This Slide set is based on a presentation that Semiconductor Industry Research Institute Japan (SIRIJ) gave to Governments/Authorities Meeting on Semiconductors (GAMS) in Kobe, Japan in 2010. The GAMS is composed of governments and authorities from the World Semiconductor Council (WSC) regions. The WSC is composed of the Semiconductor Industry Association in China, the Semiconductor Industry Association in Chinese Taipei, the Semicondutor Industry Association in Europe, the Semiconductor Industry Association in Korea, the Semiconductor Industry Association in Japan and the Semiconductor Industry Association in the U.S.

See www.semiconductorcouncil.org

The SIRIJ is a think tank established to study and revitalize the semiconductor industry.

See www.sirij.jp

Semiconductors' Social Contribution - Research Report in Japan -

September 16, 2010, Kobe

Masao Fukuma
Semiconductor Industry Research Institute Japan (SIRIJ)

Outline

1) Introduction

2) Semiconductors' Contribution
   a) Technology Spreading-out
   b) Productivity Improvement
   c) Consumer Surplus
   d) Green of/by Semiconductors

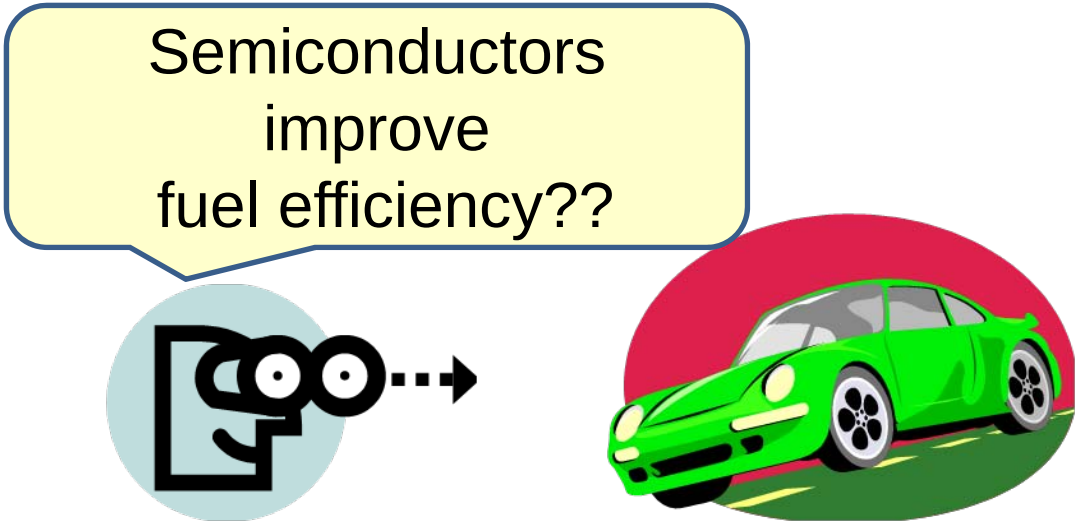
3) New Products/Services

4) Summary

Big Concern

Semiconductors are widely used in human society but do NOT attract one's notice directly

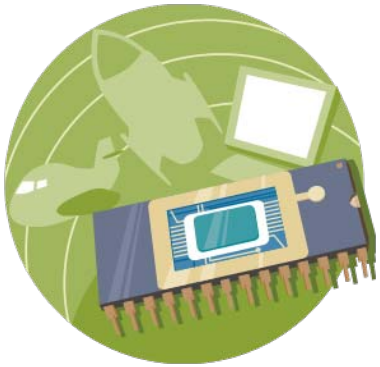
Ordinary people do not pay any attention to the contribution of the semiconductor industry



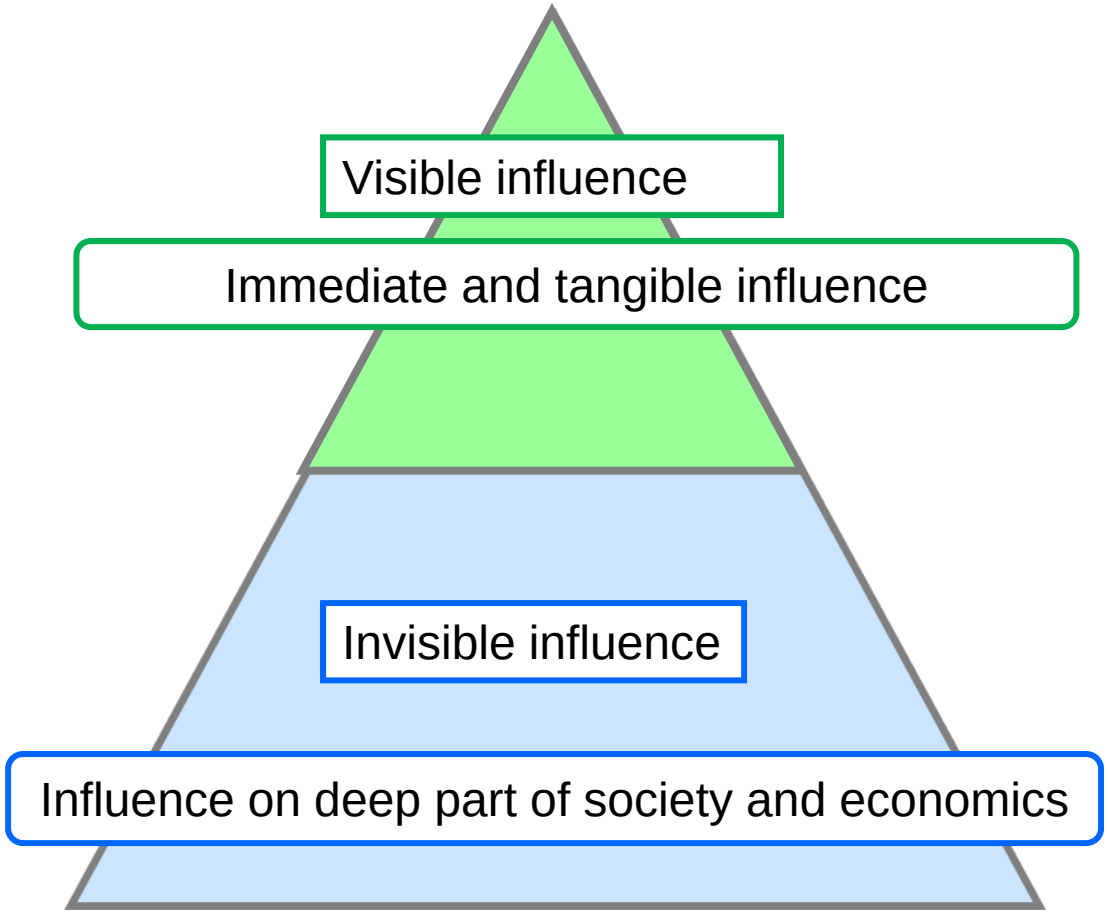
Purpose of this Report

To clarify the social influence and contribution of the semiconductor industry

To show the importance of the semiconductor industry

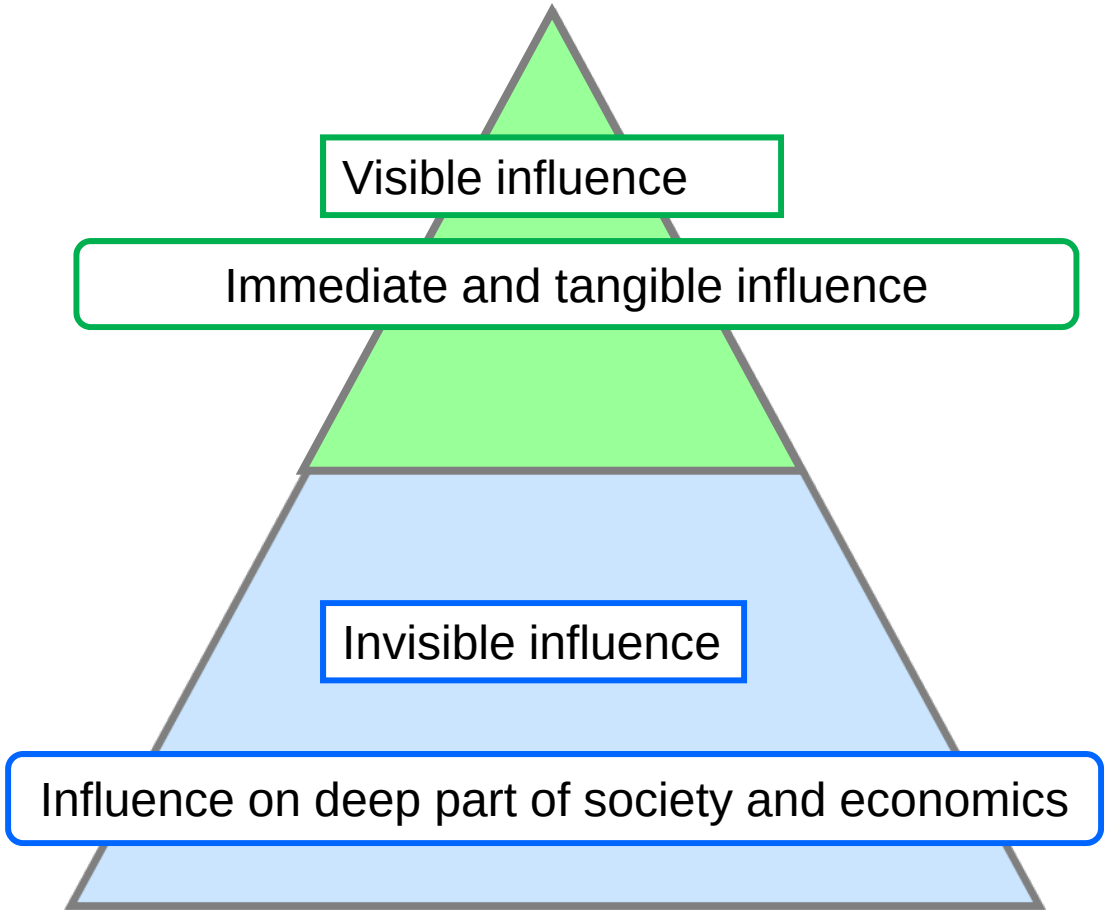


Visible and Invisible Influence



- GDP Boost
- Employment increase
- New products/services
- Green contribution of semiconductors
- Green contribution by semiconductors
- Business model innovation
- Technology spreading out
- Productivity improvement
- Consumer surplus

Visible and Invisible Influence



GDP Boost

Employment increase

New products/services

Green contribution of semiconductors

Green contribution by semiconductors

Business model innovation

Technology spreading out

Productivity improvement

Consumer surplus

Outline

1) Introduction

2) Semiconductors' Contribution

- *a) Technology Spreading-out*
- *b) Productivity Improvement (TFP)*
- *c) Consumer Surplus*
- *d) Green of/by Semiconductors*

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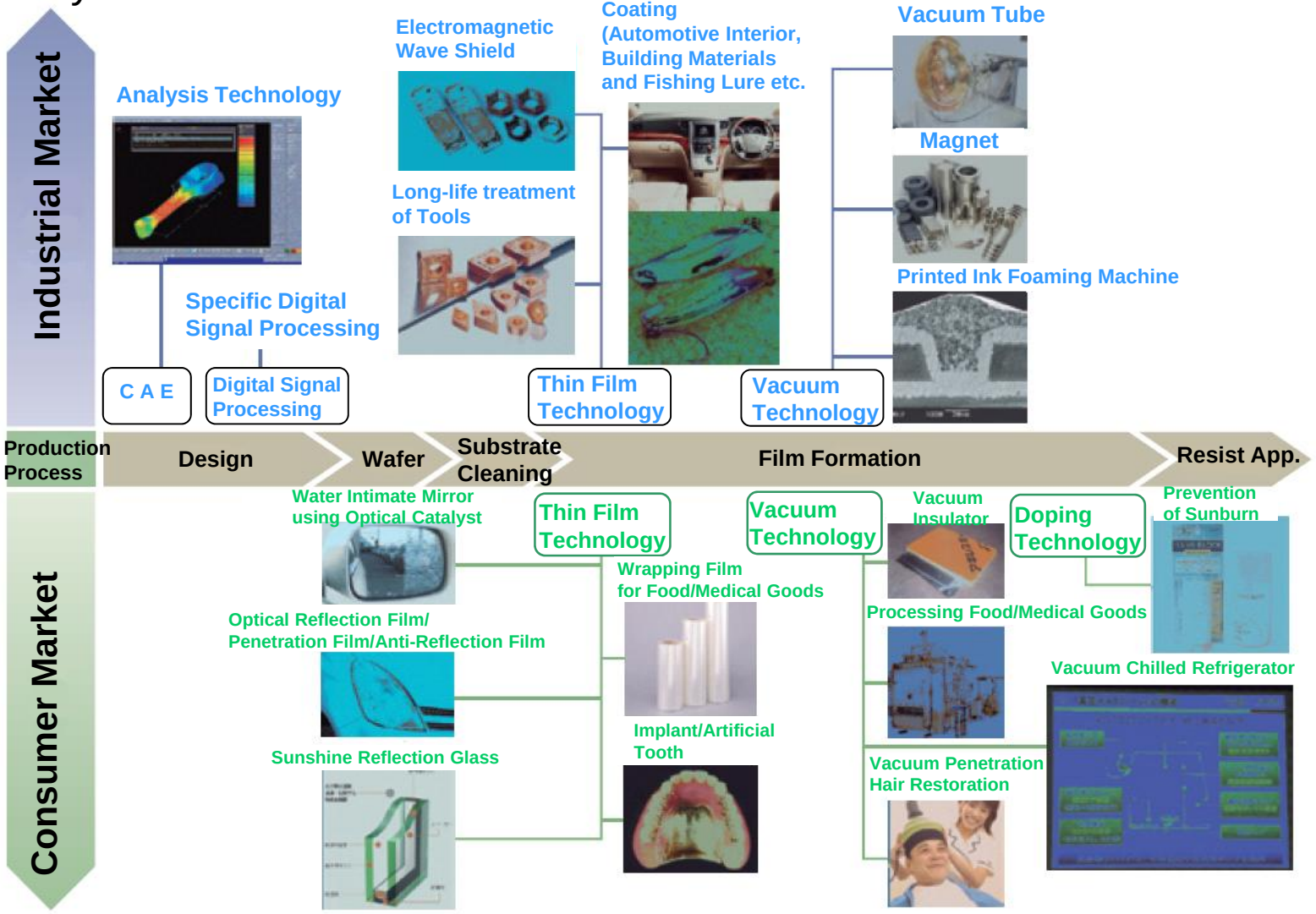
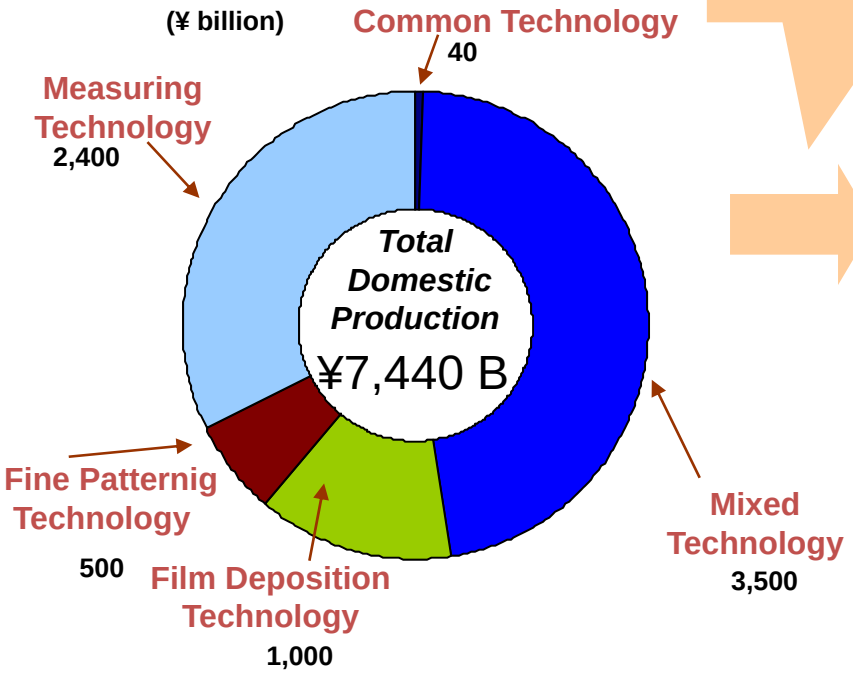
a) Semiconductor Technology Spreading-out

Technology Spreading-out refers to the effect that technology advances in one industry have on other industries.



Technology Spreading-out Effect in Japan

Markets of the Products utilizing Semiconductor technology in Japan (Fiscal Year 2007)



To multiply attributable fraction of each technology

To calculate by using the inter-industry relations table

First Effect

¥5,500 B

Second Effect

¥16,000 B

Total Value

¥21,500 B

$$\sum_{y=1970}^{2007} Total\ Value\ (y) = ¥399\ \text{trillion.}$$

Technology Spreading-out Effect Comparison

	Aviation Industry	Semiconductor Industry	Automotive Industry
Products	¥14 trillion	¥103 trillion	¥333 trillion
	1970～2000	1970～2007	1970～2000
Intra-Industrial Effect (Application Expansion)	¥12 trillion	¥285 trillion	¥872 trillion
	¥103 trillion	¥399 trillion	¥34 trillion
Inter-Industrial Effect (Technology Spreading-out)			

(Remarks) Semiconductor industry was figured based on industrial correlation table in 2005.
Automotive and Aviation industry were figured based on industrial correlation table in 1995.

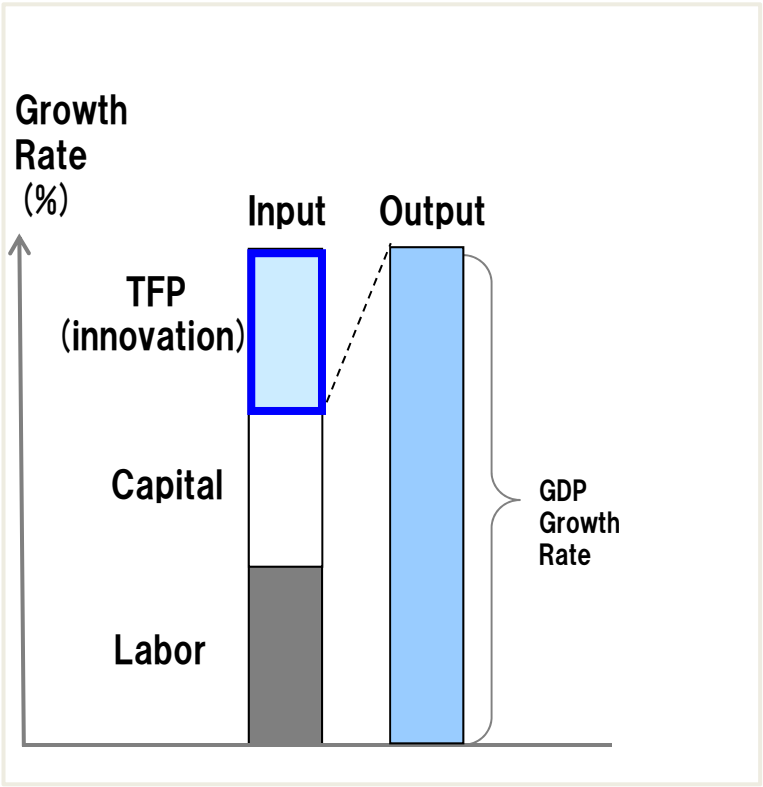
(Source) SIRIJ produced based on Mitsubishi Research Institute and Nikkei Electronics issued on July 28, 2008.

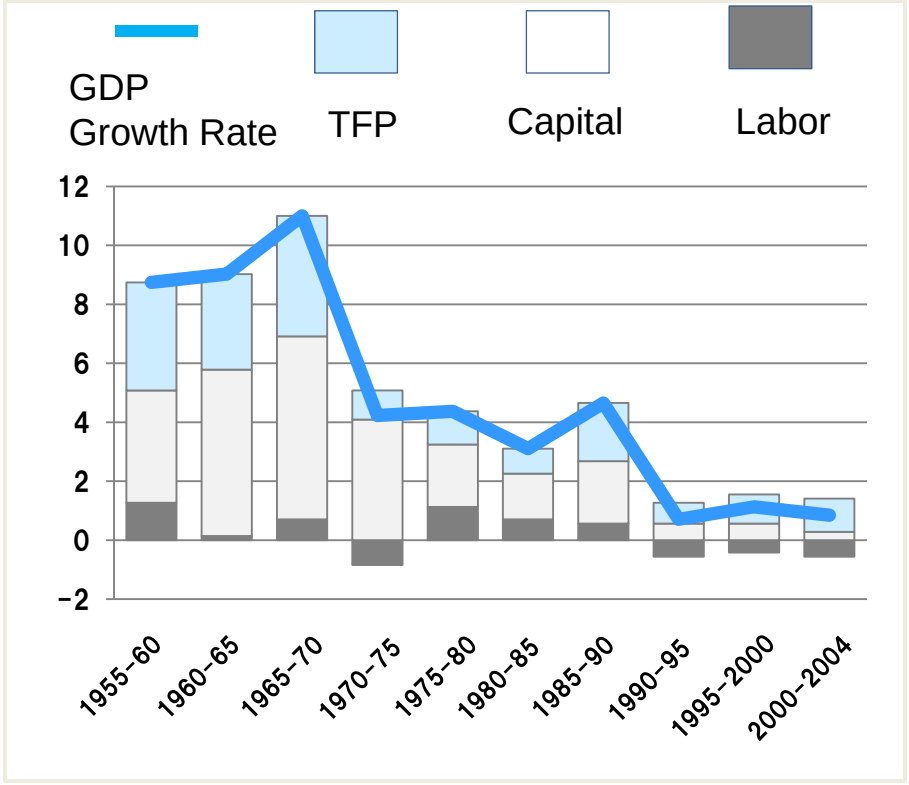
b) Total Factor Productivity (TFP)

TFP accounts for changes in economic output that are not caused by changes in the amount of labor and capital. TFP includes changes in labor productivity (output per worker) and capital productivity (output per unit of capital) due to factors such as technology advances, business model improvements, etc.

$$\Delta Product = \Delta Capital + \Delta Labor + \Delta TFP$$

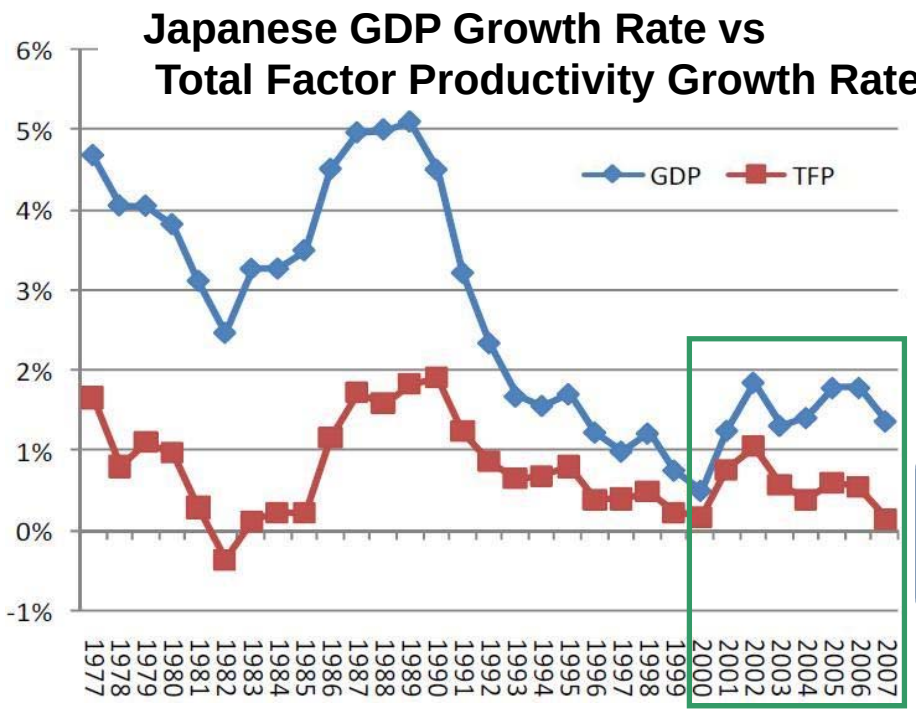
TFP: Based on Innovation





TFP Influence on GDP Growth Rate

TFP: Total Factor Productivity
- Innovation
- Innovation-originating improvements of labor and capital
- Management efficiency Improvement
- - -



< 2000 - 2007 in Japan >

- Average GDP Growth Rate from 2000 to 2007 is 1.45%.
- Average TFP Growth Rate in same period is 0.57%.

TFP contribution to GDP growth rate
~40%

(Source) Professor Motohashi, Tokyo University

Semiconductor Contribution to TFP

Semiconductor Innovation → Higher Performance, Lower Price, New business Model → TFP Growth

			2000-2007
TFP Growth Rate			0.57%
TFP Analysis	IT	Computers	0.14%
		Software	0.01%
		Communication	0.06%
		Semiconductors	0.04%
		Sub total	0.25%
	Non IT	Semiconductors	0.09%
		Others	0.23%
		Sub total	0.32%
		Total	0.57%
Semiconductor Total			0.13%

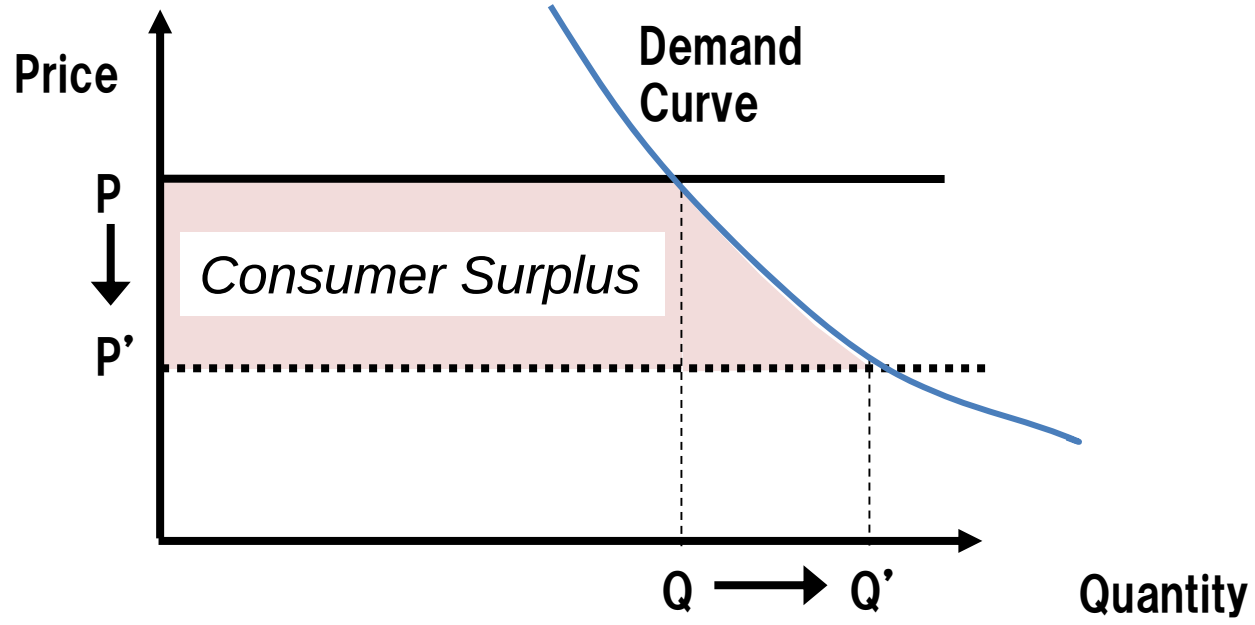
Semiconductor Portion in TFP

23% (=0.13/0.57) @2000-2007, Japan*

*Since the model is generalized, it is applicable to any country/region.

c) Consumer Surplus by Semiconductor Innovation

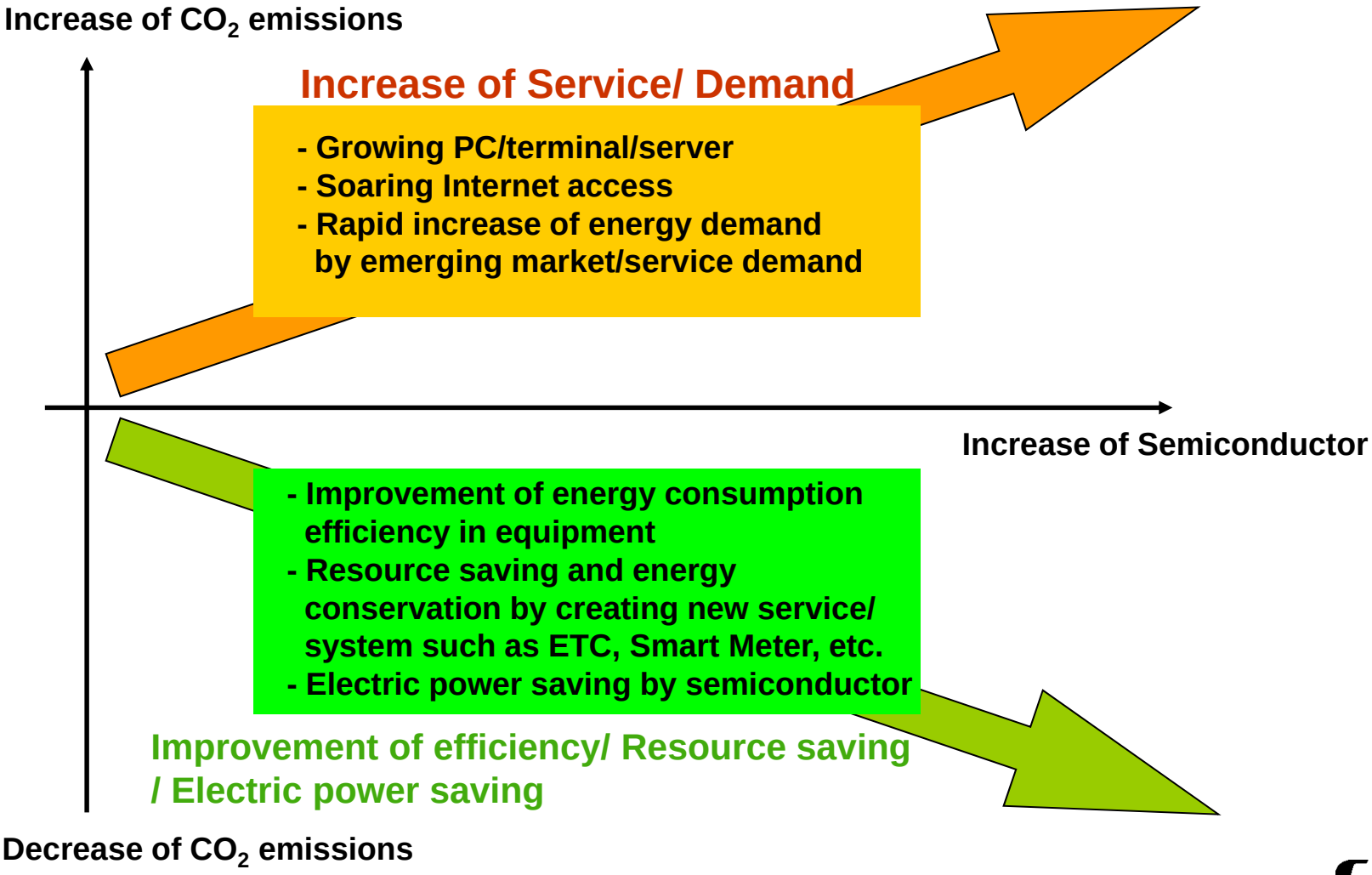
Consumer surplus is the difference between the maximum price a consumer is willing to pay and the actual price they do pay. Economists measure consumer surplus to quantify the benefits that consumers receive from falling prices.



Consumer Surplus by Semiconductor Innovation : ¥6.67 T ('95-'05)

d) Green of/by Semiconductors

Do Semiconductors Contribute to the Reduction of CO_2 Emissions?

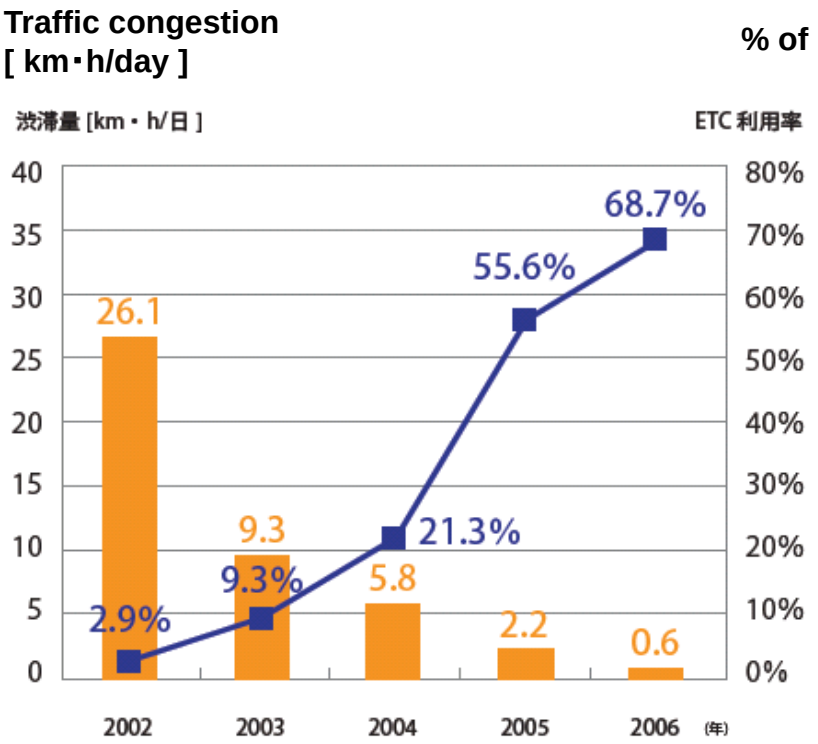


Reduction of CO_2 Emission by ETC

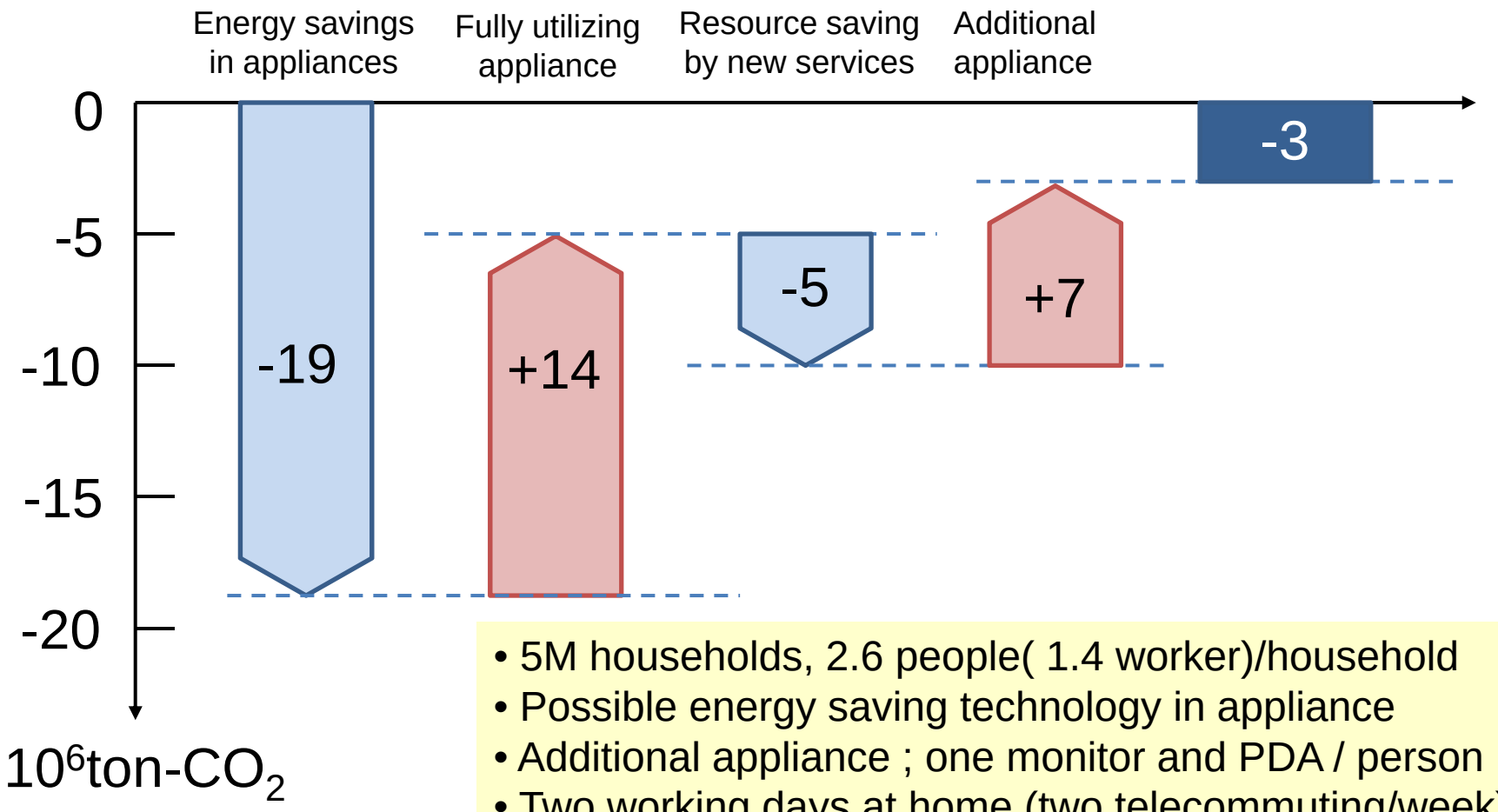
ETC : Electronic Toll Collection System

ETC Use
>80% @2010

2006 CO_2 reduction by ETC in Japan :
160 thousand ton-CO_2



Energy Consumption Reduction in Future Homes



- 5M households, 2.6 people(1.4 worker)/household
- Possible energy saving technology in appliance
- Additional appliance ; one monitor and PDA / person
- Two working days at home (two telecommuting/week)

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Market Trends

Market of Embedded Computing
(Digital Consumer, Automotive, Industrial)

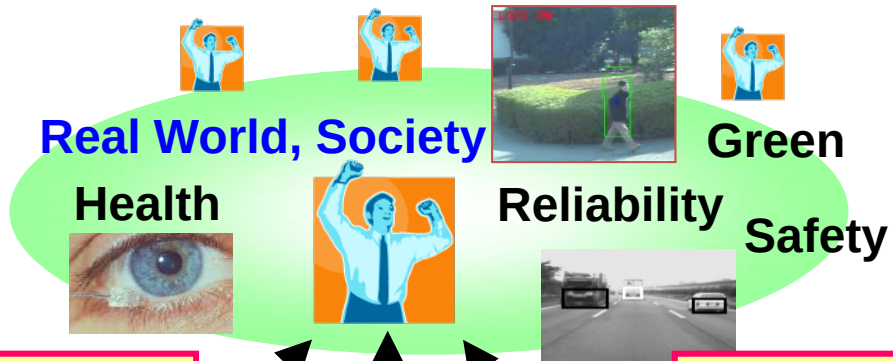
Future Market of Symbiotic Computing
Existing and New Market

Ubiquitous

Convenience & Entertainment

Symbiotic

Assist & Support People



Connectivity

Intelligence

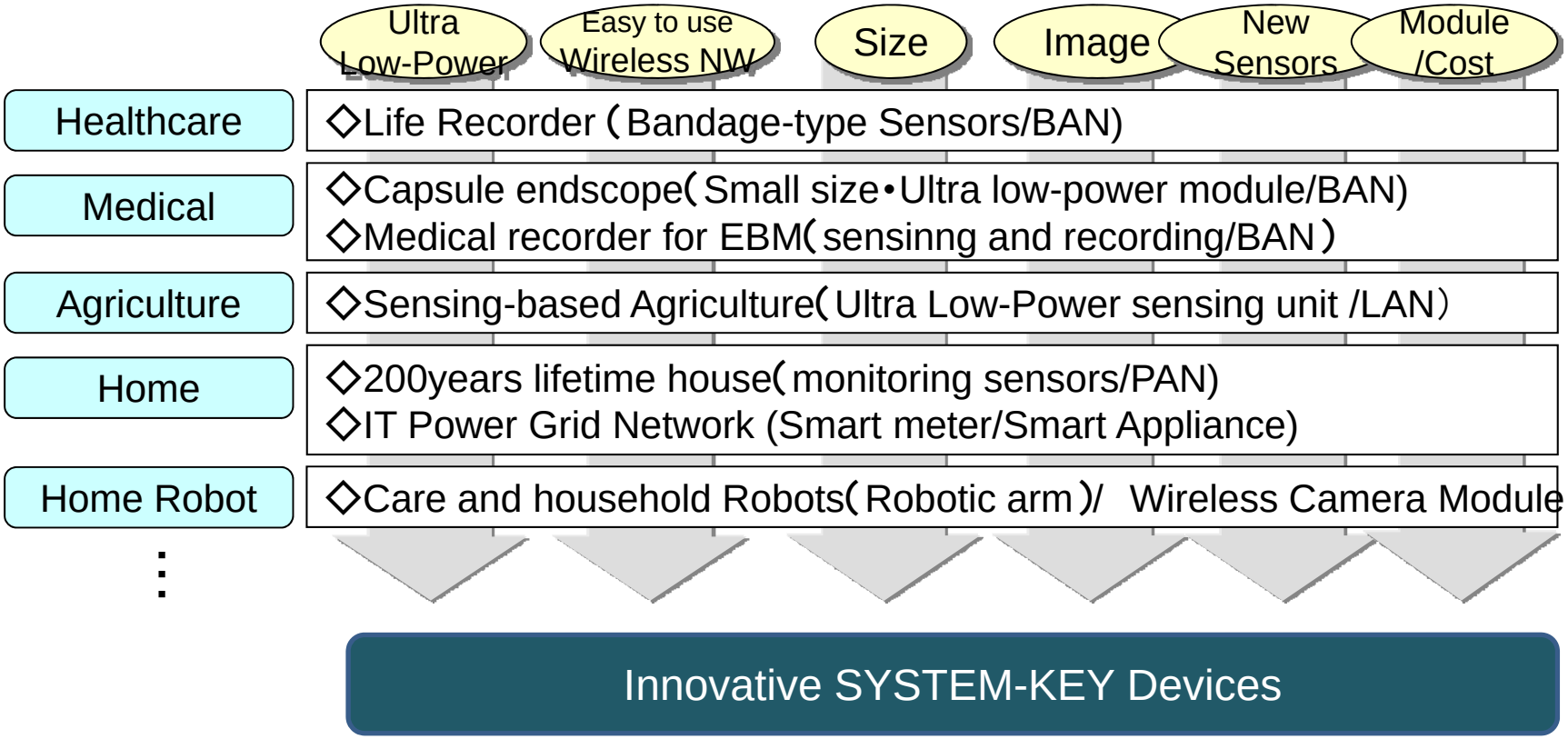
Sensor Net
BAN
NGN
Robot
Wearable
Home Network
（Wireless HD etc）
Cognitive Radio
Smart Grid
Intelligent Vehicle
（Computer Vision）

Deeper Man-Machine Collaboration (Symbiosys)
by the Reliable Embedded Computing Network

Low Cost, Energy Conscious, Dependability

Expectations for Semiconductors

Compact and low-power wireless devices
Efficient image recognition
New sensors
Efficient power supply
Service oriented

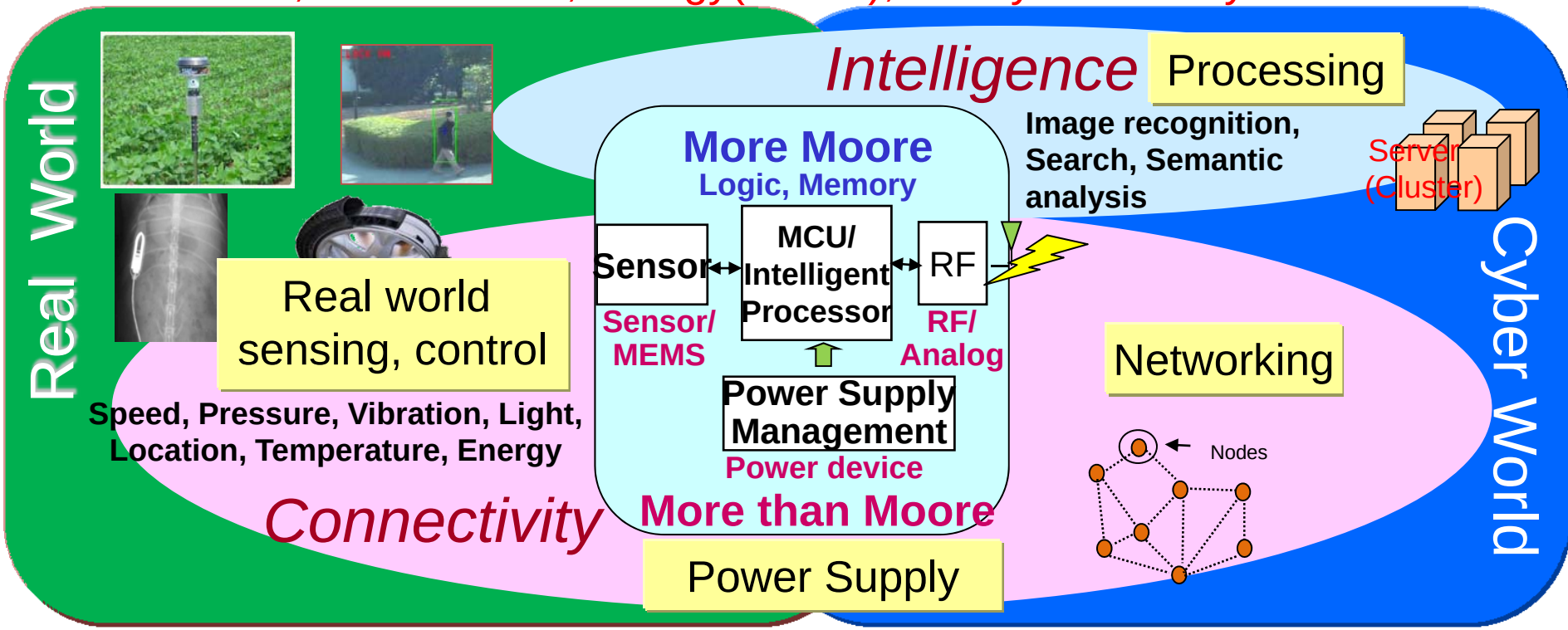


Challenges for “Symbiotic Society”

Electronics devices are now penetrating into the society more deeply, and are directly connected to human beings and environment.

New markets of Symbiotic Society: ”Cyber-World” + “Real-World”

Health care, Environment, Energy(Green), Safety & Security



1) Functional devices: RF, analog, sensors, MEMS and photonics.

2) Intelligent devices for vision, voice and security.

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Semiconductor's Contribution to our Society (Japan*)

Employment: 200 thousand (Inc. application 2.4 million)

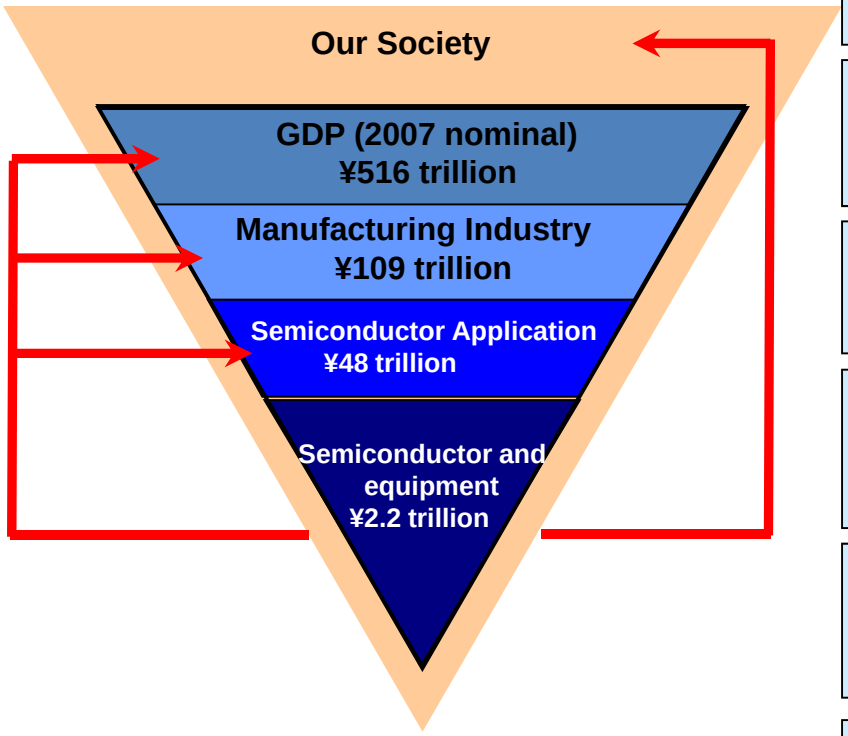
Share in GDP of Manufacturing: 44% (Inc. application)

Trade balance: ¥37 trillion (Inc. application)

CO_2 reduction by Semiconductor & IT: 18 million ton/year

Power Consumption of Semiconductor: 2000=100 ⇒ 2007=6

Market of Nano Electronics applied equipment: ¥40 trillion in 2035



Intra-Industrial Effect: ¥285 trillion (1970~2007, accumulated)

Inter-Industrial Effect: ¥399 trillion (1970~2007, accumulated)

Technology spreading-out to 24 industries

Semiconductor's attributable fraction of TFP: 23% (2000~2007)

Consumer Surplus originated by Semiconductor Innovation: ¥6,699 billion (1995~2005)

Energy Saving in Future Home: 3 million ton-CO_2/year

*The model used here can be general, and be applied even in another country and another region.