The Japanese Software Industry: What Went Wrong? (and Why Is It Important?)

Robert E. Cole
Emeritus Professor: Haas School of Business
UC Berkeley
cole@haas.berkeley.edu

Visiting Researcher, ITEC,
Doshisha University, Kyoto, Japan

Emerging Transformational Signs

- Hardware depts. reporting to software (sw) depts.
- Hw companies turning into (sw) companies
- Sw co's now buying hw companies
- R&D departments more populated by sw personnel
- More of the value of high tech products contributed by sw meeting user needs, through enabling new functionalities.

Presentation Plan

- Sw as key driver of manufacturing capability
- Results of an analysis of U.S. & J. IT patents
- Strengths & weaknesses of Japanese software
- Comparative status of IT jobs in industry
- Sw's contribution to productivity

Monozukuri and Software

- Software increasingly drives manufacturing capability, through creating value and delivering services

- Monozukuri view sees sw as simply a facilitator of hardware capabilities.

Why is Japanese Hi-tech Manufacturing Losing It's Global Competitive Edge?

- J. firms excessive confidence in their monozukuri

- Quality perfectionism inhibits IT innovation

- What counts now is making quick strategic decisions, software capabilities & going global

- <u>Not enough for management to build up existing core capabilities when meeting new challenges.</u>

* Adapted from Kimura, Hidenori, Dir., Riken BSI-Toyota Collaboration Center.

CMU Researchers' Findings Regarding U.S. & J. IT Sector Patents Granted by USPTO:1980-2004

- IT Innovation increasingly sw intensive

- Hw patents increasingly cite sw patents

- J. IT innovation relies less on sw advances than U.S.IT innovation

- Sw innovation performance of Japanese IT firms increasingly lags U.S. counterparts, particularly in sw intensive IT sectors

- J. hi tech firms disproportionately located in less sw intensive sectors & within those sectors, they are less sw intensive.

Source: Arora, Branstetter and Drev. "Going Soft: How the Rise of Software Based Innovation Led to the Decline of Japan's IT Industry and the Resurgence of Silicon Valley," Review of Economics and Statistics, 2012.

Strengths of Software Practices as Deployed in Japanese Firms (1)

- **Quality, quality, quality?**

Strengths of Software Practices as Deployed in Japanese Firms (2)

- **Operational effectiveness of Software Development**

Strengths of Software Practices as Deployed in Japanese Firms (2a)

- **Operational effectiveness of Software Development**

Survey Results Comparing U.S. and J. Global Firms Use of IT in Business Management (1)

How important is IT/Information System Investment?

	Japan	U.S.
• Very important	16%	75%
• Important	53%	20%
• Can't Say	24%	4%
• Not Very Important	7%	2%

Survey Results Comparing U.S. and J. Global Firms Use of IT in Business Management (2)

What has been the impact of IT on the firm up to now?

- <u>J. respondents top choice</u>
  Efficiency of internal business and reduction of labor
  hours (44%)

- <u>U.S. respondents top choice</u>:
  Faster and more efficient provision of products and
  services (54%).

Additional Weaknesses of SW Practices as Deployed in Japanese High Tech Firms

- Major and medium size corporations thinly staffed with IT professionals
- Low levels of in-house software development
- Weak, and often non-existent, CIO positions
- Thin IT staffing leads to risk aversion and over reliance on system integrators.

Hardware Comes First

- "We did not bring software engineers into product development at the beginning. The hardware engineers would begin the product and then software would come in after the fact. And that's because in a company that has jobs for life, the older people are at the top and the younger software engineers are on the bottom, pushing up. So there is a kind of generation gap."

- Organizational culture shapes performance metrics and the organizational culture of Japanese manufacturing firms was created, nurtured and sustained by hw engineers over the last 60+ years

- Takes strong management leadership to overcome employee commitment to past success factors

Best Jobs in America

Top 20
Rank

Job Title
Sector (Total Jobs)
Median Salary/Top Pay

1 Systems Engineer
Info Technology (88,000)
$87,100 / $130,000

Physician Assistant
Healthcare (82,000)
$90,900 / $124,000

College Professor
Education (278,000)
$70,400 / $115,000

Nurse Practitioner
Healthcare (23,000)
$85,200 / $113,000

5 IT Project Manager
IT (174,000)
$98,700 / $140,000

Certified Public Accountant
Financial (189,000)
$74,200 / $138,000

Physical Therapist
Healthcare (181,000)
$74,300 / $98,100

8 Computer/Network Security Consultant
IT (13,000)
$99,700 / $152,000

Intelligence Analyst
Government (51,000)
$82,500 / $115,000
16

Sales Director
Sales & Marketing (97,000)
$140,000 / $239,000

Anesthesiologist
Healthcare (23,000)
$292,000 / $408,000

12 Software Developer
IT (796,000)
$79,400 / $116,000

Pharmacist
Healthcare (198,000)
$109,000 / $134,000

Occupational Therapist
Healthcare (107,000)
$69,700 / $100,000

Nurse Anesthetist
Healthcare (19,000)
$157,000 / $214,000

16 Software Product Manager
IT (37,000)
$106,000 / $148,000

17 Business Analyst, IT
IT (125,000)
$82,600 / $119,000

Attorney/ Lawyer
Legal (541,000)
$115,000 / $262,000

Physician/ General Practice
Healthcare (90,000)
$150,000 / $228,000

Human Resources Manager
Other (226,000)
$71,800 / $111,000

Source: CNN/Money Survey: 2009.

14

Table 1. Relative Standing of Software Engineer/Programmer in US and Japan
: Male Average Annual Salary in 2007

occupation	US				Japan			
	annual salary 100 dollars	US index (1)	US index (2)	order	annual salary 10,000yen	Japan index (1)	Japan index (2)	order
Physicians and Surgeons	2,099	516	794	1	1,147	207	393	1
Pharmacists	1,175	289	444	2	556	100	190	6
Manager	878	216	332	3	935	169	320	2
Software Engineer	841	207	318	4	562	101	192	5
Engineer	815	200	308	5	598	108	205	4
Scientist	764	188	289	6	719	130	246	3
Programmer	657	161	248	7	404	73	138	8
Electricians	473	116	179	8	466	84	159	7
Electric Equip. Assembler	314	77	119	9	399	72	136	9
Janitors	264	65	100	10	292	53	100	10
All occupation average	407	100	154		555	100	190	

Table 2 Analysis of Primary Factors in Total Factor Productivity (TFP) Growth (in percent)

UNITED STATES	1960-95	1995-00	2000-06
TFP Growth	.56	.85	.76
Contributions to TFP Growth			
IT	.16	.51	.32
Computers	.10	.37	.15
Software	**.03**	**.06**	**.08**
Comm. Equip.	.04	.08	.04
Non-IT	.40	.34	.44

JAPAN	1975-95	1995-00	2000-07
TFP Growth	.86	.50	.57
Contributions to TFP Growth			
IT	.04	.23	.25
Computers	.07	.16	.16
Software	**-.03**	**-.01**	**.01**
Comm. Equip.	.01	.08	.07
Non-IT	.82	.27	.32

Concluding Thoughts

- Digitization/IT/SW core technologies of 21st century
- Japanese firms need to rethink role of software in global competition & build up in-house capabilities
- They need to recognize & focus on the value creating capabilities of software & the full range of innovative functionalities and services they can provide
- Corporate leadership role: Elevate the status, training and utilization of IT talent
- Government role: Incent educational institutions to elevate the quality & quantity of IT students

Embedded and Application Software

- Embedded software is computer software, written to control machines or devices that are not typically thought of as computers. It is typically specialized for the particular hardware that it runs on and has time and memory constraints. A precise and stable characteristic feature is that no or not all functions of embedded software are initiated/controlled via a human interface, but through machine-interfaces instead.

- Application software is a set of one or more programs designed to carry out operations for a specific application. Application software cannot run on itself but is dependent on system software to execute.