

DENSO

Crafting the Core



EU-Way vs JP-Way Development

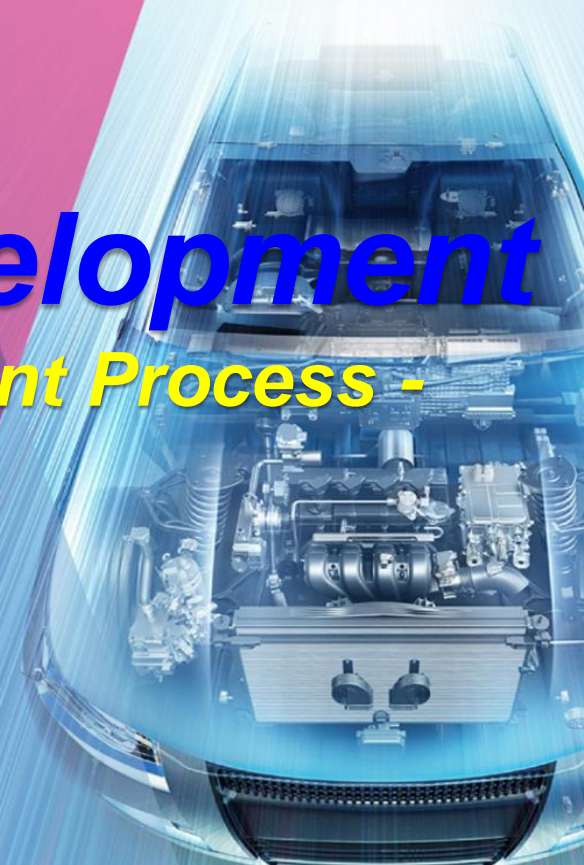
- Efficiency & Rational Development Process -

Masato(Max) Nakagawa

DENSO Corporation : Executive Fellow

HIROSHIMA University : Guest Professor

November 28th 2017





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- 1. Self-introduction**
 - 2. DENSO's Factory IoT**
 - 3. EU-Way vs JP-Way Development**



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- 1. Self-introduction**
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Self-introduction

- Born in Aichi, Japan - December 30th 1956
 - Graduated Hiroshima University in 1980
 - Entered “Nippondenso”(former DENSO) in 1980
 - Long-term experiences in overseas
 - Iowa, US : 1988-1993 Engineer
 - London, UK : 2003-2004 Chief Engineer
 - Düsseldorf, DE : 2005-2014 Engineering Head
 - Amsterdam, NL : 2014-2015 President & CEO
 - Munich, DE : 2016-2017 CTO
 - Tokyo, JP : since 2017.4 Global Affair Officer
- Guest Professor, Hiroshima University

⇒ **Established “Aachen Engineering Center”
during working with DENSO Europe**



Masato(Max) Nakagawa

**DENSO Corporation
Executive Fellow**



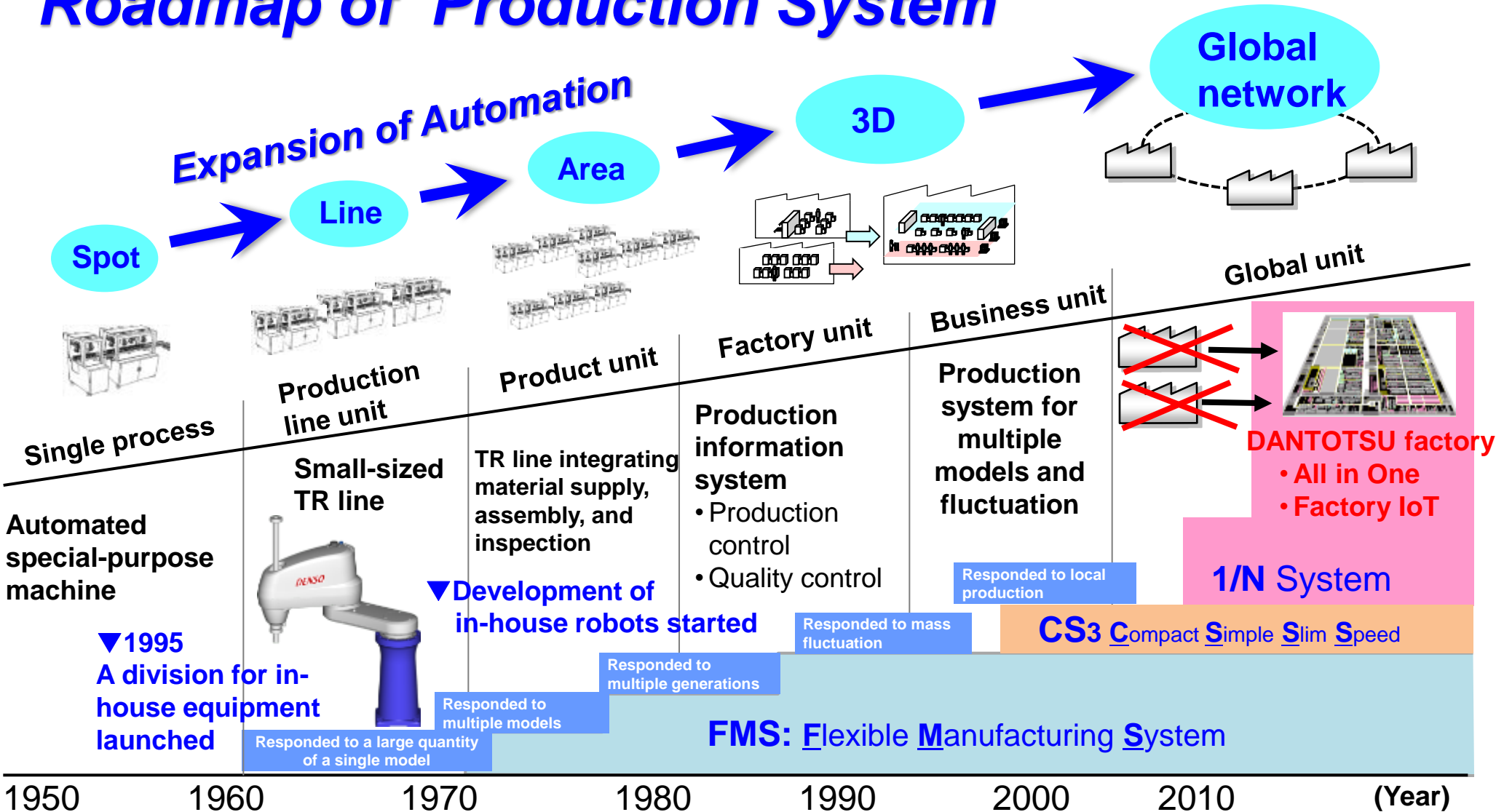
HIROSHIMA UNIVERSITY

**Guest Professor
(Technology Transfer Theory)**



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Roadmap of Production System



Striving for creating production lines that are ahead of the times

What Does “DANTOTSU” Mean?

Origin of “DANTOTSU” ⇒

DANZEN

+

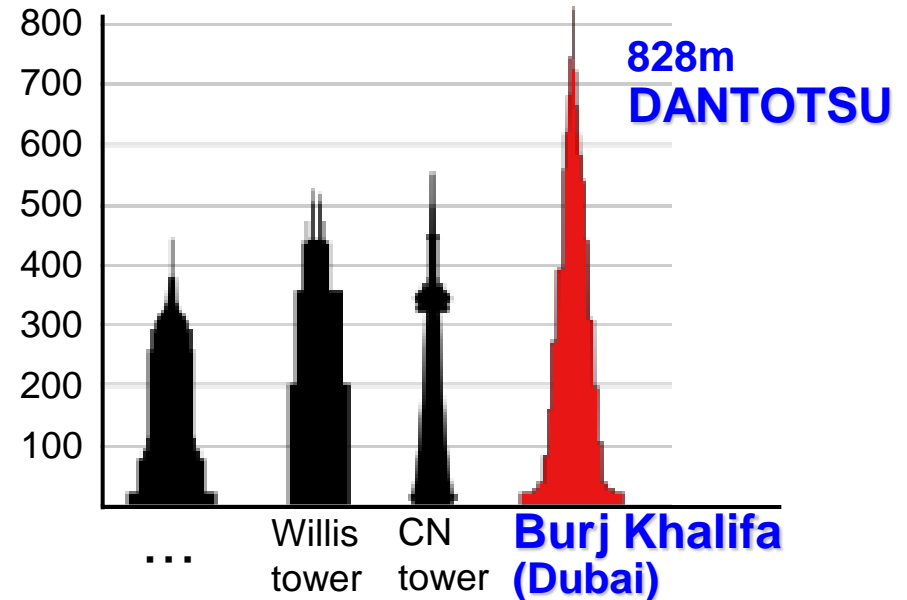
TOP

< extremely, absolutely >

Usain Bolt won 100m final at
'08 Beijing Olympics



Burj Khalifa is the highest
construction in the world(2012)



“DANTOTSU” means by far the most competitive
against 2nd place and below

Creation of “DANTOTSU” Factory

Pursuit of “MONOZUKURI” to provide unique values to the market at the right time

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- (1) World's best products
 - (2) World's best production line and factory
 - (3) Production in accordance with sales speed
 - (4) Reduction in lead time of SC
 - (5) Lean production activities
 - (6) Improving production sites

Focus of Activities

1/N
Equipment

Modular
Structure
Equipment

Intelligent
Automation

Efficient
Factory
Activity
(TPS)

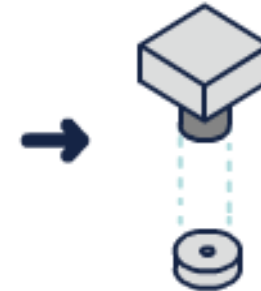
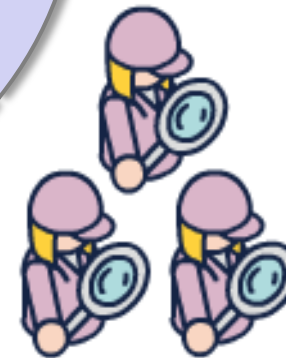
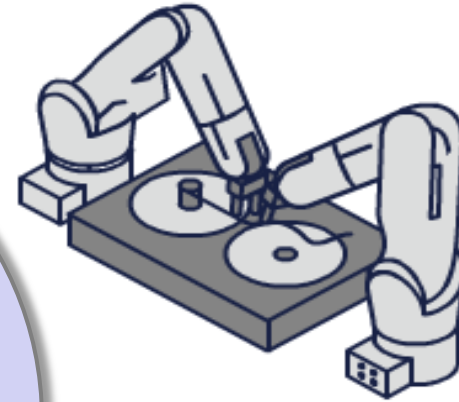
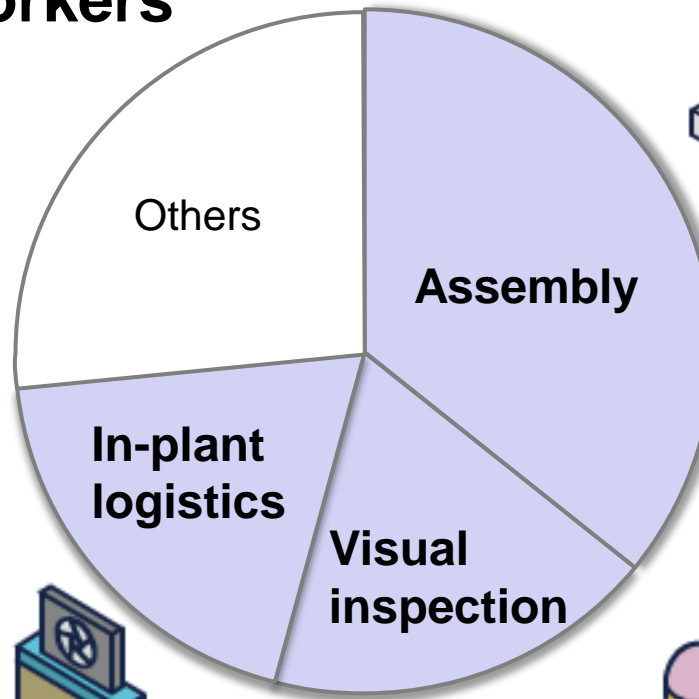
Factory IoT

**DENSO's DNA
Manufacturing**

- ◆ Activities that Integrate Technologies & Skills
- ➡ Concurrent Engineering
- ◆ Human Resources Development

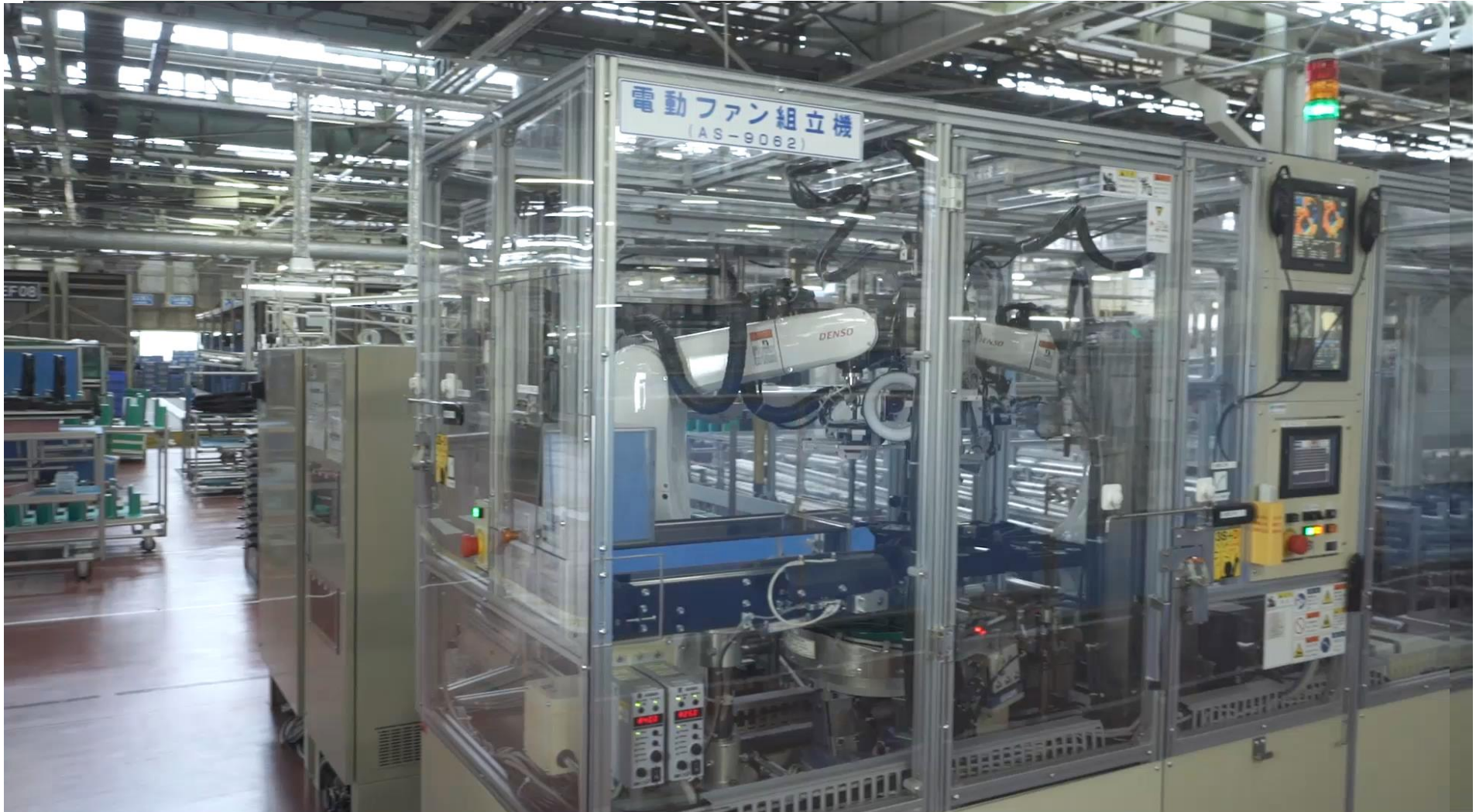
Applicable Areas of Automation

Direct workers



We pursue to automate the processes by using the robotic intelligent technologies

Example : Automated Production – Assembly Area



ECM(Engine Cooling Module Line) Automated Assembly Line

Example : Automated Production – Inspection Area



**Automate accuracy inspections
with the use of spiral light and image analysis**

Example : Automated Production – Final Inspection

2. Automation Trial in Laboratory



The robot imitates inspector's motion
and investigates the pictures
all around of product

**Automate final appearance inspections
by making machines learn high-quality big data**

Actions for Factory-IoT

Supply Chain

Maximize human growth and creativity by judging situations, collecting and utilizing knowledge as if all production lines and colleagues around the world were under one roof

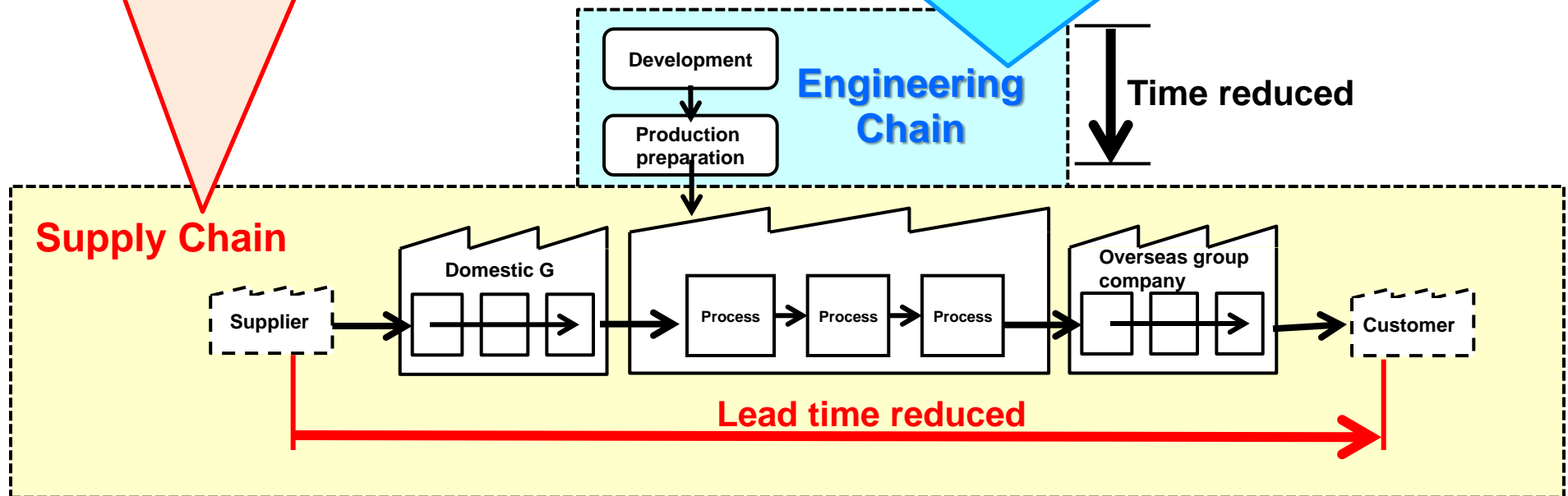
Factory Management IoT

Engineering Chain

Optimize products and processes and maximize human growth and creativity on a global scale by avoiding a dependence on human skills in CE,* which is DN's strong point

(*CE : Concurrent Engineering)

Production Preparation IoT



Factory Management IoT Concept

Maximize human growth and creativity
by grasping situations, collecting and utilizing knowledge
as if all production lines and colleagues around the world were under the same roof

Activate all approx. 130 factories around the world by connecting them together

⇒ **Improve productivity**

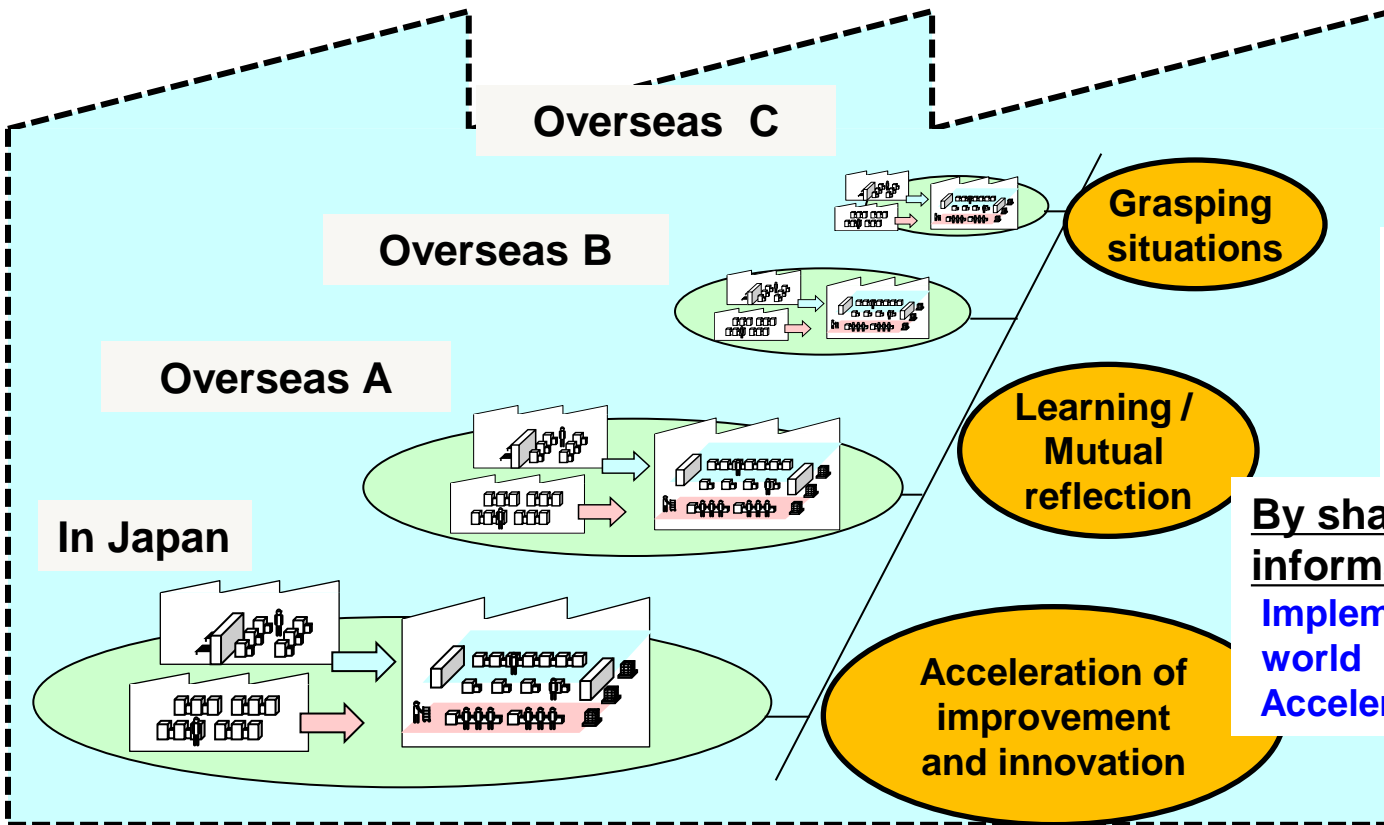
By real-time monitoring
Quick action

By know-how accumulation and DN-style analysis

Create highly reliable equipment and production lines
Create preventive production sites

By sharing globally valuable information

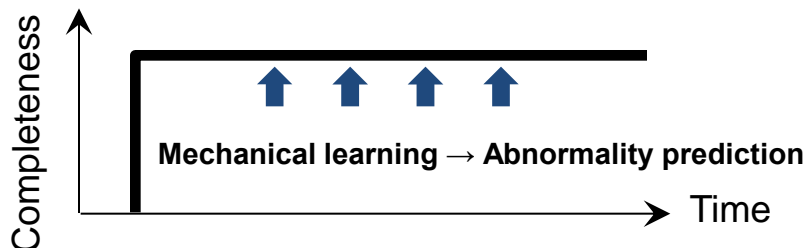
Implement best practices around the world
Accelerate KAIZEN to continue the evolution



Principle of Factory IoT

< Utilization of IT/IoT for sustainability >

Target: To sustain stable production anywhere around the world without being affected by acquirement levels of human skills



Big data analysis

Eliminate human influence



Info. for Engineer

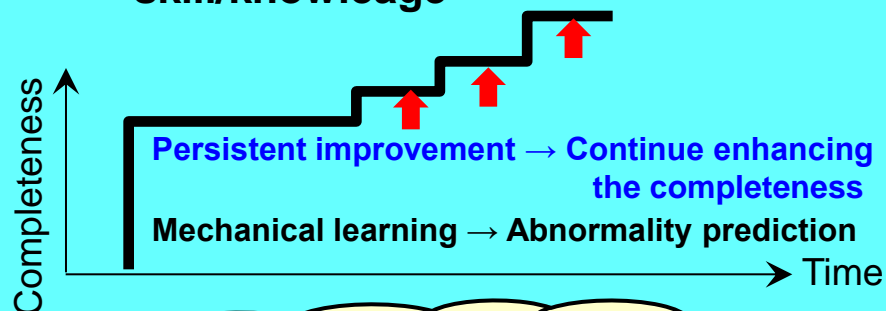


Maintain and control with mechanical loop

Mechanically calculate **optimal solutions**

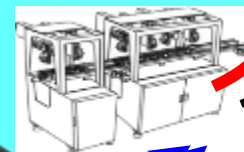
< Utilization of IT/IoT for evolution >

Target: Sustainable growth & continuous evolution by utilizing human skill/knowledge



Big data analysis

Co-creation by human and machine



Edge analysis

Both human and machine continue To be improved

Human Interface Device





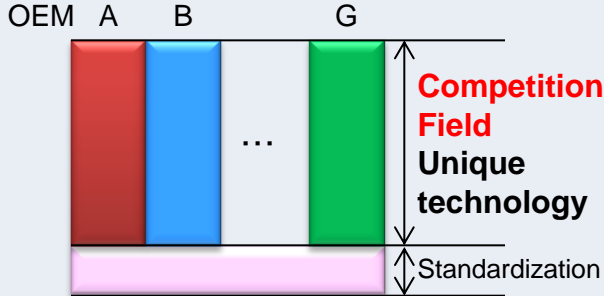
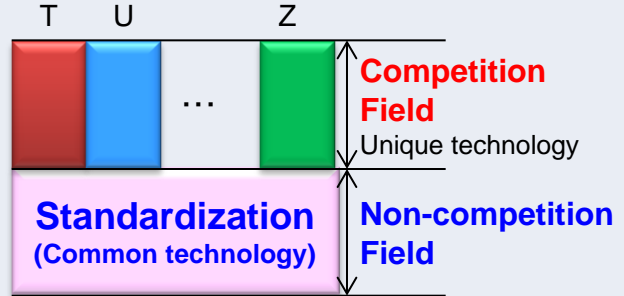
Provide more solutions so as not to generate defects and not to stop equipment even **for unknown problems**



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Comparison between Japan & Europe

	 Japan	 Europe
Business Model	JP unique → Global	EU optimize → Global
Features	Homogeneity / Uniformly	Multinational / Diversity
Work Style	Teamwork / Harmony	Rational / Individualism
Development Style	<p>Independent (unique technology by each OEM)</p> 	<p>Cooperation & Competition</p> 



Non-Competition vs Competition Field

Example : ICE (Internal Combustion Engine)

	Discussion Points	Examples
Non-Competition Field (Cooperation)	“WHAT” <ul style="list-style-type: none">▪ Measure in-cylinder pressure real time▪ What kind of function?▪ To ensure the accuracy?	Definition of CPS concept <ul style="list-style-type: none">▪ Pressure accuracy level Test procedure <ul style="list-style-type: none">▪ Accurate measurement with robustness
Competition Field	“HOW” <ul style="list-style-type: none">▪ Element parts▪ How to utilize this device?▪ Price→ Added-value to end users	<ul style="list-style-type: none">▪ Technology and element parts▪ Utilization▪ Design and configurations▪ Cost

Note) CPS: Cylinder Pressure Sensor

Collaboration Concept between Germany & Japan

TEAM Germany & Japan

Global competitiveness



JP-way Development

The points we have to pursue

- ✓ Hang-on
- ✓ Dignity / diligent
- ✓ Teamwork / harmony



Fusion



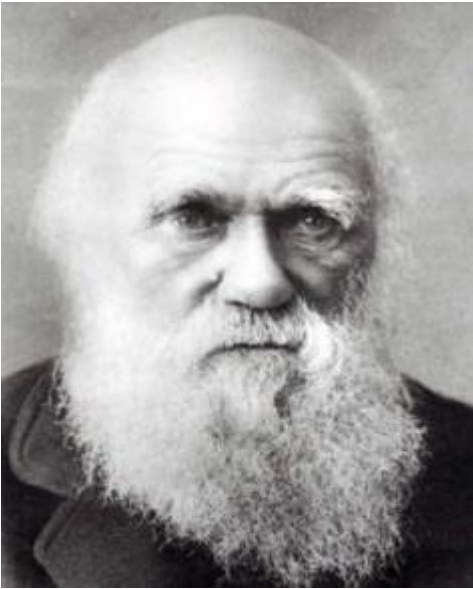
EU-way Development

The points we have to learn

- ✓ Efficient / rational
- ✓ Standardization
- ✓ Cooperation / collaboration



Message for sustainable growth



“It is not the strongest of the species that survive, nor the most intelligent, but the one most **adaptable to change.”**

Charles Darwin

To pursuit sustainable growth & contribute better society, Team Germany & Japan should collaborate each other in many industry domains

<Inquire>
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Thank You

Future Vision Creation Technology