rank	Company	Mil. Tonnes
1	Arcelor Mittal	95.5
2	China Baowu	63.8
3	HBIS	46.2
4	NSSMC	46.2
5	**POSCO**	**41.6**
6	Shagang	33.3
7	Ansteel	33.2
8	JFE Steel	30.3
9	Shougang	26.8
10	Tata Steel	24.5

World Steel Association

POSCO
#5 Steel Producer in the world

2016
Sales: $45.4 Billion USD
Operating Profit: $2.43 billion

POSCO's Smart Factory

Creating new values by combining 'Domain Expertise' with 'ICT Knowledge'

" Value "

- Competitiveness
- New Business

[Smart Technology]

Connected	Data-driven	Intelligent
Data collection from field using IoT tech.	Analysis & Prediction based on Big Data	Control & Optimization all processes using AI

POSCO's Smart Factory:

- Sense smart : IoT
- Analyze smart : Big Data
- Control smart : AI

Zero-Error Operation	Predictive Quality Control	AI Driven Optimization	Real-Time Safety

PosFrame (POSCO Smart Factory Platform)

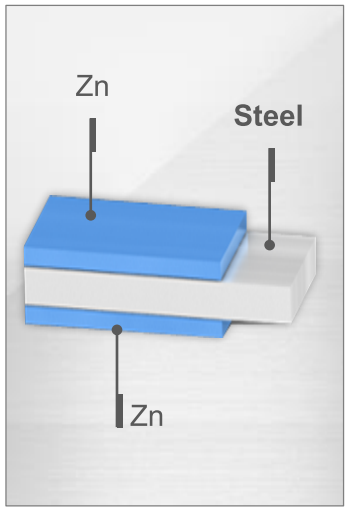
IoT	Big Data	AI

USE-CASE : Coating weight control in CGL

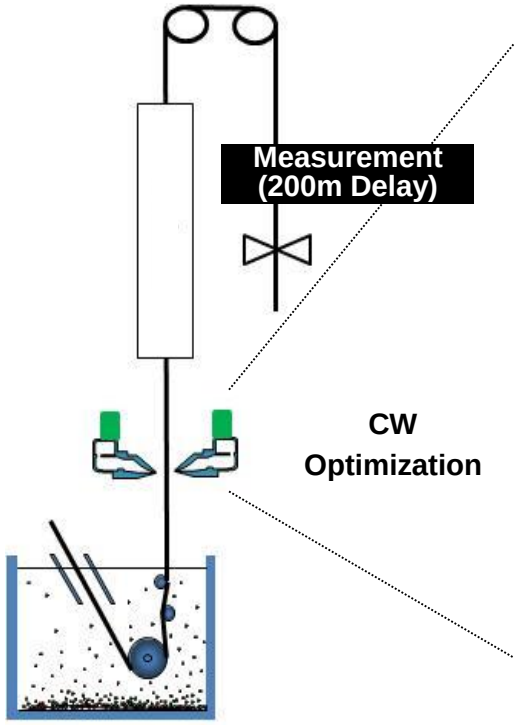
Problem : Large coating deviation with various operating conditions

➔ Non-uniform coating weight (CW)

Coating Weight Control Based on AI in CGL (Continuous Galvanizing Line)



Zn-coated steel



Input

- Width
- Speed
- Air Knife Gap
- A/K Pressure
- ….

Clustering

Data Stream Clustering, AI

Optimization

Air Knife Gap, Pressure

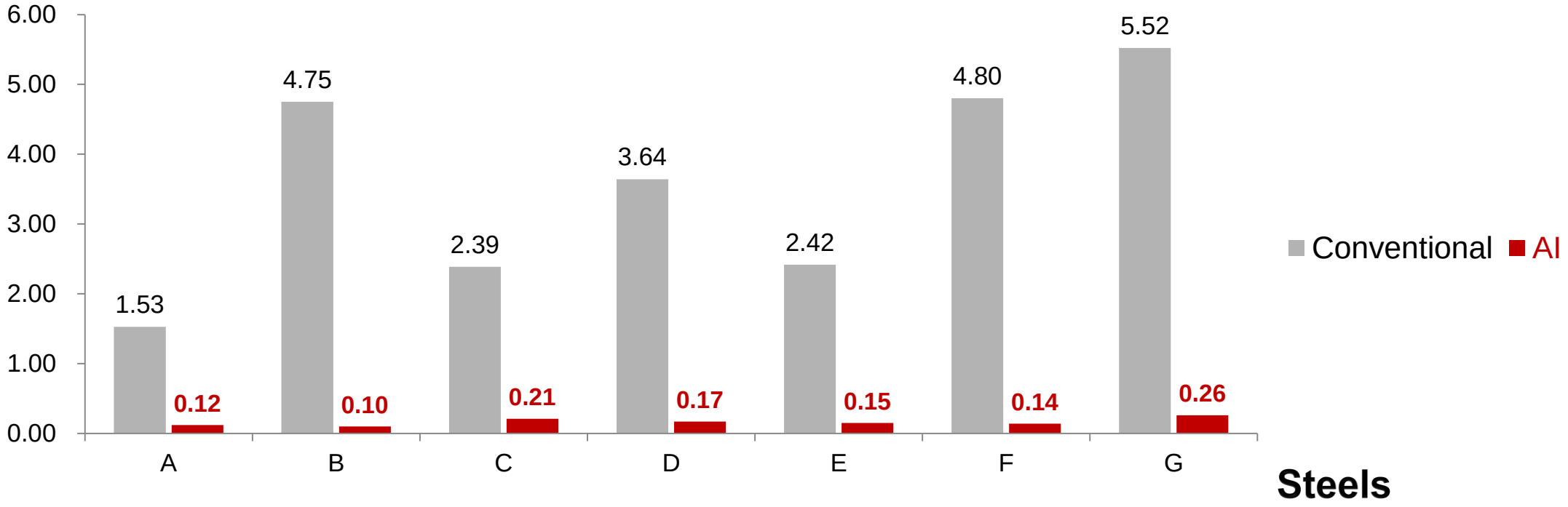
Self-Learning

Recurrent Neural Network

Intelligent Innovation : Coating weight control in CGL

Results Performance of coating control is improved
84% → **99% (AI)**

Profit return : USD 5 million/year (estimated)



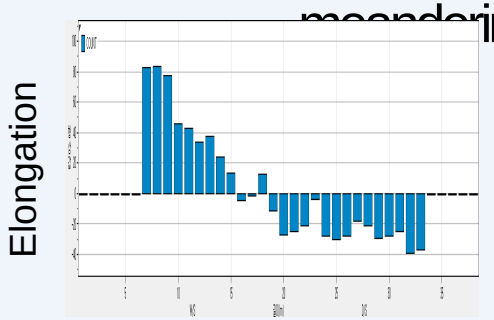
[Coating Weight Deviation]

Automatic rolling concept based on AI for ZRM

Recognition

Inputs Data : shape, rolling speed,

rolling force, tension, meandering, etc.



Inputs
(42)

Decision

Automatic operation

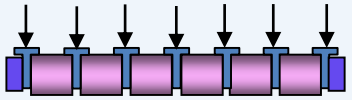
AI model (RNN)

Outputs
(10)

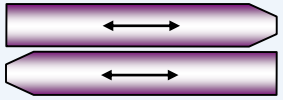
Action

Actuators

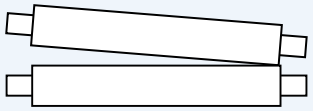
Crown rolls



Shift rolls



Leveling



※ RNN : Recurrent Neural Network

POSCO's Smart Factory - Cases

Optimized model of purchasing plans for each coal brand

- Low-cost purchase plan that meets the 43 constraints of quality, brand, shipping conditions, and etc.

Enhanced formula for designing heavy plate length

- Improved design error rate and quality by optimizing the crop length margin based on operating performance

Energy optimization and informatization

- Save energy, integrated production management system using smart instrument

Worker's status detection and alarm

- Utilization of wearable device (Ex. safety helmet, smart band, etc.)

ZRM* operation automation

- Automatic control by learning operator's operation pattern through deep learning

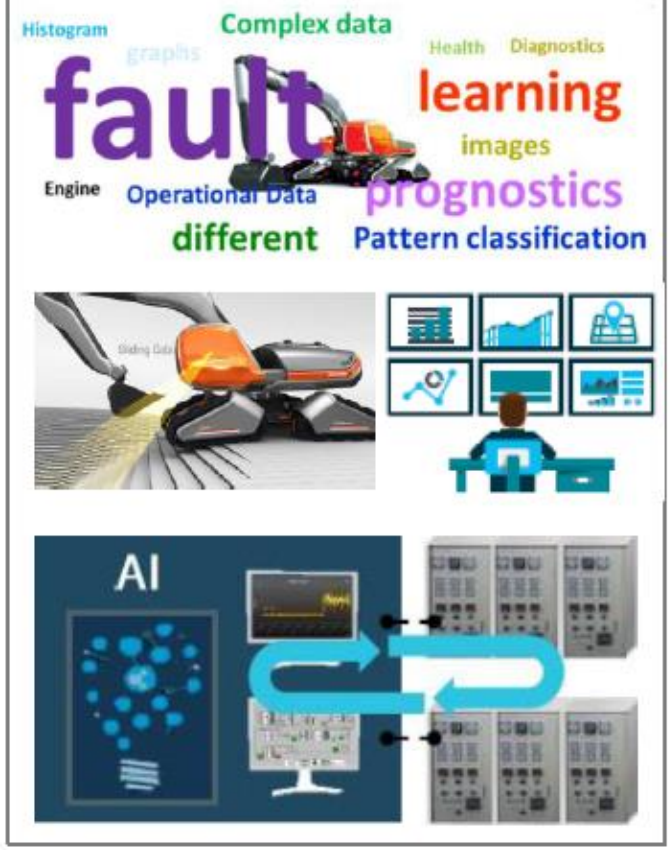
* ZRM : Sendzimir Rolling Mill

Use-Case in Korea

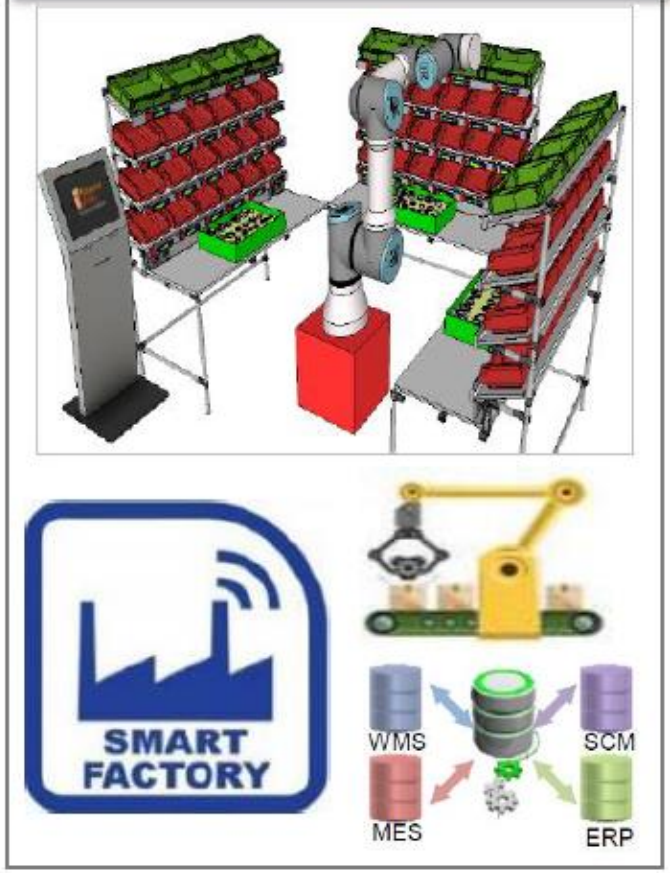
Doosan Industry 4.0 Summary

Doosan Industry4.0 Progress Direction

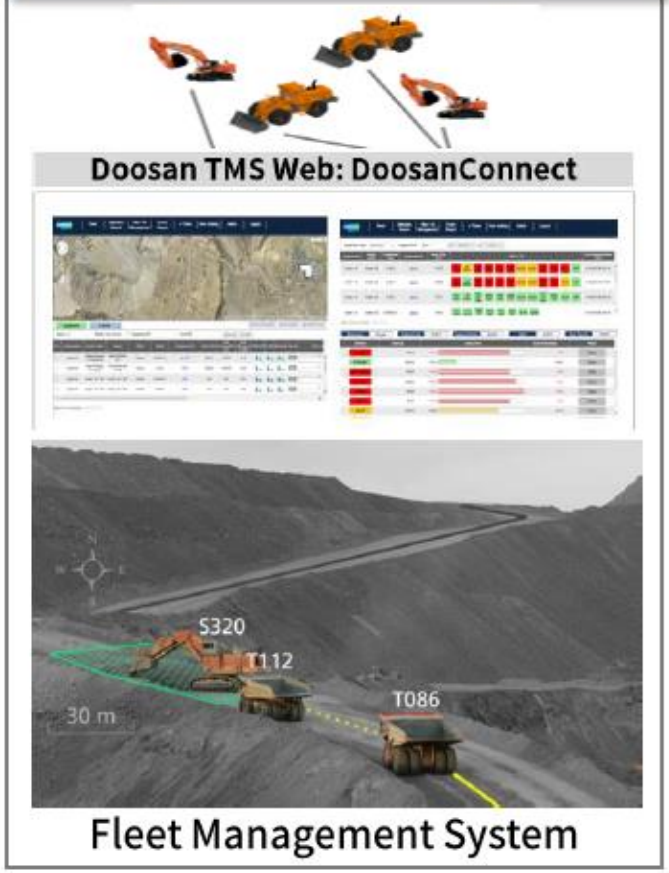
Product Performance Thru. Value-add



Operation Efficiency



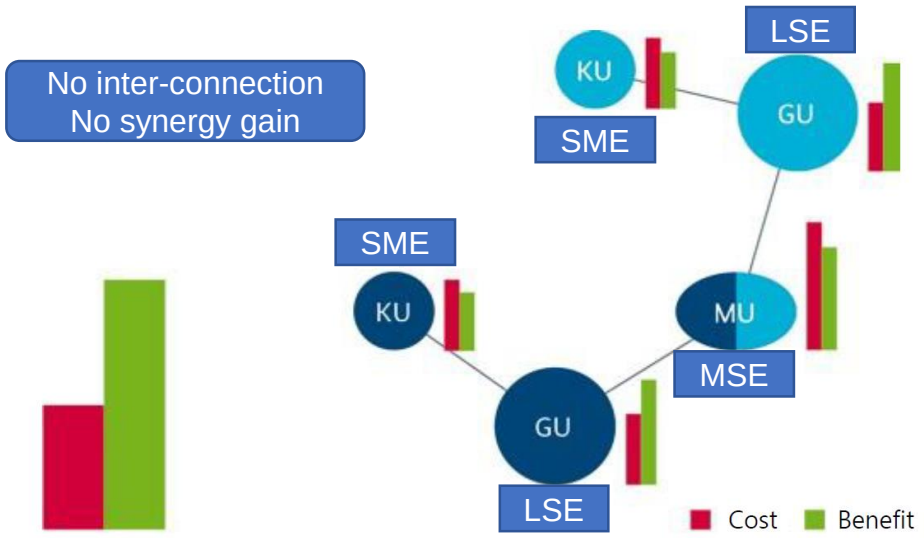
New Business (New Service)



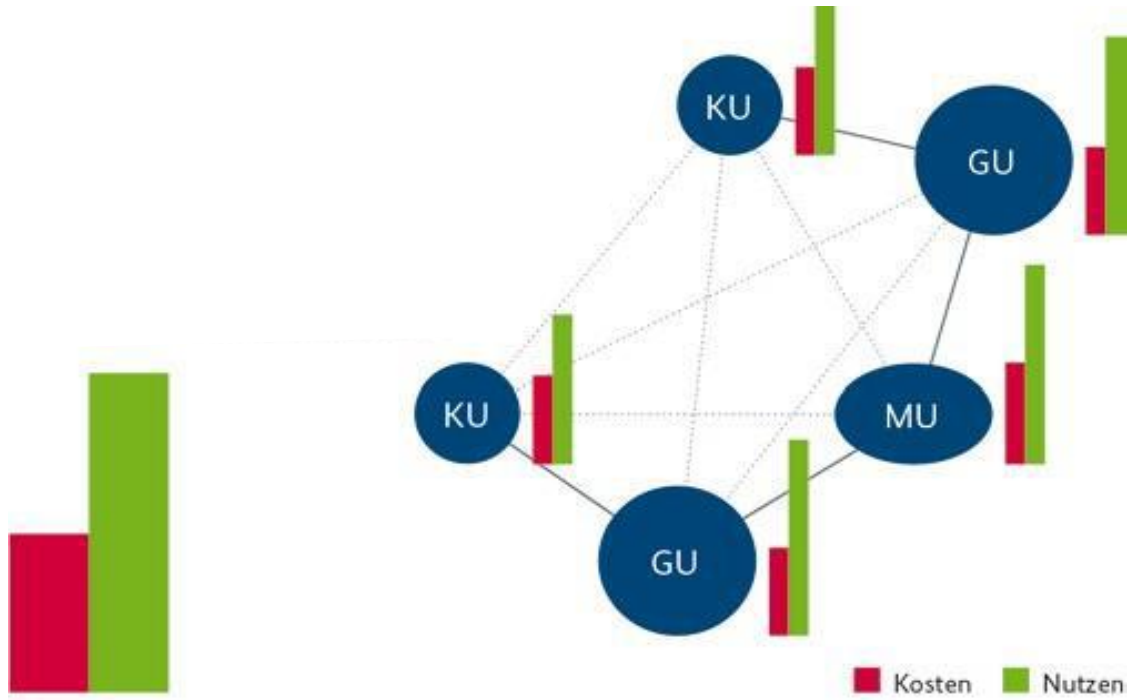
Discussion Point:

While some LSEs demonstrated the benefit of T&I, it is still in the early cycle and not fully integrated with their suppliers.

Where do we go from here?
– Harmonize LSEs and SMEs by utilizing the 4th IR

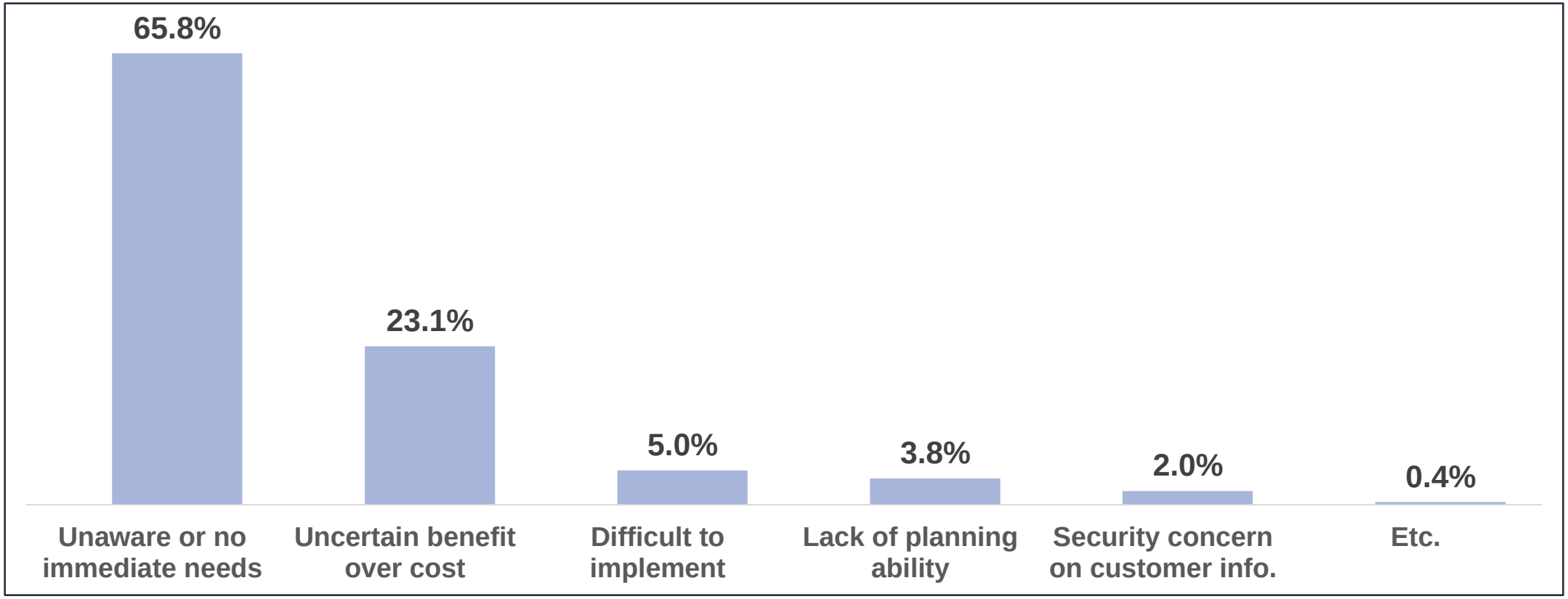


Source : iit 2015



Quelle : iit 2015

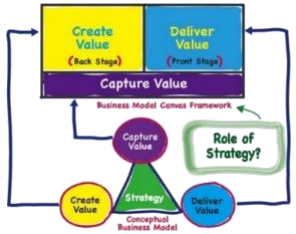
SMEs Reluctant to Adopt New Technologies Transforming Production (South Korea)



Source: KOSBI (2016)

UNIST developed SMEs' Manufacturing Innovation Program

▣ 5 Phase Approach for SME Development

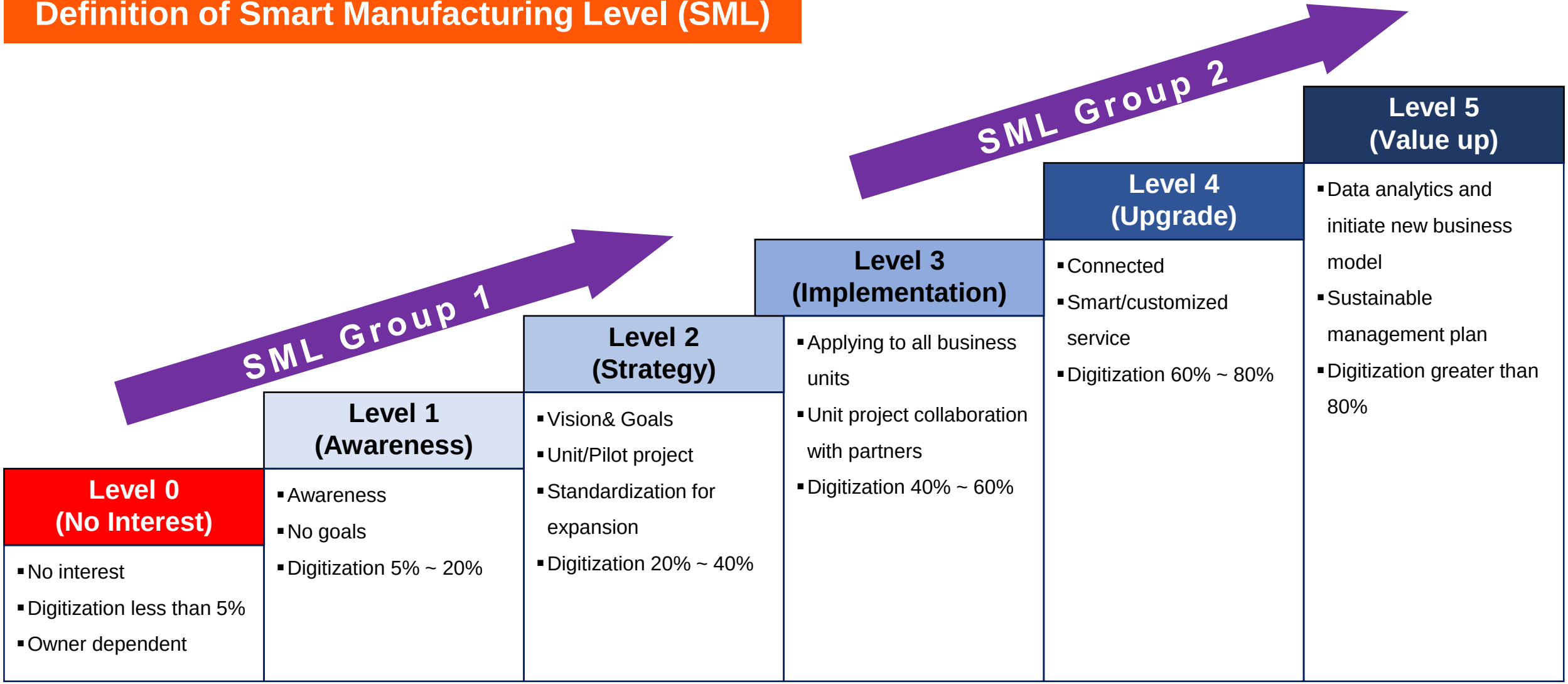
Diagnosis & Strategy	Product Development	Process	Business Model	Globalization
				
- Understand 4IR Concepts - Diagnose & Build Strategy	- Develop Smart Products - Develop Smart Services	- Build Smart Prod. System	- Innovate Business Model	- Develop Global Eco-System - Become a Global leader
Strategy Development	**Smart Product & Service Development**	**Smart Process Development**	**Business Model Innovation**	**Globalization**

- Manufacturing Innovation with the 4IR Concepts, Training Material (O)
- SME Development Program - Phase I (O)
- Smart Manufacturing Level (SML) and Strategy Planning Module (O)

- Smart Product/Service Development Guide (~2017.12)
- Digital Business Model Guide (~2017.12)
- SME 4IR Business Strategy Guide

Diagnosis – Level Assessment

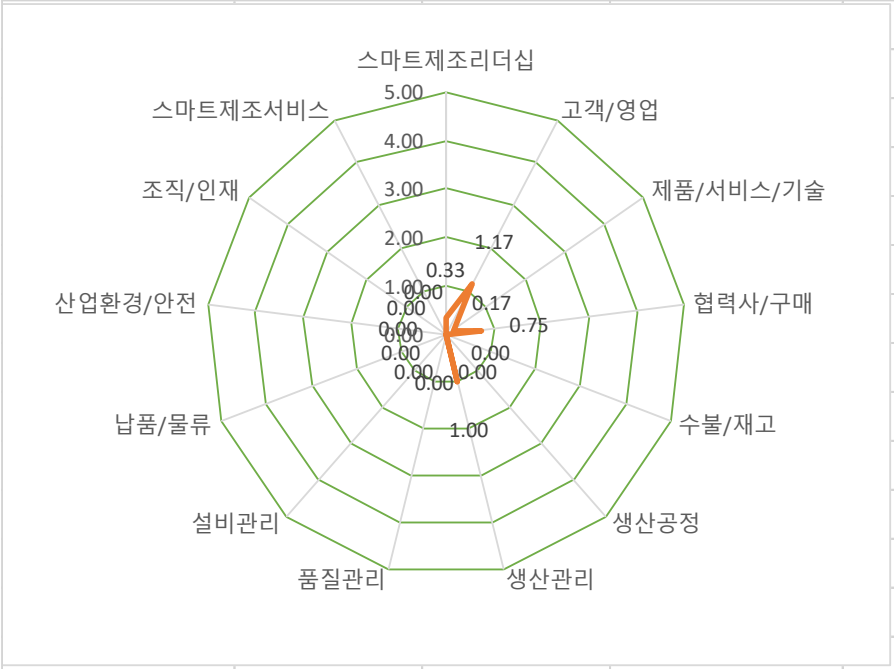
Definition of Smart Manufacturing Level (SML)

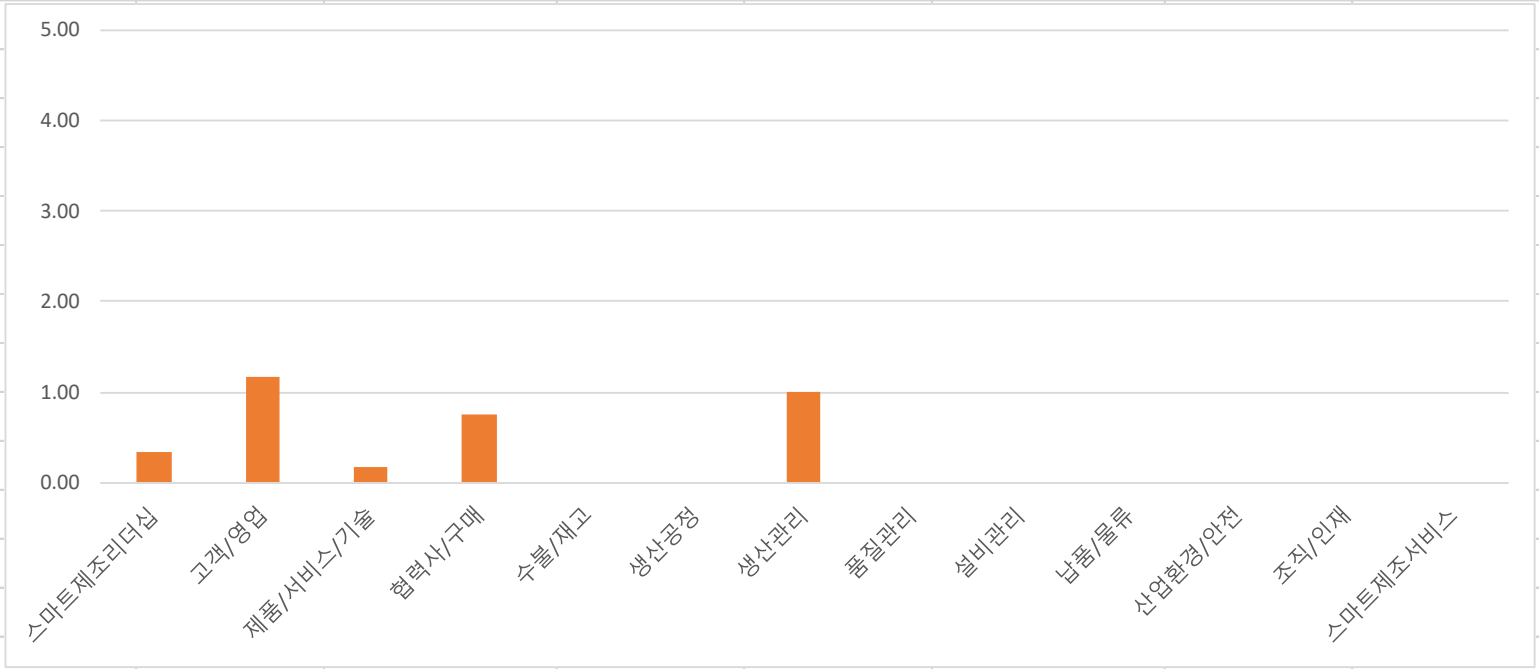


[Pilot Program] HANKUKMOLD
– A Molding Company for Auto Part

- **Annual Revenue: $50 Million**
- **Smart Manufacturing Level Results: 0.26/5 → 1.5 after 4 months of interaction**

* 업무 영역별 평가 결과 - 사무 부분





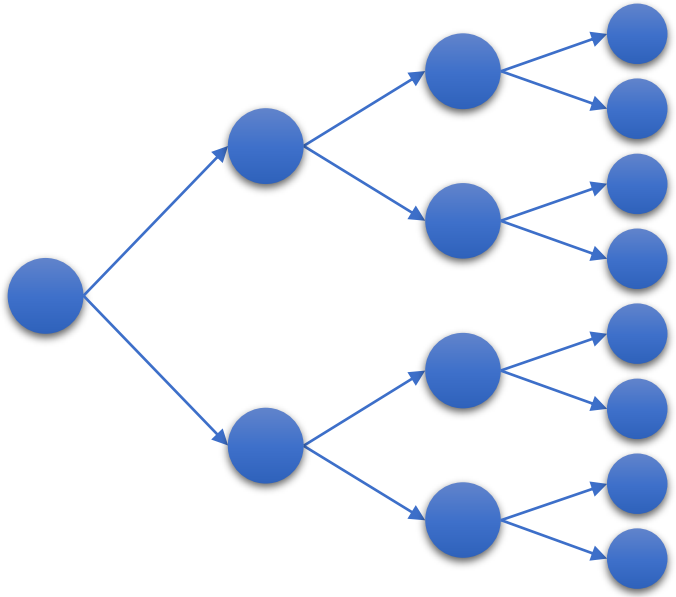
업무구분	Level	스마트제조평가	업무구분	Level	스마트제조평가	업무구분	Level	스마트제조평가	업무구분	Level	스마트제조평가
스마트제조리더십	Level 0.33	0.33	수불/재고	Level 0	0.00	설비관리	Level 0	0.00	스마트제조서비스	Level 0.00	0.00
고객/영업	Level 1.17	1.17	생산공정	Level 0	0.00	납품/물류	Level 0	0.00			
제품/서비스/기술	Level 0.17	0.17	생산관리	Level 1.00	1.00	산업환경/안전	Level 0	0.00			
협력사/구매	Level 0.75	0.75	품질관리	Level 0	0.00	조직/인재	Level 0	0.00	평균	Level 0.26	0.26

Discussion Point:

We found that the SME Innovation Program is effective and improvement has been made, but this process is too slow to spread out.

How to Accelerate the Process?

– A buddy system is proposed to accelerate and wide-spread the process.



Concluding Remarks

- Transformation has to take place in Process, Product and Business Model Innovation
- MNCs are beginning to see benefits of Smartization

Challenges

- SMEs (excluding Start-ups) are far behind the progress
- Fair collaboration between LSE and SME is yet to happen
- How to enable SMEs to fully utilize the 4th IR

Suggestion

International Collaboration on Transforming Conventional Industrial City to a City for the Future of Production