

Part 1



Basic principle of TPS

TPS -Toyota Way

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Agenda

1. Introduction
2. Why should you learn TPS
3. What is TPS/Lean system
4. Toyota Way (TPS)
5. Fundamental of TPS
6. Concluding

<Speaker's Profile>

- Worked for Toyota for 34 years and had experience in the car production preparation engineering together with IT engineering
- Specialized in Factory Automation based on TPS (1980~2000)
- Involved in IMS and E-Commerce project organized by METI.
- After retirement from Toyota, had been a visiting professor of Nagoya /Kyusyu Institute of Technology and have been working for some NPOs, such as ESD21 and APSOM and so forth.

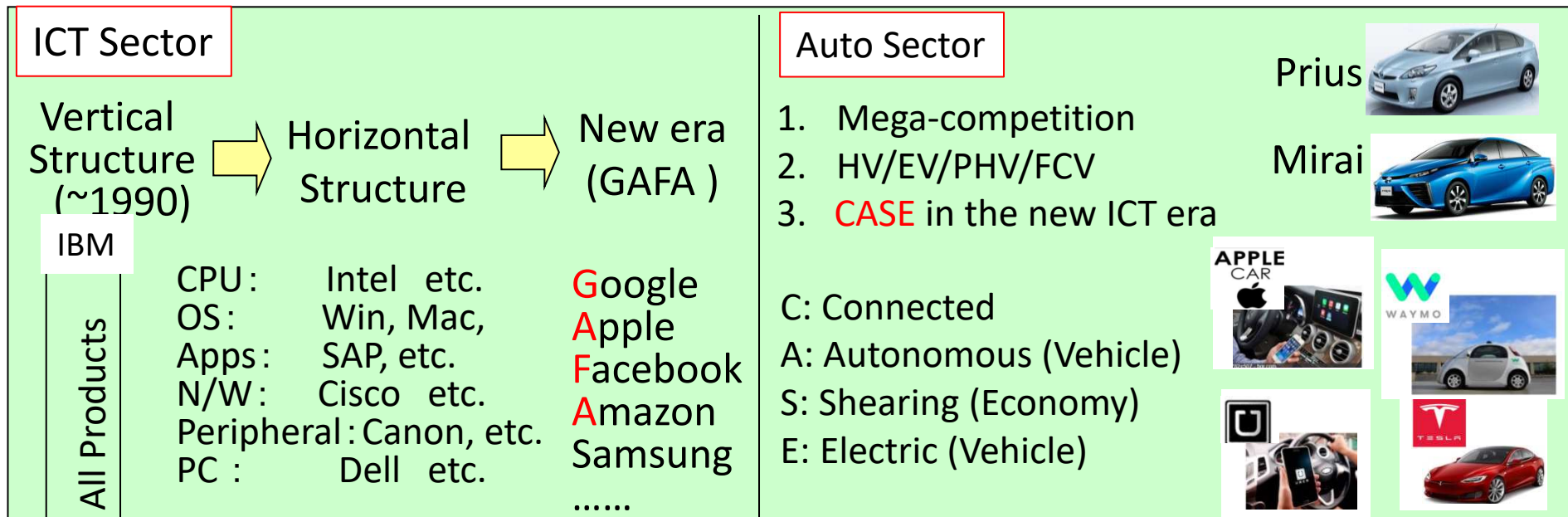
Structural change to the global economy

Almost all issues brought by ICT evolution and digitalization

Key Issues

- Open - Speed - Global - Collaboration - Core-competence

1. Globalization of economy
2. Environment and energy issues
3. Change of the industrial structure
4. New ICT impact to the manufacturing industries



Initiatives of enhancement of manufacturing in the new ICT era

GAFA
 Google, Apple
 Facebook, Amazon

BATH
 Baidu, Aribaba
 Tencent, Huawei

Industry 4.0

Society 5.0

AMP, IIC
 IIC is a consortium organized by GE in 2014

Industrie 4.0
 Activities of standardization

中国製造2025
Made in China 2025

RRI/ IoT-A (2015),
Society5.0(2016)

 since2012

 Since2011

 Since2015

 Since2015 RRI



Local Labo: 101

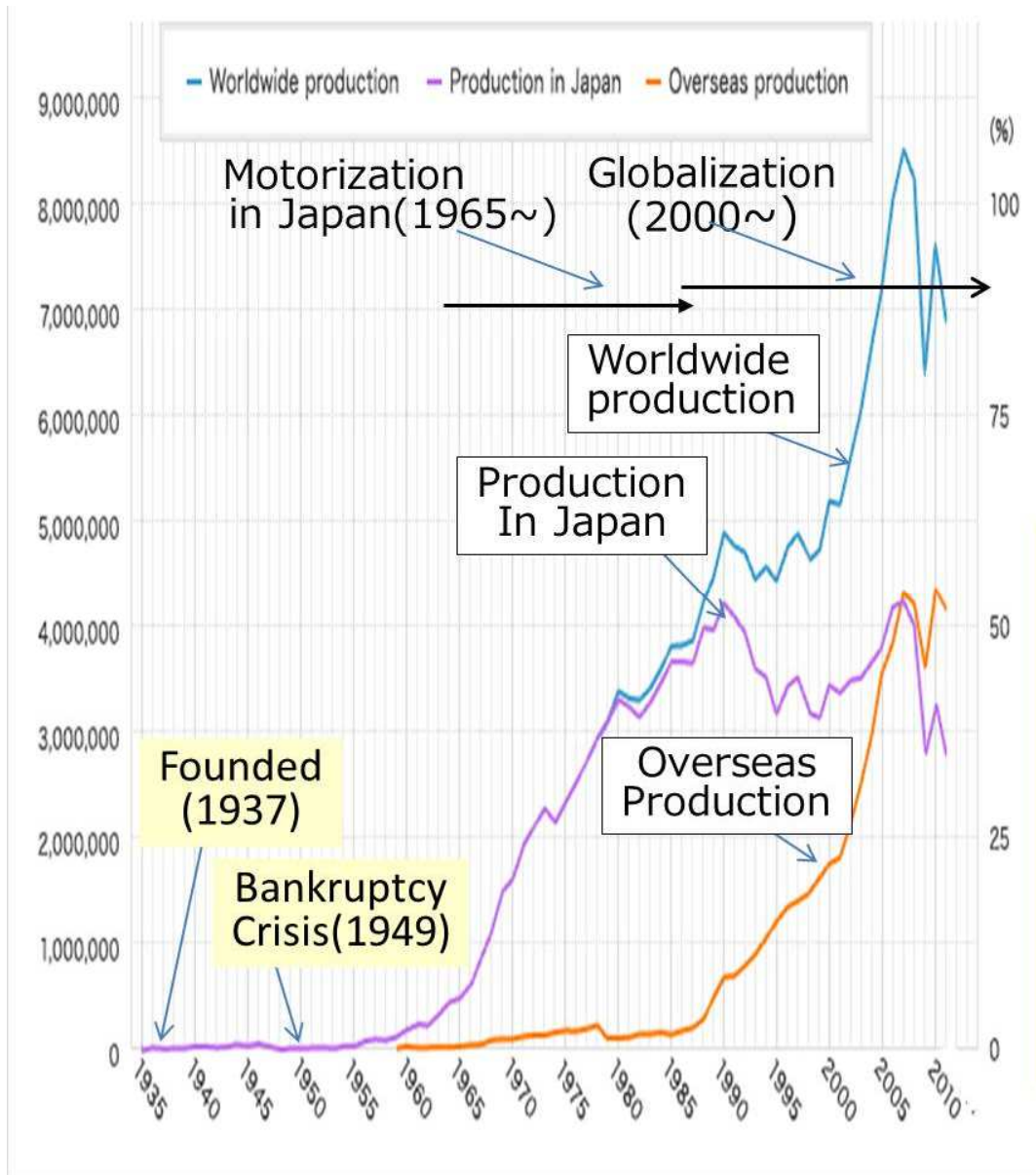
-AMP=Advanced Manufacturing Partnership
 -IIC=Industrial Internet Consortium

-RRI=Robot Revolution Consortium

Industrie4.0: 1st IR(Steam)⇒ 2nd IR(Motor)⇒ 3rd IR(Computer)⇒ 4th IR(??)

Society 5.0: S1 (Hunting) ⇒ S2(Agrarian) ⇒ S3(Industrial) ⇒ S4(Information) ⇒ S5(??)

Toyota's production history and overviews



-No. of vehicle produced : 8,985,186
 -No. of vehicle sold: 8,976,795
 -No. of employees: 370,870
 -Net revenues: 30,225.6 billion yen
 -Operating Income: 2,467.5 billion yen
 -Net Income: 1,882.8 billion yen
 (FY2019 Consolidated)
 Source :Toyota Sustainability Data Book July 2020

No. of Vehicle production

- Japan: 48%
- North America : 20%
- Europe: 8%
- Asia: 19%
- Other : 5%



Why should you learn TPS

Toyota System(TPS) and ICT are critical for sustainable manufacturing

General-purpose technologies (GPTs) are technologies that can affect an entire economy (usually at a national or global level)

<After AD to 19th Century>

“Printing”, “Steam Engines”,
“Railway”, “Electricity”
and so forth

<GPTs in the 20th Century>

- Automobile
- Airplane
- Mass Production (Ford System)
- Computer
- Lean Production (Toyota System)
- Internet
- Biotechnology

GPT	Spillover Effects	Date	Classification
Domestication of plants	Neolithic Agricultural Revolution	9000-8000 BC	Process
Domestication of animals	Neolithic Agricultural Revolution, Working animals	8500-7500 BC	Process
Smelting of ore	Early metal tools	8000-7000 BC	Process
Wheel	Mechanization, Potter's wheel	4000-3000 BC	Product
Writing	Trade, Record keeping	3400-3200 BC	Process
Bronze	Tools & Weapons	2800 BC	Product
Iron	Tools & Weapons	1200 BC	Product
Water wheel	Inanimate power, Mechanical systems	Early Middle Ages	Product
Three-Masted Sailing Ship	Discovery of the New World, Maritime trade, Colonialism	15th Century	Product
Printing	Knowledge economy, Science education, Financial credit	16th Century	Process
Factory system	Industrial Revolution, Interchangeable parts	Late 18th Century	Organisation
Steam Engine	Industrial Revolution, Machine tools	Late 18th Century	Product
Railways	Suburbs, Commuting, Flexible location of factories	Mid 19th Century	Product
Iron Steamship	Global agricultural trade, International tourism, Dreadnought Battleship	Mid 19th Century	Product
Internal Combustion Engine	Automobile, Airplane, Oil industry, Mobile warfare	Late 19th Century	Product
Electricity	Centralized power generation, Factory electrification, Telegraphic communication	Late 19th Century	Product
Automobile	Suburbs, Commuting, Shopping centres, Long-distance domestic tourism	20th Century	Product
Airplane	International tourism, International sports leagues, Mobile warfare	20th Century	Product
Mass Production	Consumerism, Growth of US economy	20th Century	Organisation
Computer	Digital Revolution	20th Century	Product
Lean Production	Growth of Japanese economy	20th Century	Organisation
Internet	Electronic business, Crowdsourcing, Social networking, Information warfare	20th Century	Product
Biotechnology	Genetically modified food, Bioengineering, Gene therapy	20th Century	Process
Business Virtualization	Paperless office, Telecommuting, Software agents	21st Century	Process
Nanotechnology	Nanomaterials, Nanomedicine, Quantum dot solar cell, Targeted cancer therapy	21st Century	Product
Artificial Intelligence	Autonomous car, Inventory robot, Industrial robot	21st Century	Process

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

Why should you learn TPS

Basic fundamentals of Monozukuri

TPS(Toyota Production System)

- Just-In-Time
- Jidoka (Automation)
- Production technology
- Processing technology
- TQM / TPM - IT system

Global NO.1
Product

Monozukuri

Continuous Improvement
with Technology and Skill

Quality First

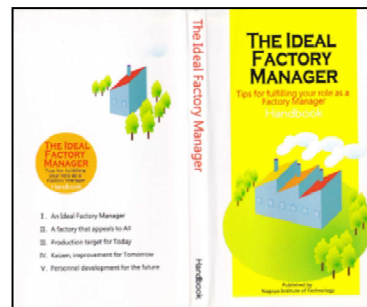
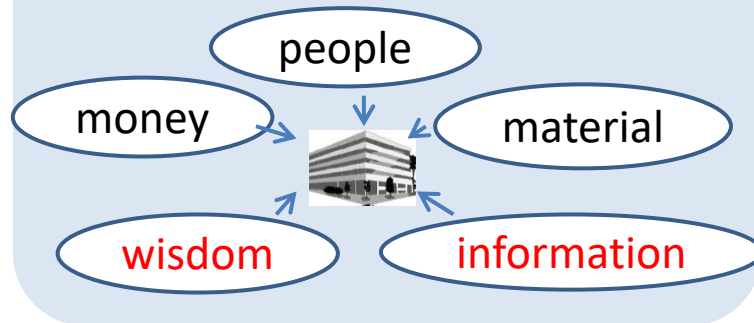
- Gnechi-genbutu (Go and see)
- QC(Quality control)
- Making things is making people
- Respect for people
- Teamwork

Technology
Evolving

Hitozukuri

Hitozukuri= Human development Monozukuri= Manufacturing

Resources of an enterprise



The Ideal Factory Manager
published by NIT

Aim for an ideal Factory

Zero number of accidents

Zero number of delays

Zero number of defects

Zero number of conveyances

Reduce stock near zero

Zero number of disasters

Perform your 100% abilities

Perform 100% facility capacity

Why are Toyota System (TPS) and IT?

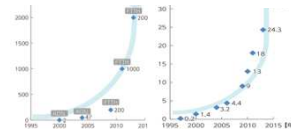
- Business outcome is brought by activities with **people** and machine systems (IT)
- IT has evolved one million times in 50 years.
- IT is a powerful tool for business activities

4 million years

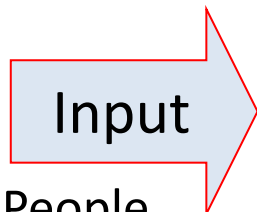


Communication speed

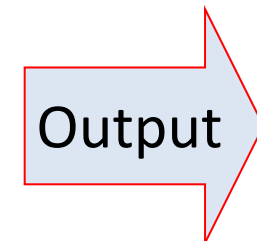
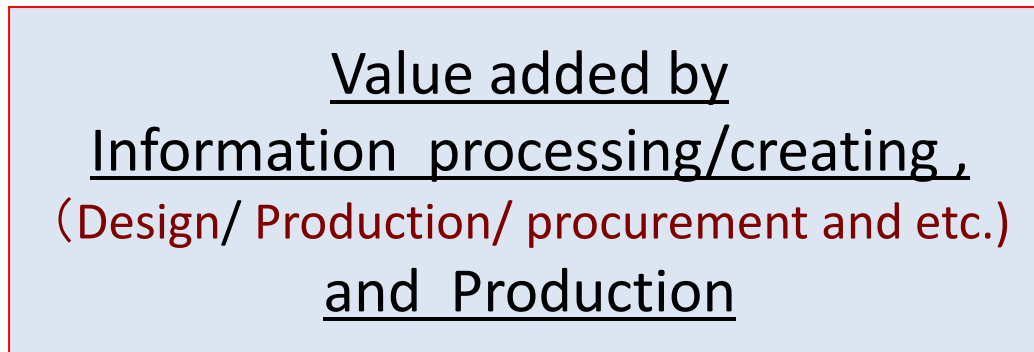
CPU speed



<Business Activity>



People
Material
Money
Information



Products, Service
Customer Value

Productivity and Competitiveness

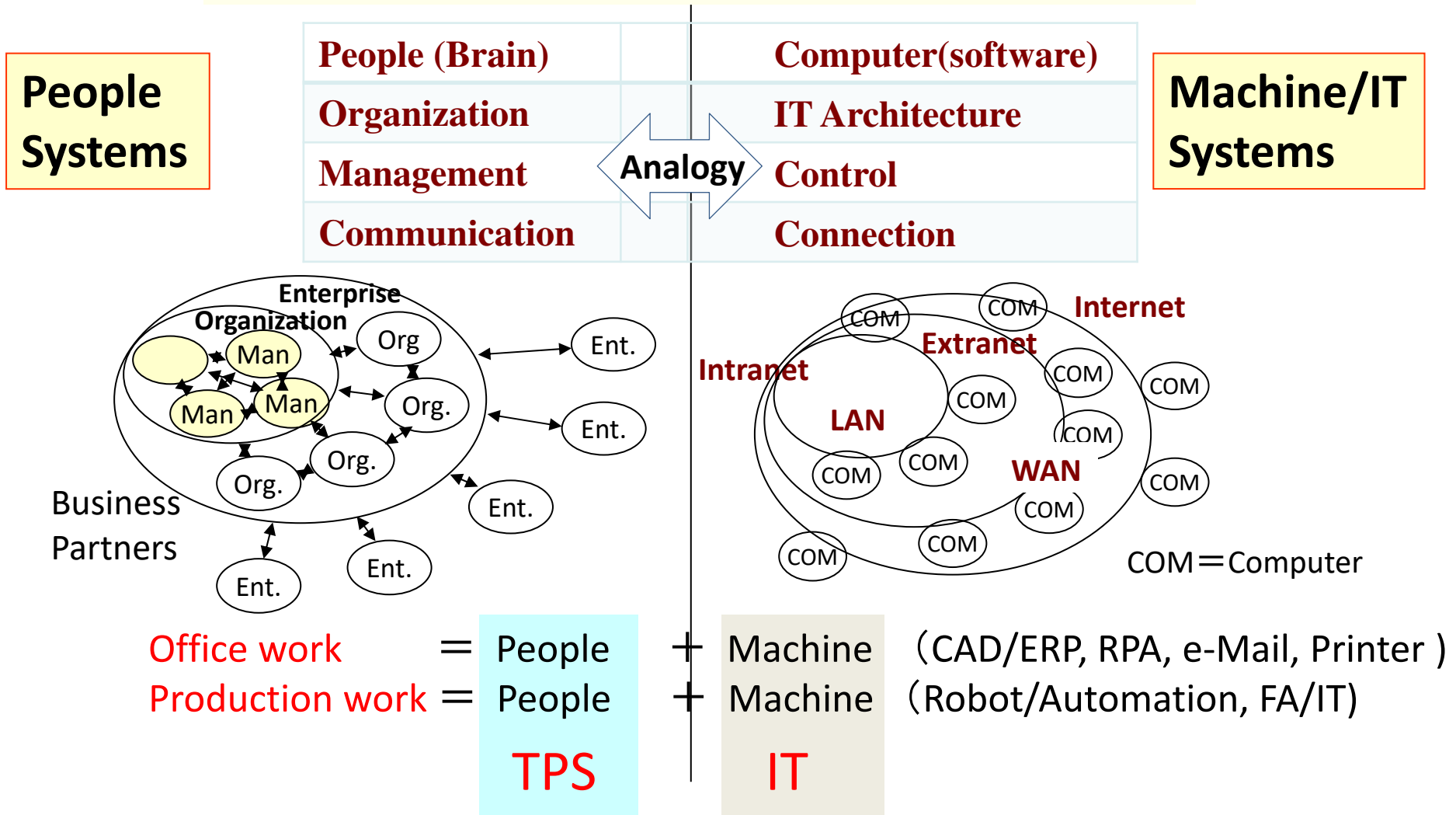
$$\text{Productivity} = \frac{\text{Output}}{\text{Input}} = \frac{\text{Value added}}{\text{Lead-time}} = \frac{\text{Sales}}{\text{Cost}}$$

Increase productivity

- ◆ Increase sales
- ◆ Reduce cost
- ◆ Shorten lead-time

Business consists of people and machines(IT)

Business Activities are information processing with people and machine systems (IT)



Why should you learn TPS

"Man-machine (IT) system" in manufacturing



Engine production order indicator in 1980



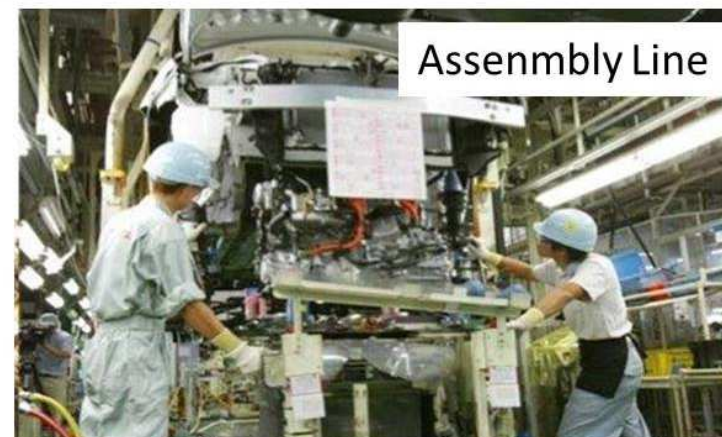
Fujitsu PC production factory Monozukuri Grand Award in 2015



Toyota's Kanban (Index card)



Vehicle production Line (process) of Assembly plant



Part 1

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