Intellectual Capital for Communities
In the Knowledge Economy

Digital Data: A New Class of IC

~ Japanese Knowledge / IC Agenda, an update ~

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Abstract

After briefly updating Japanese landscape of measurement and promotion of intangibles for innovation and growth, the presentation shall focus upon growing torrent of digital data as a new class of intellectual capital. A large amount of data, digitized and often transferred across organizational boundaries, is becoming a key factor of production and competition, as well as a promising solution to societal challenges. Socio-economic values of big data also raises a set of policy issues, including privacy, security, intellectual property and fair access.

Outline

- Knowledge / IC Agenda in Japan
  - Measurement of Intangibles & Performance
  - Knowledge / IC Agenda in the Policy Initiatives

- Digital Data : a New Class of IC
  - Growing Torrent of Digital Data ("*Info-plosion*")
  - Socio-Economic Value of Data-driven Innovation
  - Challenges for Harnessing "Big Data"

Knowledge / IC Agenda in Japan
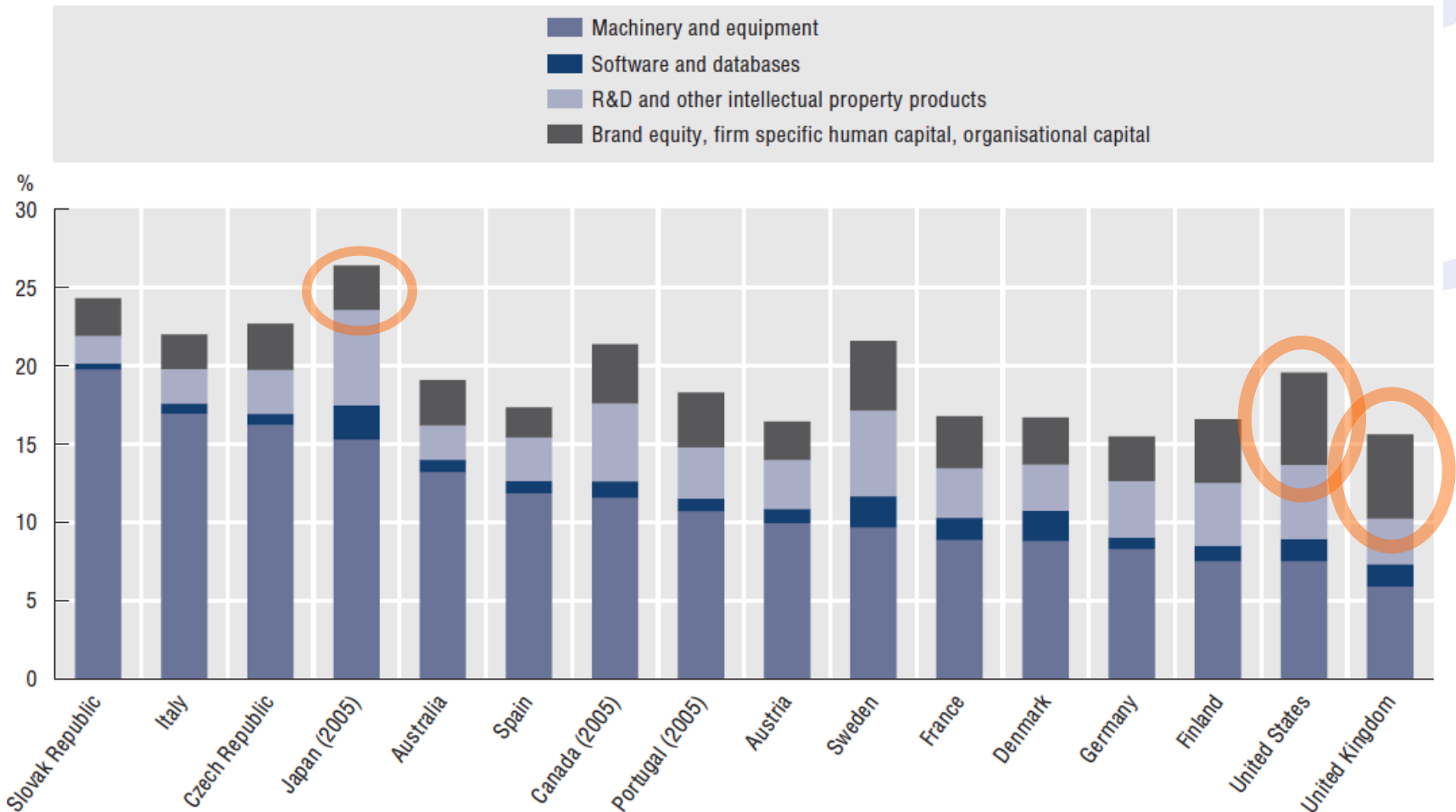## ~ Measurement of Intangibles~

- Measurement of Intangibles & Performance
  - Intellectual Asset Management & Reporting
  - Research on Intangibles / Knowledge Network
  - 3rd Innovation Survey (2012)
  - 2008 SNA (2011~2016)

IC & Performance Measurement
~ Aggregated Level ~

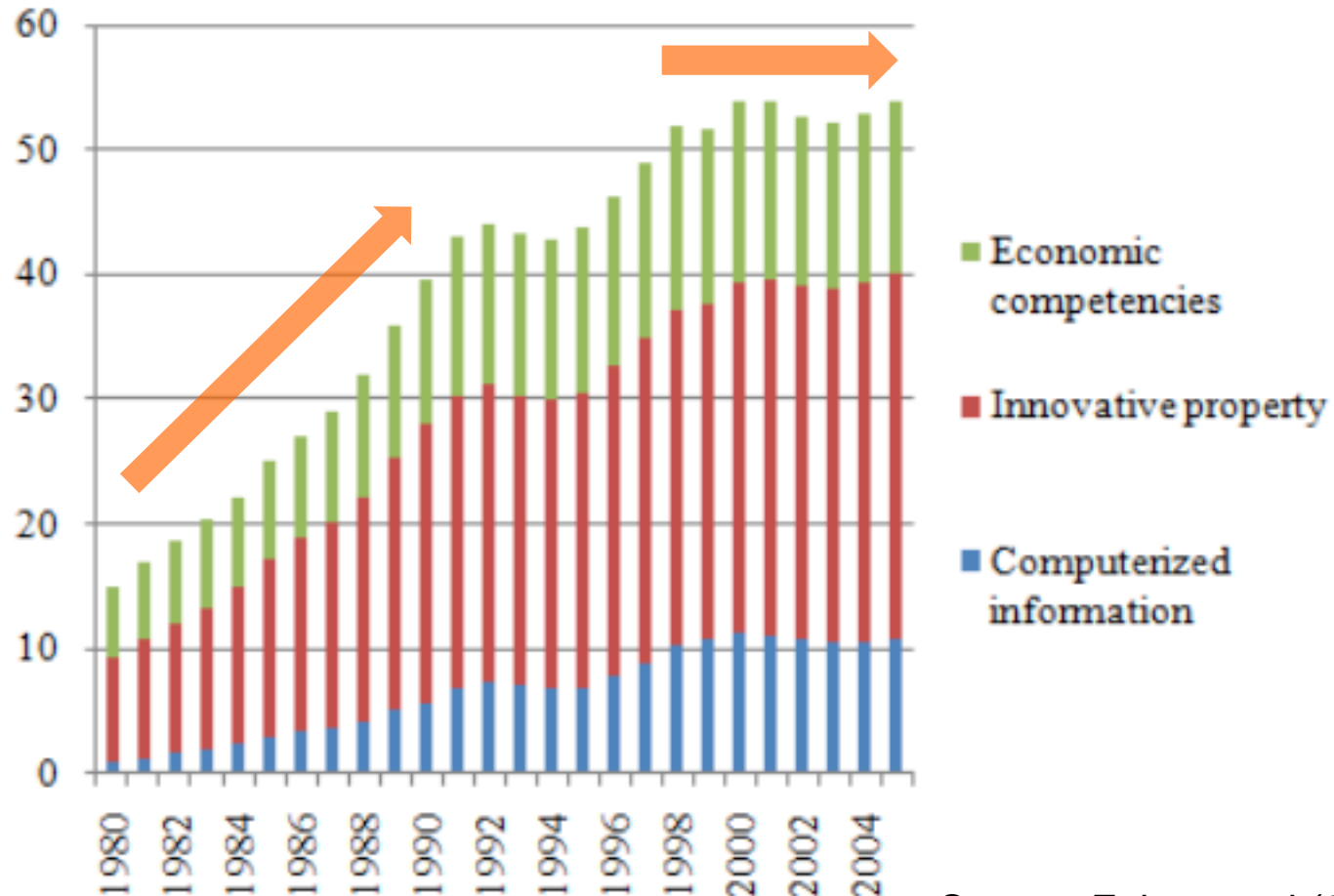**Investment in fixed and intangible assets as a share of GDP, 2006**

- Machinery and equipment
- Software and databases
- R&D and other intellectual property products
- Brand equity, firm specific human capital, organisational capital

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Source: OECD (2010)

IC & Performance Measurement
~ Aggregated Level ~

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Intangible Investment in Japan

trillions of yen

Legend:
- Economic competencies (green)
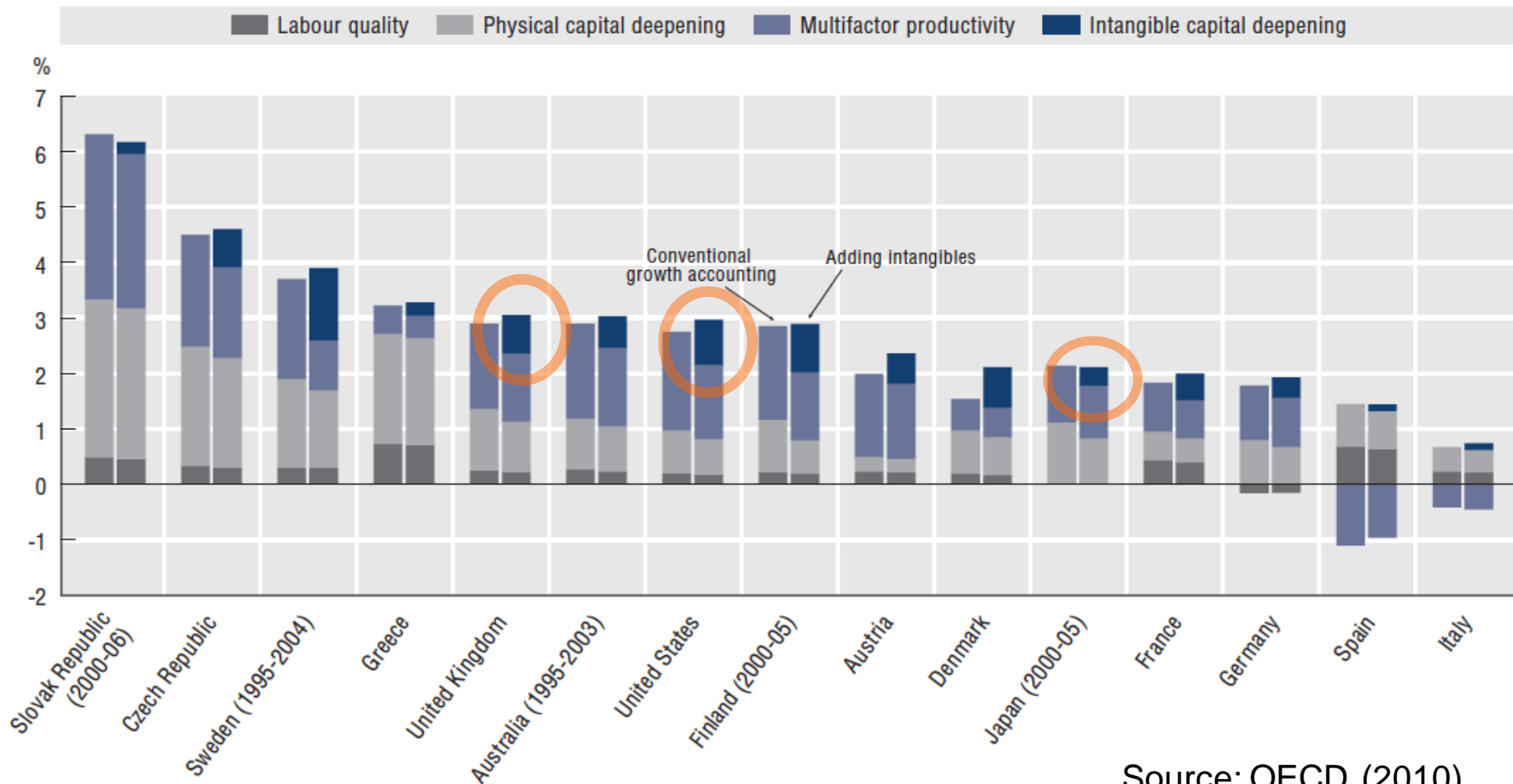- Innovative property (red)
- Computerized information (blue)

Source: Fukao et al (2009)

IC & Performance Measurement
~ Aggregated Level ~

Labour productivity growth: adding the contribution of intangible assets, 1995-2006

Legend: Labour quality · Physical capital deepening · Multifactor productivity · Intangible capital deepening

Conventional growth accounting

Adding intangibles

Categories: Slovak Republic (2000-06), Czech Republic, Sweden (1995-2004), Greece, United Kingdom, Australia (1995-2003), United States, Finland (2000-05), Austria, Denmark, Japan (2000-05), France, Germany, Spain, Italy

Source: OECD (2010)

IC & Performance Measurement
~ Firm Level ~

- **Growth accounting approach**: applying CHS to financial statements
  - Hulten (2010)

- **Production function approach**: estimating production function including intangibles
  - Lev & Radhakrishnan (2005), Bloom & Van Reenen (2007), and Miyagawa et al (2010)

- **Market value approach**: value of intangibles from the market value residual unexplained by tangible assets
  - Yang & Brynjolfsson (2001), Miyagawa & Kim (2008), and Hulten & Han (2008)

IC & Performance Measurement
~ Firm Level ~

Growth Accounting in Microsoft

(%)

	1988– 94	1995-2000	2000-06	1988-2006
Growth in output	45.3	30.0	12.2	30.0
Labor input	5.1	2.1	1.5	3.0
Intermediate input	8.8	4.7	2.6	5.5
Tangible capital input	3.8	1.6	0.5	2.1
Intangible capital input	16.9	15.5	6.9	13.3
MFP growth	10.9	6.1	0.8	6.2

Source: Hulten (2010)

IC & Performance Measurement
~ Firm Level ~

Distribution of Management Scores
(Organizational Management)
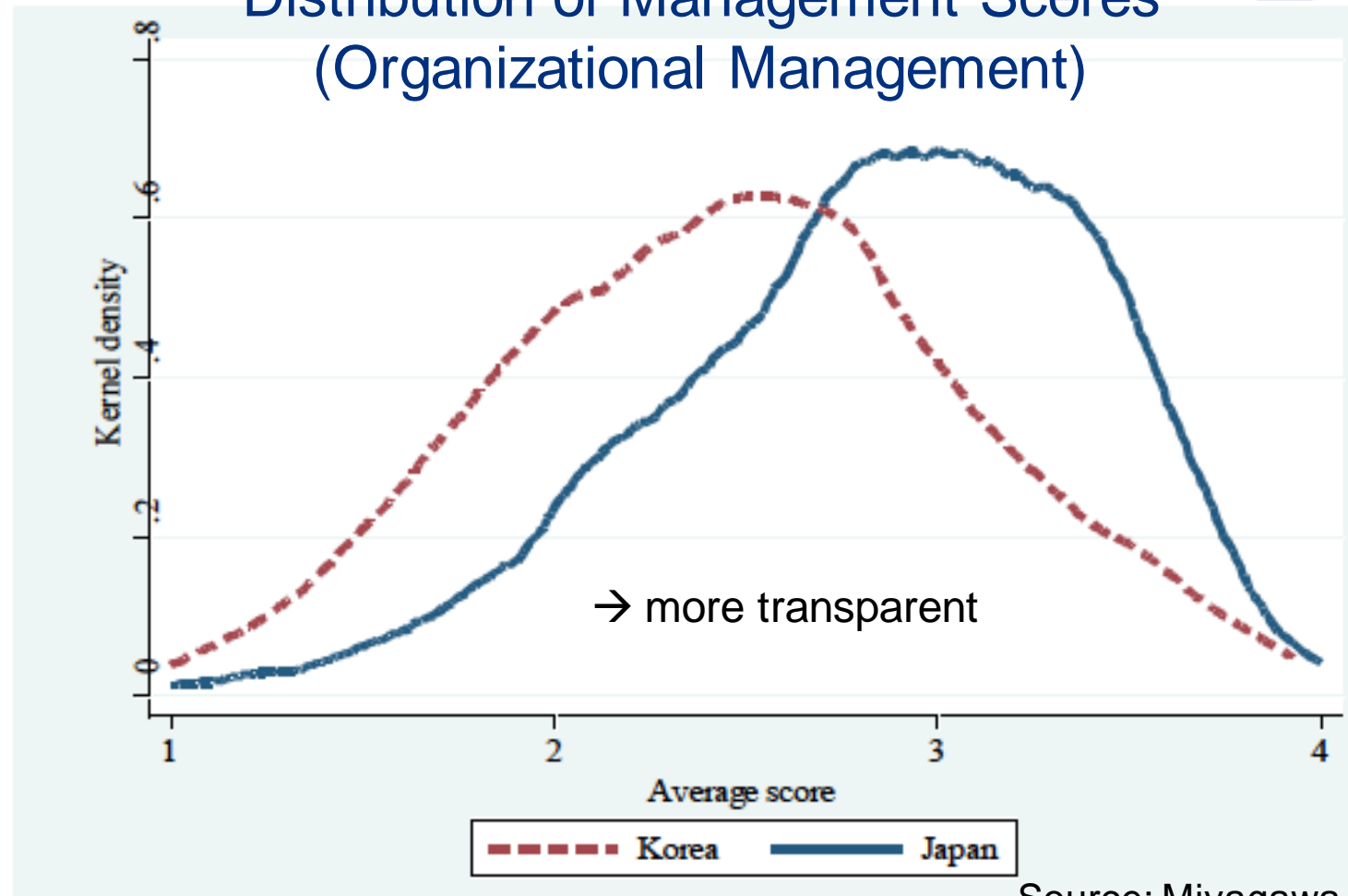
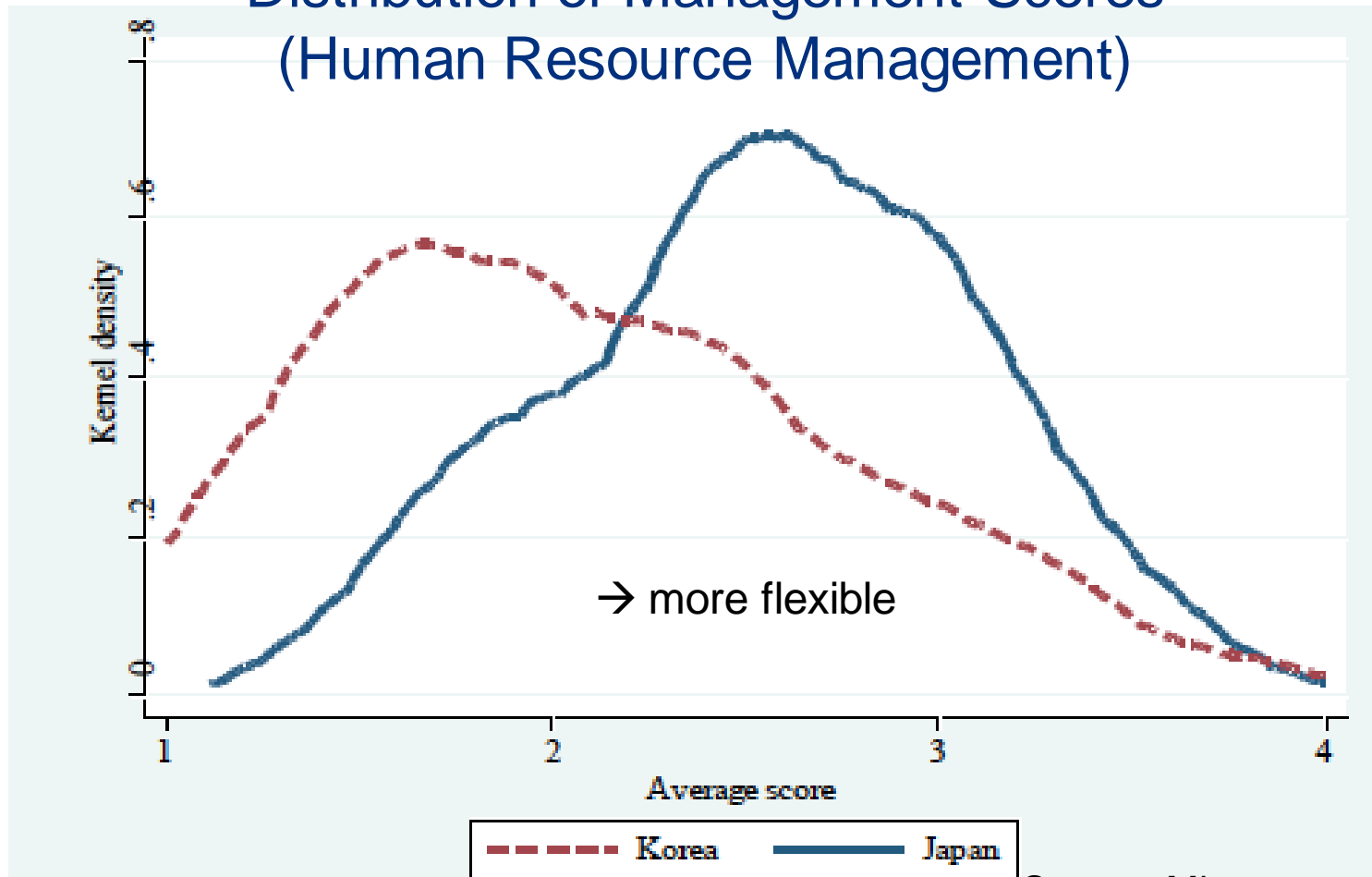
→ more transparent

Korea — — — —   Japan ————

Source: Miyagawa et al (2010)

IC & Performance Measurement
~ Firm Level ~

Distribution of Management Scores
(Human Resource Management)

→ more flexible

Source: Miyagawa et al (2010)

IC & Performance Measurement
~ Firm Level ~

	lnY		ln(Y/L)		lnTFP (Tornqvist index)	
	Japan	Korea	Japan	Korea	Japan	Korea
Management Score	-0.012	0.009	-0.045	0.009	-0.01	0.009 **
	[-0.757]	[1.477]	[-1.222]	[1.477]	[-0.670]	[2.063]
Organizational Reform	0.029 *	-0.015	0.052	-0.015	0.034 **	-0.004
	[1.898]	[-0.788]	[1.606]	[-0.788]	[2.500]	[-0.277]
lnK	0.03 ***	0.032 **				
	[4.836]	[2.023]				
lnL	0.191 ***	0.132 ***	0.009	0.0228 *	0.008	0.017 *
	[14.711]	[5.549]	[0.694]	[1.959]	[1.407]	[1.921]
lnM	0.779 ***	0.858 ***				
	[69.427]	[41.16]				
ln(K/L)			0.067 ***	0.0323 **		
			[5.012]	[2.023]		
ln(M/L)			0.467 ***	0.858 ***		
			[19.086]	[41.16]		
Constant	0.979 ***	1.505 ***	0.603 ***	1.505 ***	-0.076	-0.105 **
	[17.819]	[7.056]	[4.379]	[7.056]	[-1.436]	[-2.114]
Observations	520	349	520	349	510	340
R2	0.991	0.983	0.832	0.954	0.018	0.083
Adjusted-R2	0.991	0.983	0.829	0.952	0	0.058
F value	6026.6	1491	256.6	379	1.8	3

Note 1. Robust t statistics in parentheses.

2. * significant at 10%; ** significant at 5%; *** significant at 1%.

Source: Miyagawa et al (2010)

IC & Performance Measurement
~ Firm Level ~

- ## Miyagawa & Kim (2008)
  - Intangible assets, which are complementary to R&D and advertising expenditures, increased MFP growth rate at 0.1% at the firm.

- ## Brynjolfsson et al (2011)
  - firms that adopt "data-driven decision-making (DDD)" have output and productivity that is 5-6% higher what would be expected given their other investments and information technology usage.

Knowledge / IC Agenda in Japan
~ IC Agenda in the Policy Initiatives ~

- IC Agenda in the Policy Initiatives
    - New Growth Strategy
    - 4th S&T&I Master Plan
    - New ICT Strategy (e-Gov 2.0)
    - Smart Grid / Smart Community

IC Agenda in the Policy Initiatives
~ New Growth Strategy (2010-20) ~

- **Global Market, BoP**
- **Local Development**

New Frontier

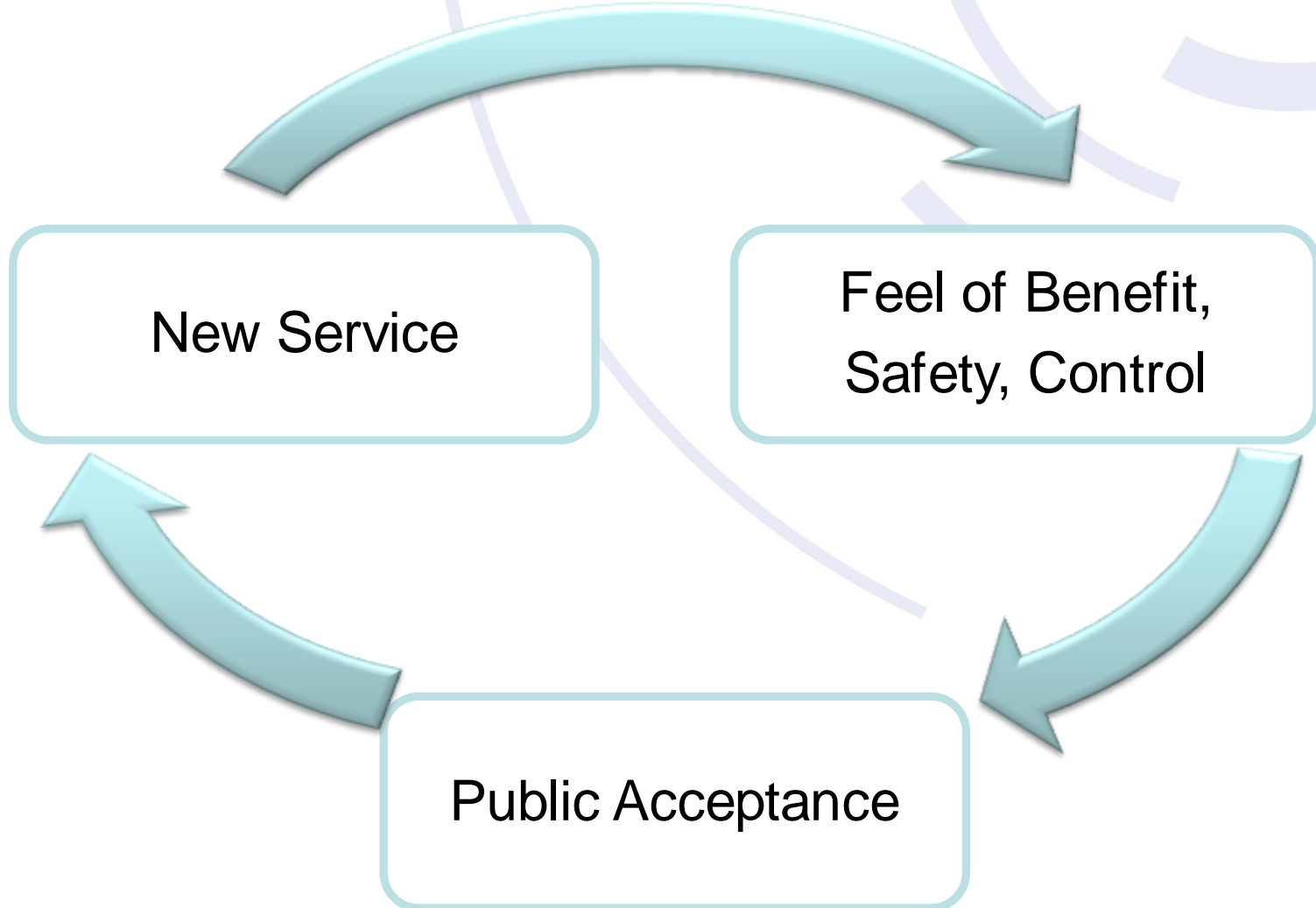**Innovation for Societal Challenge**

Growth Platform

- **Green Innovation**
- **Life Innovation**

- **S&T** ・ **ICT**
- **Human Resource**

Sustainable Growth

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IC Agenda in the Policy Initiatives
~ New Growth Strategy (2010-20) ~

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New Service

Feel of Benefit, Safety, Control

Public Acceptance

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IC Agenda in the Policy Initiatives
~ 4th S&T&I Master Plan (2012-17) ~

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Agile innovation for short time to market !

Venture carve-out

Sell-off sleeping IPs

Firm

Alliance

University / RI

Firm

No.1

M&A / A&D

Hi-tech Venture

Alliance

Firm

Alliance
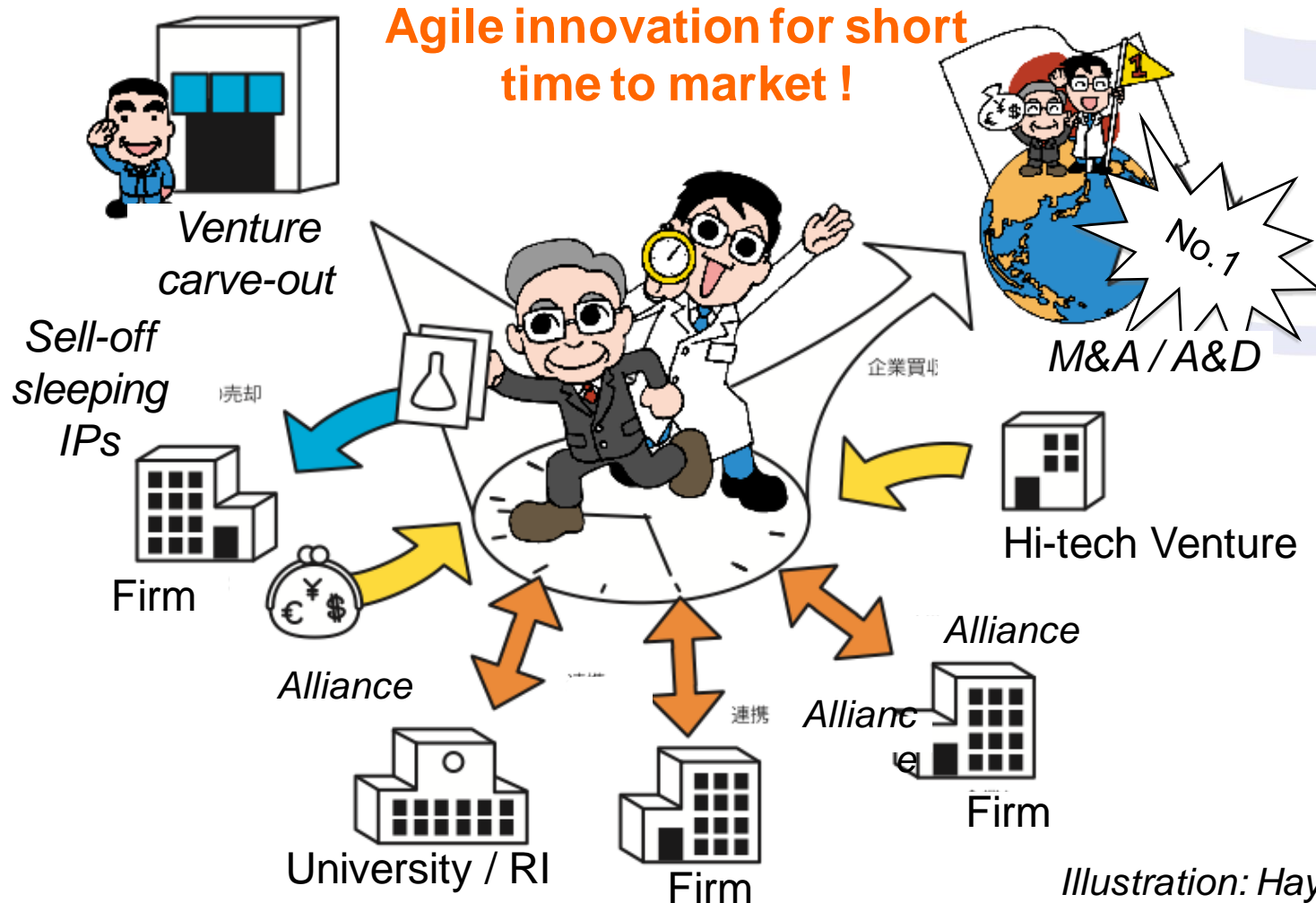
Illustration: Hayanon

IC Agenda in the Policy Initiatives
~ New ICT Strategy (e-Gov 2.0) ~

e-Government for the 21st Century

- Transparency
- Participation = Government as a Platform
- Collaboration

- Accountability
- Empowerment
- Trust for government
- Citizen's consciousness

IC Agenda in the Policy Initiatives
~ New ICT Strategy (e-Gov 2.0) ~

Animated and Empowered Individual

Information

Recognition

Resource

Efficient PR

Non-financial Reward

Measuring Impact

Collaboration Platform

Available IT resource

Knowledge-Creation Community
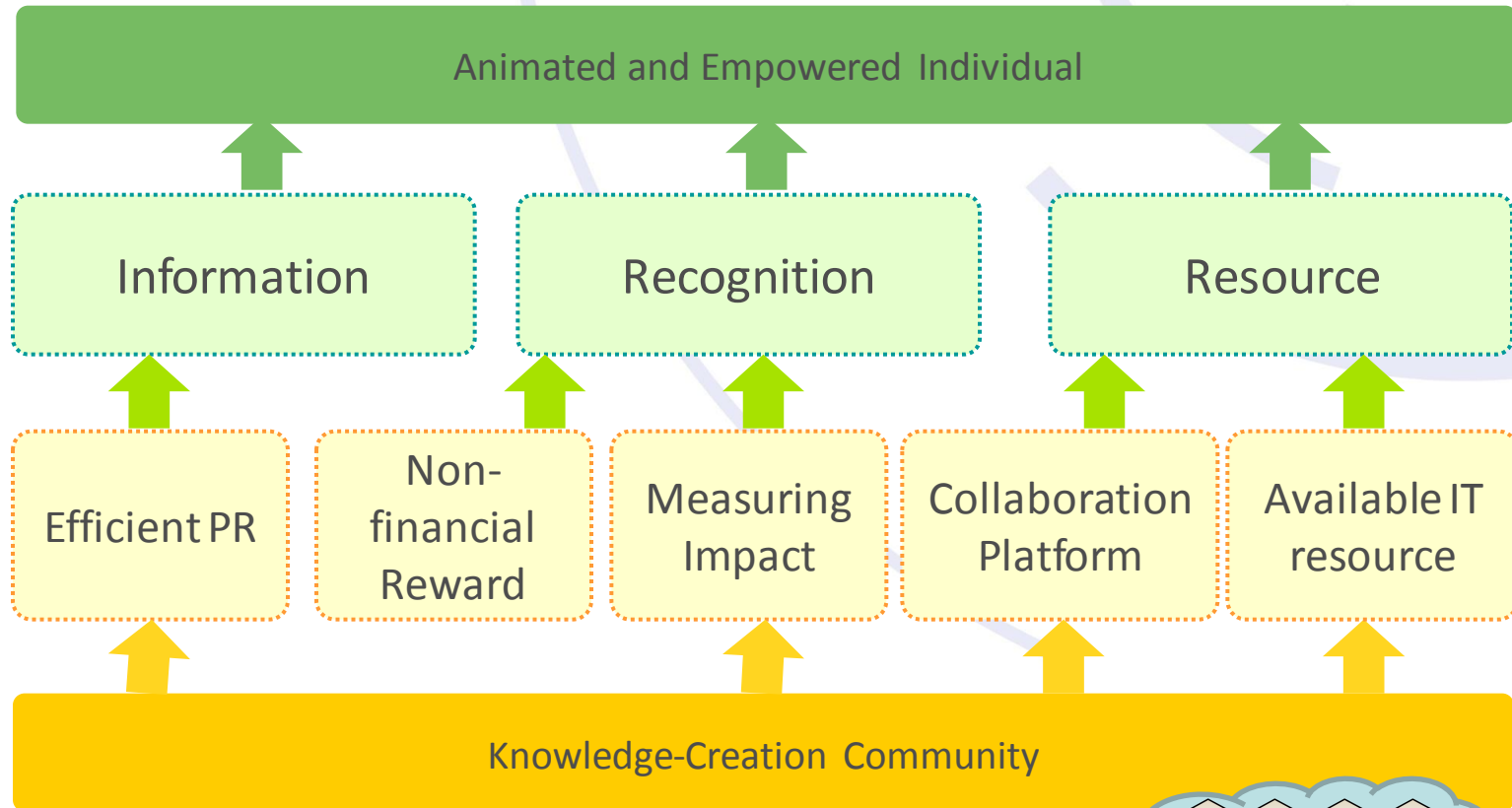
**Social Network Service in the "Cloud"
+ Data dissemination (Data.Gov)**

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IC Agenda in the Policy Initiatives
~ Smart Grid / Smart Community ~
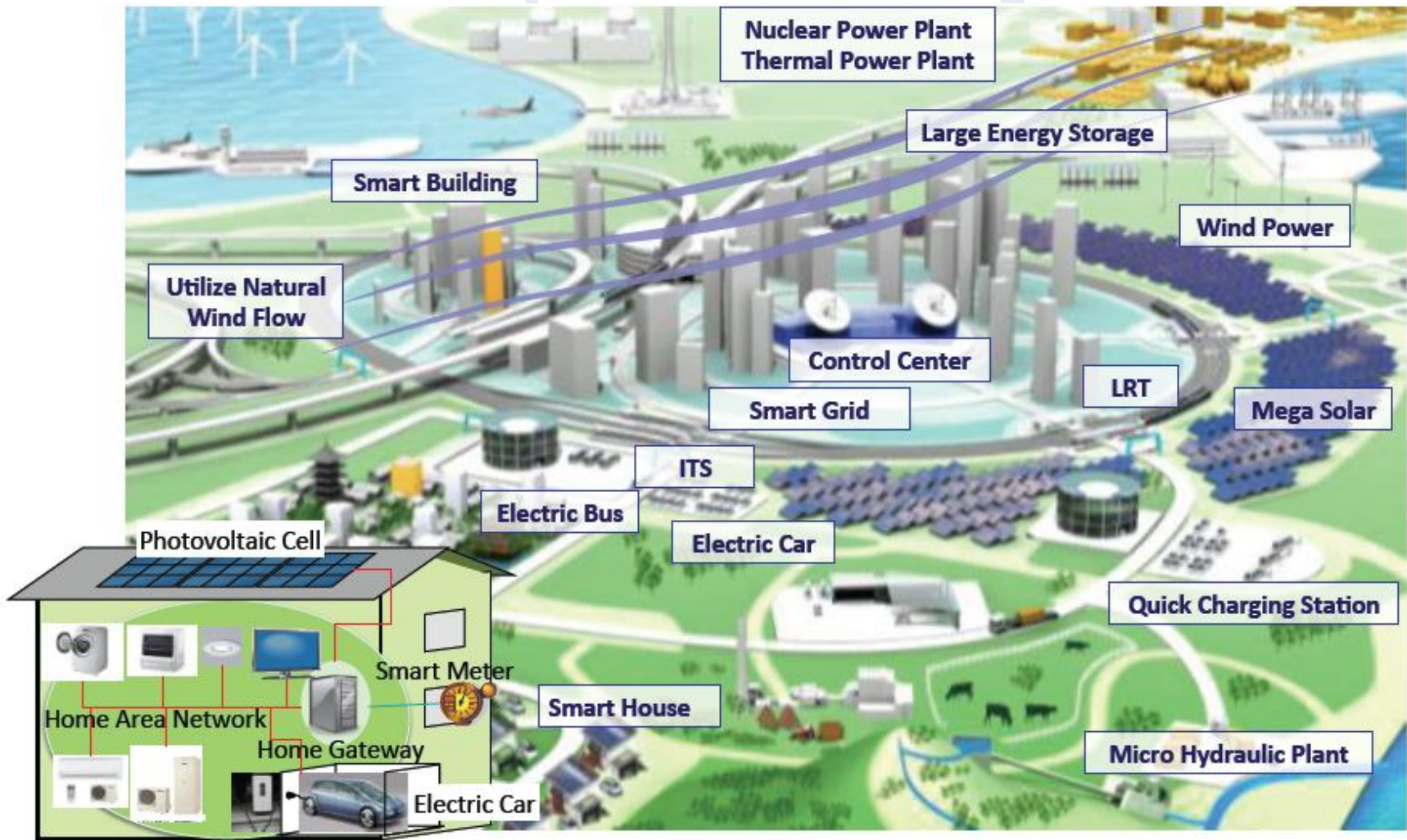
World Conference on Intellectual Capital for Communities
- Seventh Edition -

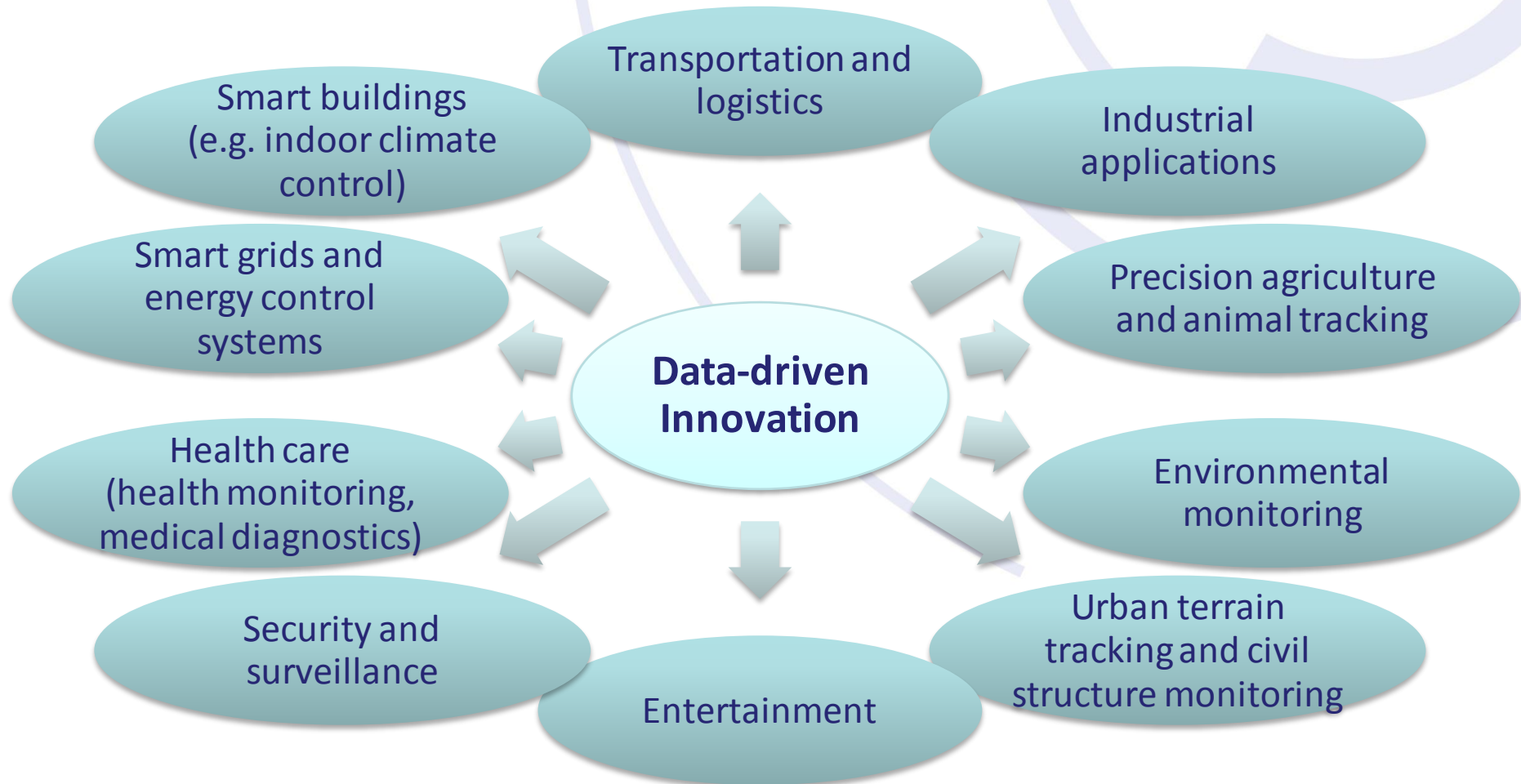# Digital Data : a New Class of IC
~ " Info-plosion " ~
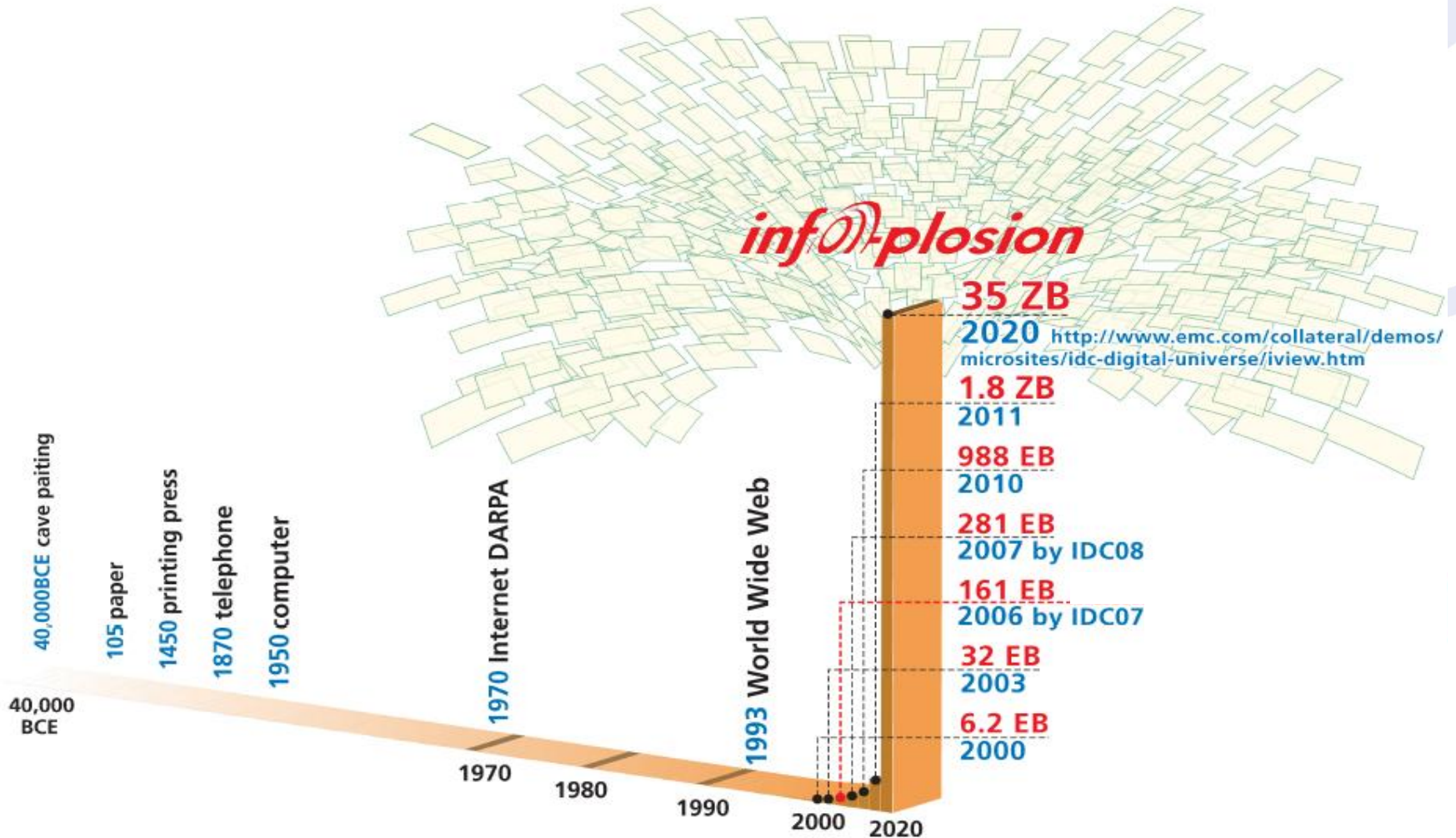
Digital Data : a New Class of IC
~ Eco-System of Data-driven Innovation~

data privacy, security

consumer protection

business, gov. and users

(smart) devices

huge amounts of **data**

innovation

- **System-wide Efficiency**
- **Citizen Empowerment**
- **New Service Creation**

security

ICT infrastructure
Broadband, Cloud Computing, Internet of Things, …
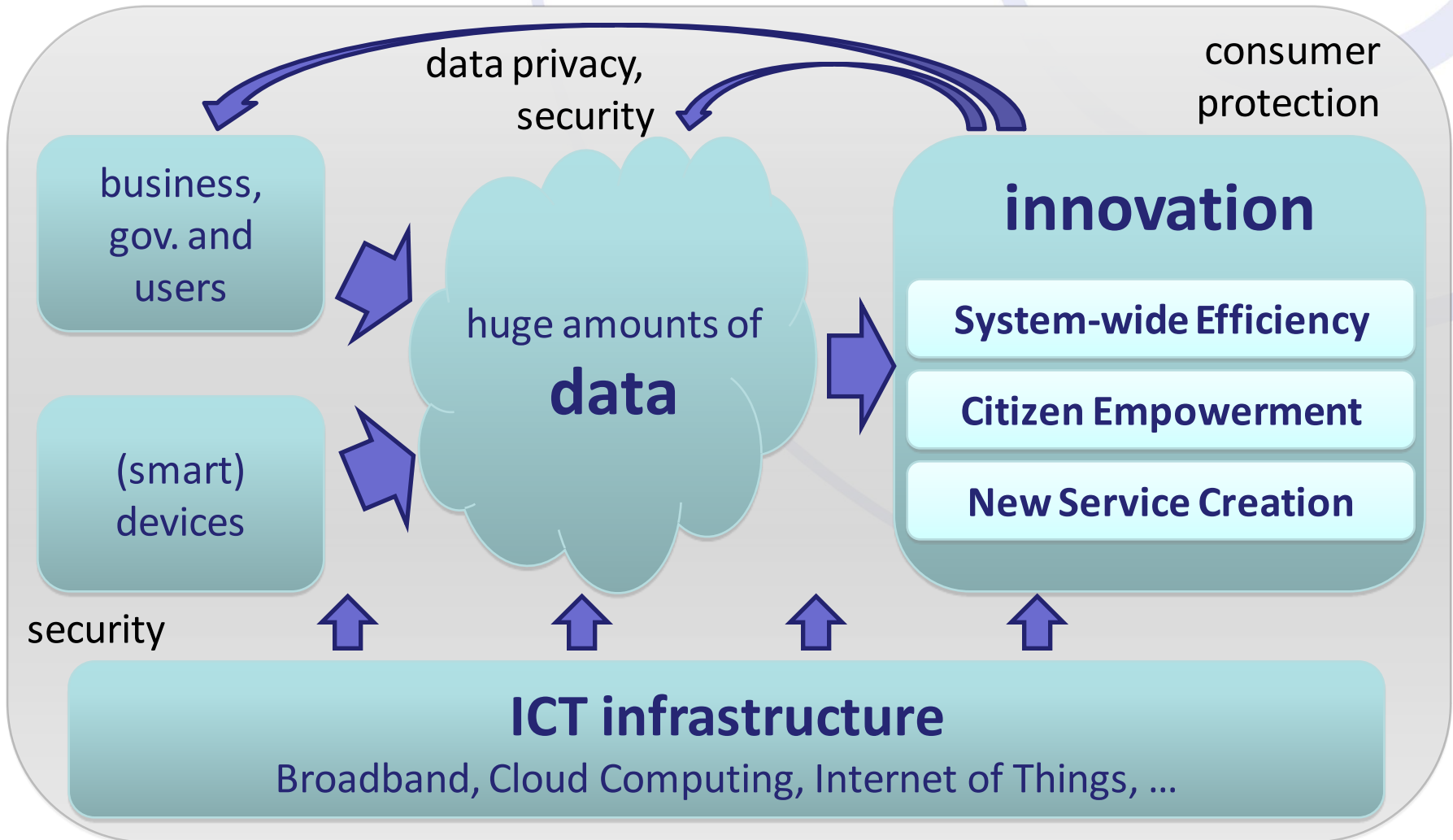
Digital Data : a New Class of IC
~ Beneficiaries of Data-driven Innovation~

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Data-driven Innovation

- Smart buildings (e.g. indoor climate control)
- Transportation and logistics
- Industrial applications
- Smart grids and energy control systems
- Precision agriculture and animal tracking
- Health care (health monitoring, medical diagnostics)
- Environmental monitoring
- Security and surveillance
- Entertainment
- Urban terrain tracking and civil structure monitoring

Source: OECD based on Culler et al., 2004, Heppner, 2007, Verdone et al., 2008

Digital Data : a New Class of IC
~ MGI "Big Data" Report~

- Big data: The next frontier for innovation, competition, and productivity

  http://www.mckinsey.com/mgi/publications/big_data/index.asp

  – $300 billion for US healthcare

  – €250 billion for Europe's public sector

  – $300 billion consumer surplus from utilizing personal location data

  – 1.5 million managers & analysts in the US to ask right questions

Digital Data : a New Class of IC
~ MGI "Big Data" Report~

MGI has compiled a heat map of the value potential of using big data across sectors

Legend:
- Top quintile (highest potential)
- 2nd quintile
- 3rd quintile
- 4th quintile
- Bottom quintile (lowest potential)
- No data available
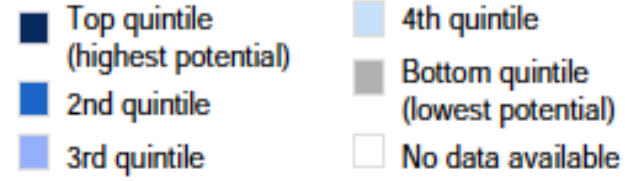
Categories	Sectors	Overall value potential index[1]	Amount of data per firm	Variability in performance	Customer and supplier intensity	Transaction intensity	Turbulence
Goods	Manufacturing	Bottom quintile	3rd quintile	3rd quintile	3rd quintile	4th quintile	3rd quintile
	Construction	Bottom quintile	4th quintile	Bottom quintile	4th quintile	3rd quintile	3rd quintile
	Natural resources	3rd quintile	2nd quintile	Top quintile	Bottom quintile	2nd quintile	4th quintile
	Computer and electronic products	2nd quintile	Top quintile	3rd quintile	Bottom quintile	3rd quintile	2nd quintile
	Real estate, rental, and leasing	2nd quintile	2nd quintile	2nd quintile	3rd quintile	Top quintile	Bottom quintile
	Wholesale trade	Top quintile	3rd quintile	Bottom quintile	2nd quintile	Top quintile	Top quintile
	Information	Top quintile	Top quintile	Top quintile	4th quintile	2nd quintile	Top quintile

Source: McKinsey Global Institute (2010)

Digital Data : a New Class of IC
~ MGI "Big Data" Report~

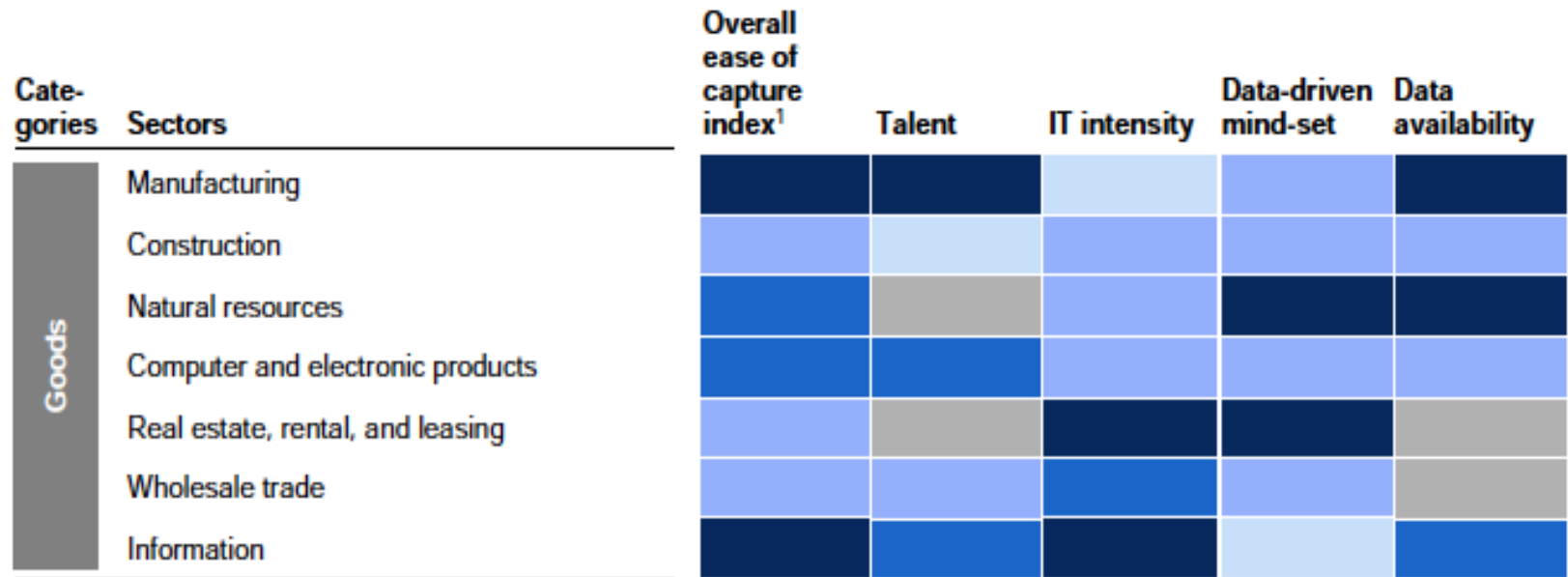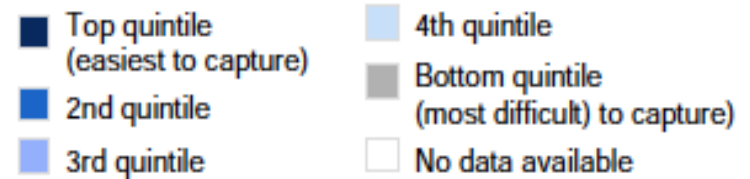Value potential Heat Map (contd.)

Source: McKinsey Global Institute (2010)

Digital Data : a New Class of IC
~ MGI "Big Data" Report~

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A heat map shows the relative ease of capturing the value potential across sectors

■ Top quintile (easiest to capture)	☐ 4th quintile
■ 2nd quintile	■ Bottom quintile (most difficult) to capture
■ 3rd quintile	☐ No data available

Categories	Sectors	Overall ease of capture index[1]	Talent	IT intensity	Data-driven mind-set	Data availability
Goods	Manufacturing					
	Construction					
	Natural resources					
	Computer and electronic products					
	Real estate, rental, and leasing					
	Wholesale trade					
	Information					

Source: McKinsey Global Institute (2010)

Digital Data : a New Class of IC
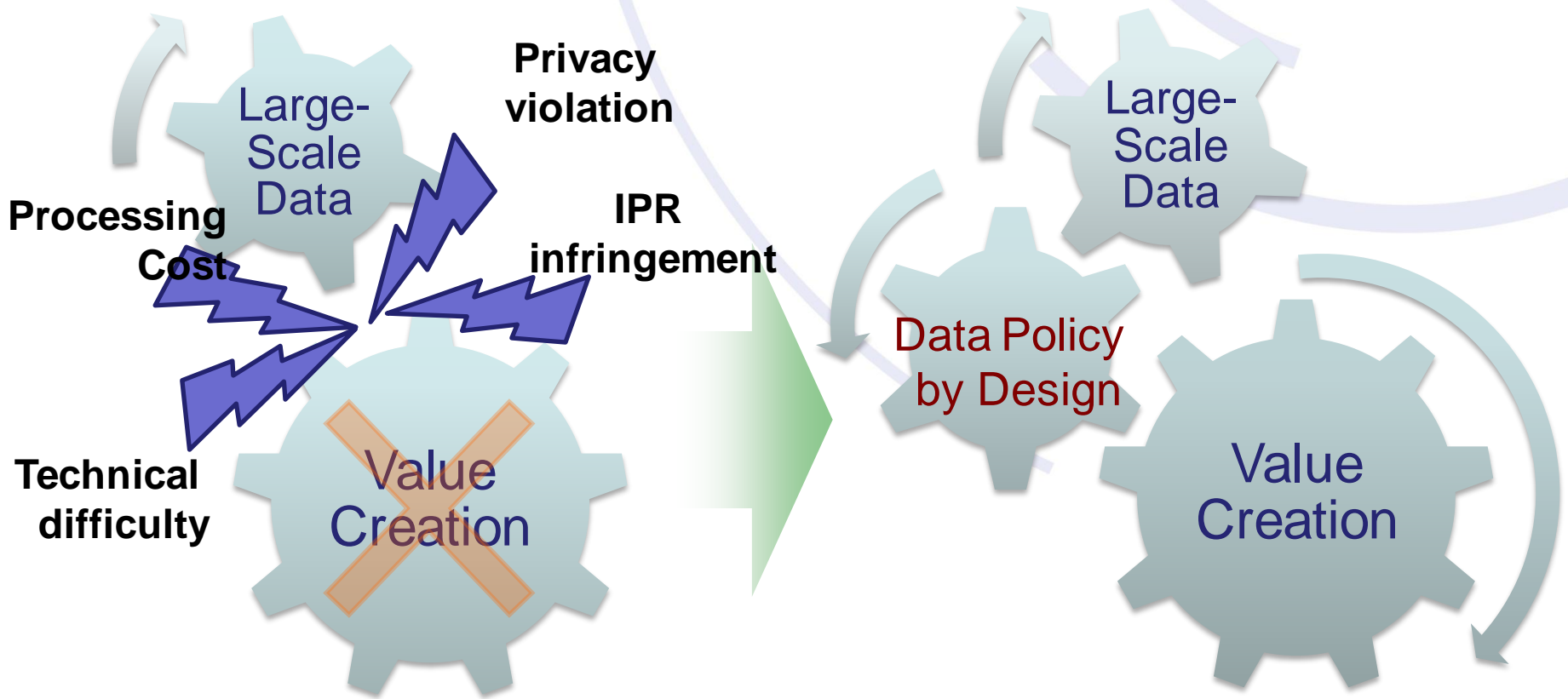## ~ MGI "Big Data" Report~

Ease of Capturing Heat Map (contd.)

Categories	Sectors	Overall ease of capture index[1]	Talent	IT intensity	Data-driven mind-set	Data availability
Services	Transportation and warehousing					
	Retail trade					
	Administrative, support, waste management, and remediation services					
	Accommodation and food services					
	Other services (except public administration)					
	Arts, entertainment, and recreation					
	Finance and Insurance					
	Professional, scientific, and technical services					
	Management of companies and enterprises					
Regulated and public	Government					
	Educational services					
	Health care and social assistance					
	Utilities					

Source: McKinsey Global Institute (2010)

Digital Data : a New Class of IC
~ Challenging Issues ~

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Large-Scale Data

Privacy violation

Processing Cost

IPR infringement

Technical difficulty

Value Creation

Data Policy by Design

Large-Scale Data

Value Creation

Digital Data : a New Class of IC
~ Policy Agenda ~

Sharing Vision and Strategy

R&D & Demonstration

Standardization, Interoperability, & Dependability

Balancing Innovation and Privacy/Security Protection

Building Human Resource for Data Analysis & Management

International Cooperation

"Knowledge is the key resource in society and knowledge workers are the dominant group in the workforce."

--- Peter Drucker

"Knowledge is the key resource in society, and all individuals shall be empowered and animated to be knowledge workers and/or knowledge citizens. … Let them be the dominant group in your society."

--- Yoshi TOJO @ IC6

"Knowledge is the key resource in society, and all individuals shall be empowered and animated with ubiquitous and timely information feedbacks to be knowledge workers and/or knowledge citizens. ... Let them be the dominant group in your society."

--- Yoshi TOJO @ IC7

Thank you!

Yoshiaki TOJO

Director General, General Affairs and Policy Planning
New Energy and Industrial Technology Development Organization

Yoshi TOJO is now responsible for policy planning and resource allocation of the NEDO, the largest R&D management agency in Japan. He has been long working on the issue of intangible enablers for innovation and economic growth. He conducted various national and international projects, including Information Grand Voyage Project (promotion of data-driven innovation, METI / Japan, 2007-2010) and Intellectual Assets and Value Creation Project (measurement of intangible capital, OECD, 2004-2008).

http://www.ytojo.com