

New Paradigm of Manufacturing and Government Policy in Japan

– From perspective of Science & Technology Policy –

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科学技術振興機構

Introduction of JST/CRDS

JST (Japan Science and Technology Agency)

- Funding agency for science, technology and innovation under Ministry of Education, Science and Technology (MEXT).
- Our major achievements are “Blue LED (Prof. Akasaki, Prof. Amano and Prof. Nakamura)” and “iPS (Prof. Yamanaka)”.

CRDS (Center for Research and Development Strategy)

- Think tank for Japan in the field of Science and Technology established in 2003.
- Headed by Prof. Hiroyuki YOSHIKAWA.

Outline

1. Past Experience in Japan
2. Current Situation of Japan
3. New Paradigm of Manufacturing
(Based on the study of CRDS)
4. Government Policy of Japan
(From Perspective of ST&I Policy)
5. Discussions

1. Past Experience in Japan

Success of the Manufacturing Industry

Achieved High Economic Growth

- Economic development was led by processing trade (Over 10% growth during 1956–73. GDP of Japan became the 2nd in the world in 1968).
- “Japan as No. 1” (Ezra F. Vogel, 1979)

Established Competitiveness based on “Process Innovation”

- “Toyota Production System” drew worldwide attention.
- Became leader in the global market by “high-spec, high-quality products”.
- Lead to establish “Intelligent Manufacturing Systems (IMS)” in 1995.

Cope With Environmental Challenges

Environmental Pollution

- Pollution caused diseases was serious during 1950–70s.
- Introduced “Polluter–Pays–Principal” from 1970s.
- Trigger to introduce “end of pipe technology”. Further developed to “zero emission system” and “eco–town system”.

Energy Shortage

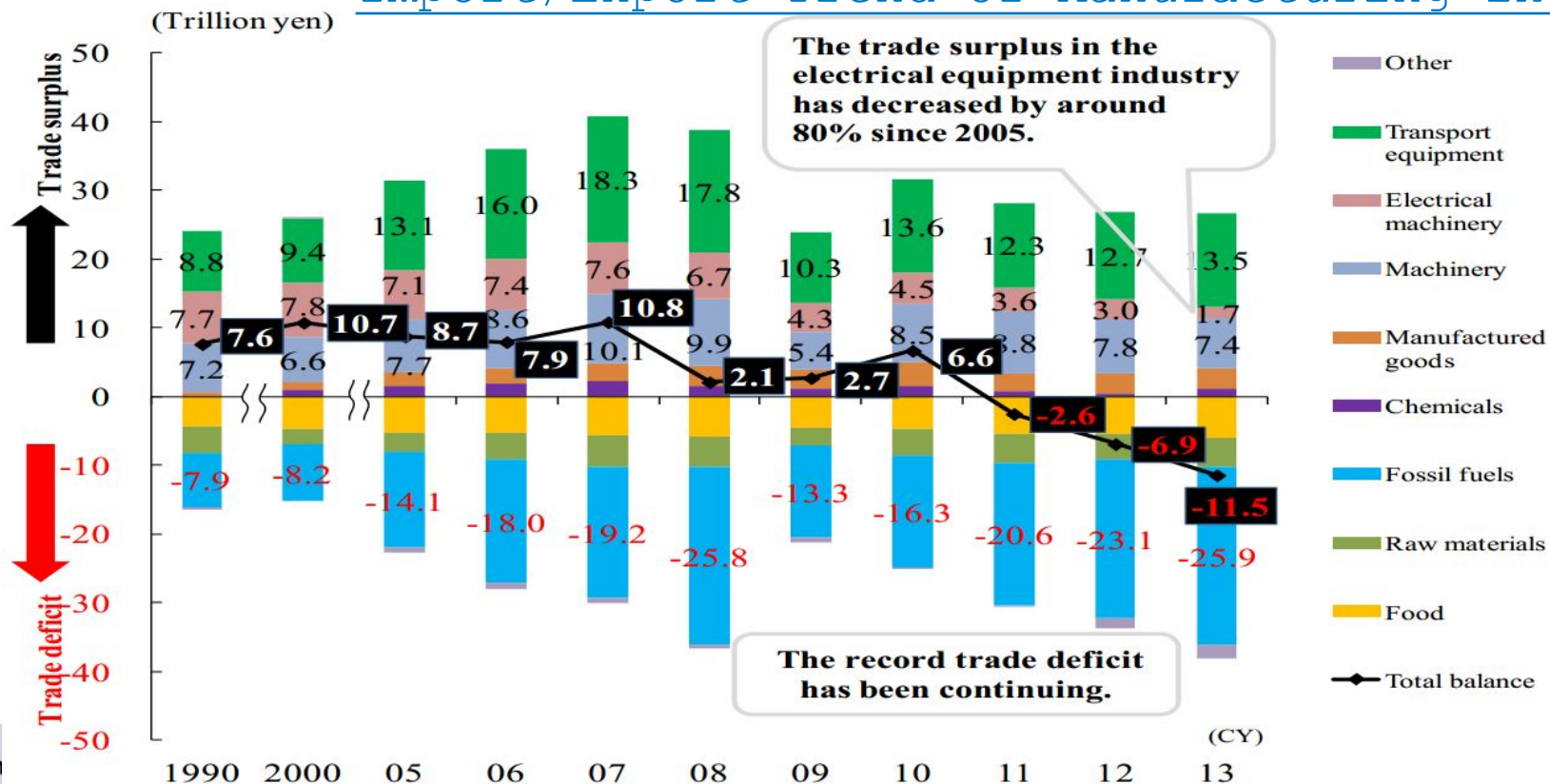
- High economic growth period ended due to the oil crisis in 1973.
- Trigger to promote R&D for energy saving technology.

2. Current Situation of Japan

Current Situation of Manufacturing in Japan

- Shrinkage of the surplus in trade balance. Especially in the electrical equipment industry.
 - Offshore, losing competitiveness in product innovation, etc...

Import/Export Trend of Manufacturing in Japan



Why are Japanese Manufacturers Deteriorating their Position in Global Competition?

- Catch-up of developing countries.
- High-spec high quality goods are not necessarily major market needs.
- Struggling to define “What to make?”
 - Diversification in Global Market
 - Shrinkage of Local Market
- Rapid technological changes in ICT.

3. New Paradigm of Manufacturing (Based on the study of CRDS)

Technology development: A driving force for promoting diversity in the function of “things”

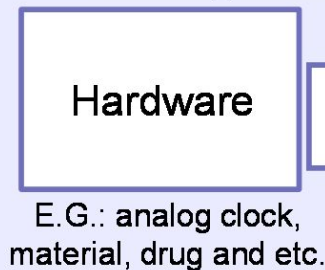
Digital Technology

- Diversification of function of “things (manufactured products)” by embedding software. (Fig. 2)

Network Technology

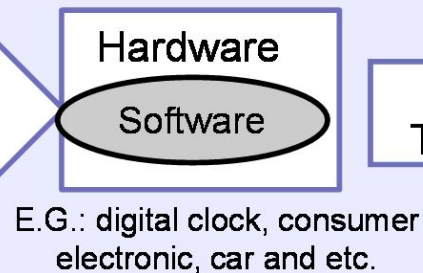
- A big potential to provide services to users through “things” by embedding connectivity via network. (Fig.3)

**Fig.1 “Things”,
in original means**



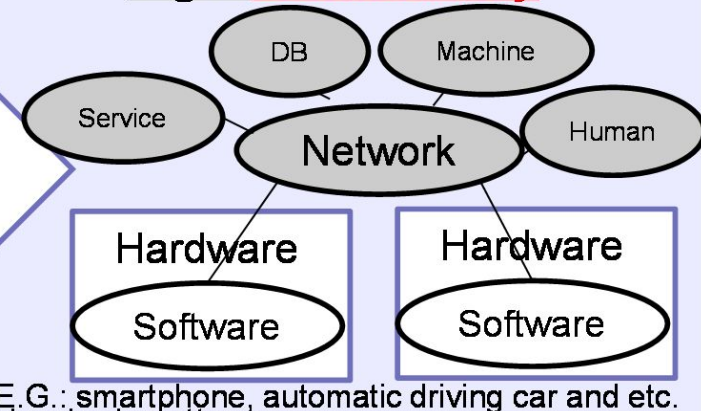
Digital
Technology

**Fig.2 “Things”,
software embedded**



Network
Technology

Fig.3 Connectivity



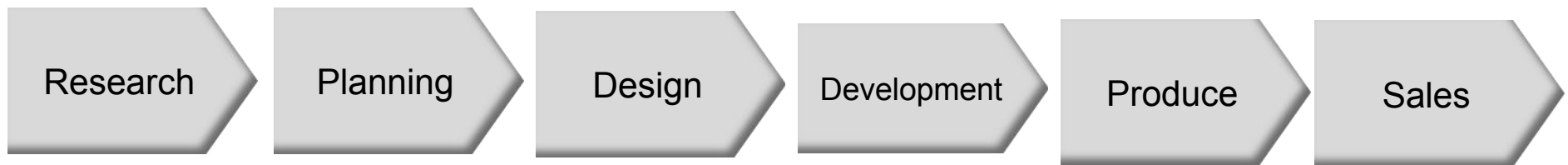
Note:

- Hardware: “Things”, whose function is described by characteristics of physical matters
- Software: “Things”, whose function is described by artificial logic (program)

Source: JST/CRDS

What do we need beside “Process Innovation”?

- Japan used to have global competitiveness in “Process Innovation”.
- What kind of transformation in the value chain do we need?

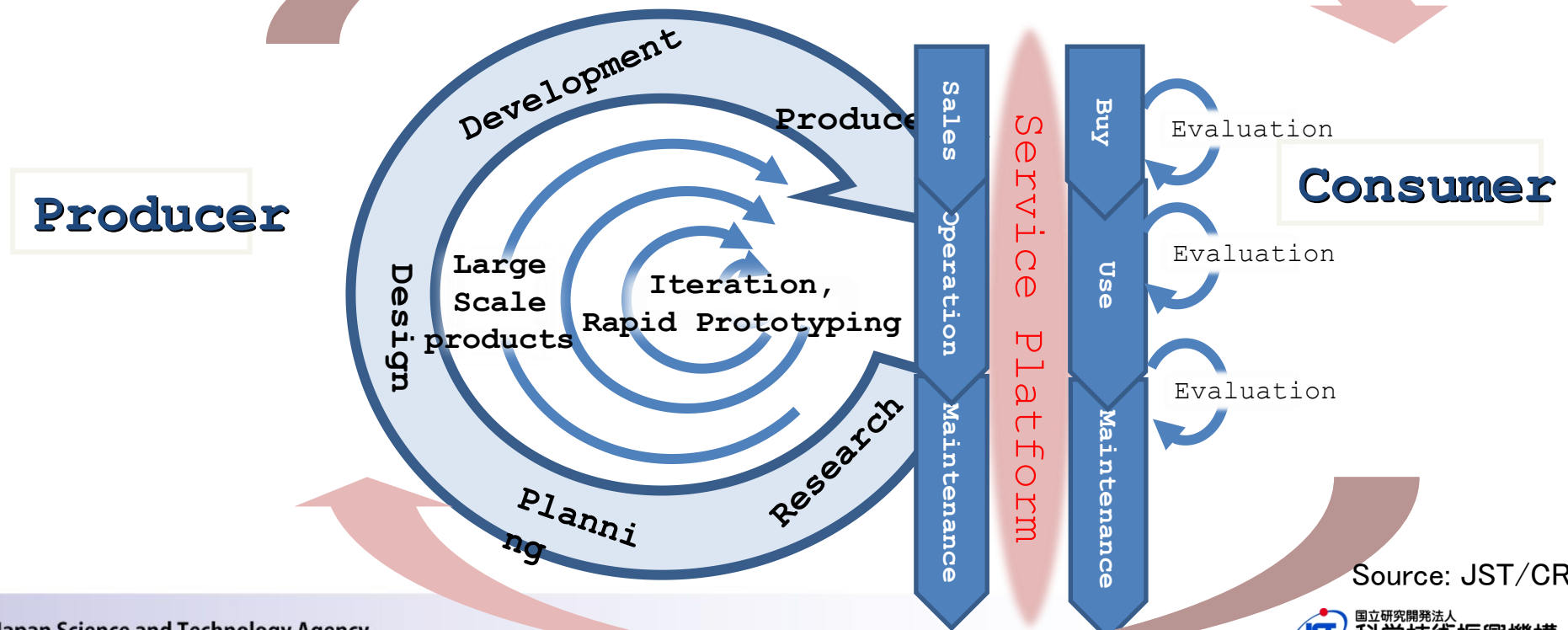


General Value Chain of Manufacturing Industries

A System to Converge Manufacturing and Service

- Platform interacting with consumers is needed in next generation manufacturing system.
- Strategic use of ICT may lead to create new value add.

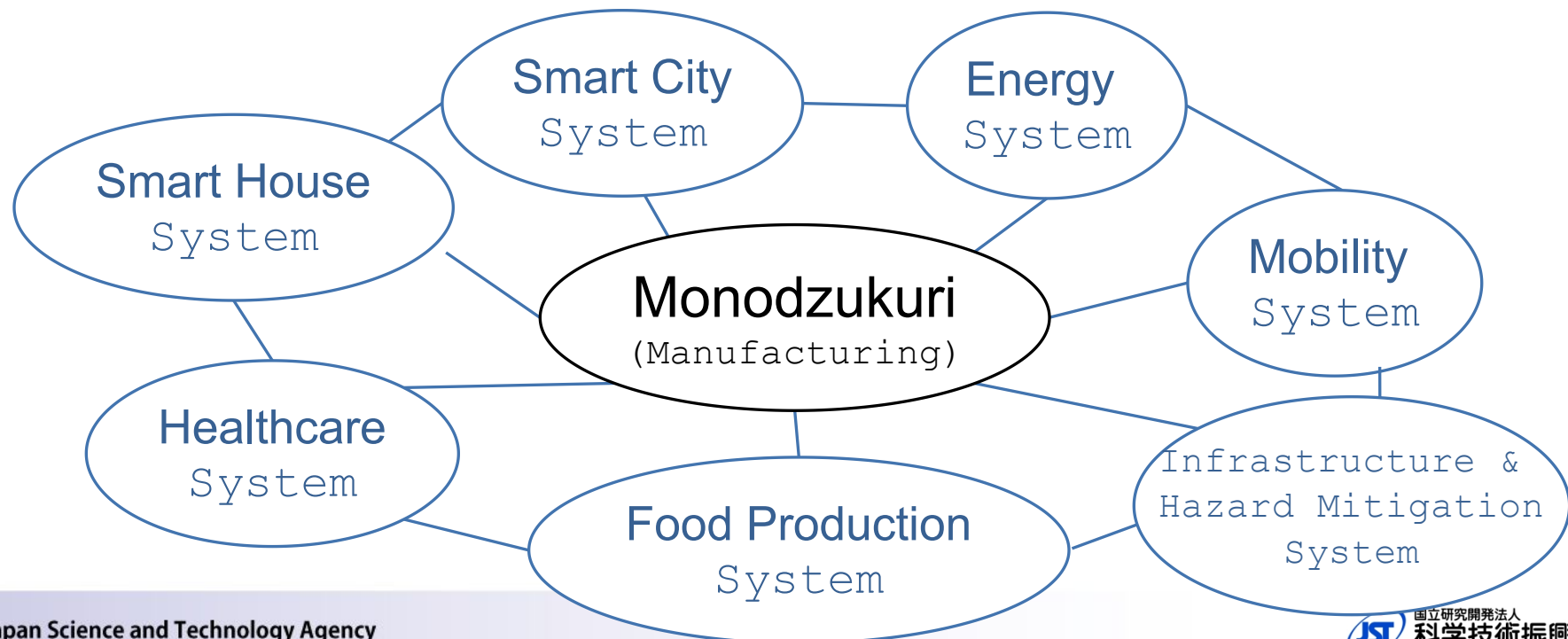
Value Co-design/ Co-creation



Source: JST/CRDS

What is the Shape of Future Industry?

- Would “Service Platform Business” become the “Umbrella” of Future Industry?
- How should we use ICT to improve sustainability, resiliency and social well-being towards inclusive development?



4. Government Policy of Japan (From Perspective of ST&I Policy)

Overview of the Previous Science and Technology Basic Plans

1st Basic Plan
(FY 1996–2000)

2nd Basic Plan
(FY 2001–2005)

3rd Basic Plan
(FY 2006–2010)

● Increase in government R&D expenditure

The total budget for governmental R&D expenditure exceeded 170 B\$. < 176 B\$ >

● Construction of new R&D system

- **Increase in competitive research funds**
- Support plan for 10,000 post-doctoral fellows
- Promotion of industry-academia-government collaboration
- Implementation of evaluation systems

● Strategic priority setting in S&T

- Promotion of basic researches
- **Prioritization of R&D**

Prioritized 4 Areas

- * **Life Science**
- * **ICT**
- * **Environment**
- * **Nanotech/Materias**

● S&T system reforms

- Doubling of competitive research funds
- Enhancement of industry-academia-government collaboration
- Total budget :240 B\$ < 211 B\$ >

● Emphasis on Promotion of Innovation

- Strategic priority setting in S&T
- Promotion of basic researches
- Prioritization of R&D

Prioritized 4 Areas

- * **Life Science**
- * **ICT**
- * **Environment**
- * **Nanotech/Materias**

Promoted 4 Areas

- **Energy**
- **Manufacturing technology**
- **Social Infrastructure**
- **Frontier**

Key Technologies of National Importance

● S&T system reforms

- Developing, securing and activating human resources
- Creating scientific development and persistent innovation
- Total budget :250 B\$ < 215 B\$ >

The 4th S&T Basic Plan (FY 2011–2015)

- Visions of the country:
 - Recover from the Great East Japan Earthquake.
 - Realize the affluent high-quality of life for people.
 - Take initiative in solving global issues.
 - Possess S&T as the foundation of national survival.
 - Continue to create “Knowledge” assets and fosters S&T as a culture.
- Basic idea:
 - To promote Science & technology to solve social issues we face.

Recent Trend of ST&I Policy Related to Manufacturing

Recent Trend of ST&I Policy

- Comprehensive ST&I Strategy (2014) : “Smart”, “System”, “Global”
- 5th S&T Basic Plan (2016–): “Super Smart Society” (ongoing discussion)

Policies and Discussions related to Manufacturing

- From “process innovation” to “product innovation” (2000)
- From “Monozukuri (make goods products)” to “Kotozukuri (not only goods but also implement user experience)” (2006–)
- “New Robot Strategy” (2015)

New R&D Programs: Towards System Approach

Program	Outline
SIP* ¹ (Cabinet Office)	<ul style="list-style-type: none"> ◆ Promote ST&I through R&D overlooking from basic research to application and commercialization by cross-ministerial cooperation. ◆ Agenda and PD are decided by CSTI*². ◆ 10 projects including "Innovative Design/Manufacturing Technologies" are running. Approx. 50B JPY/year is supported (in total).
Center of Innovation Program (MEXT* ³)	<ul style="list-style-type: none"> ◆ Support for large-scale IAG*⁴ cooperative research & innovation to meet potential societal needs. ◆ Three visions; Smart life care, Smart Japan, Active sustainability

*1 SIP: Cross-ministerial Strategic Innovation Promotion Program

*2 CSTI: Council for Science, Technology and Innovation

centers.

*3 MEXT: Ministry of Education, Culture, Sports,

Science and Technology

5. Discussions

- What would the shape of future industry be?
- What would be the role of future manufacturers?
- What is our mutual challenge towards sustainable (environmentally, societally and economically) and inclusive development?