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Japan: A Huge IT Consumption Market

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In early August 2000, officials from the Japanese Ministry of Economy, Trade, and Industry dined in Seattle, Washington, with a Boeing engineer. METI's head delegate was shocked when the engineer said, "We accept many visitors from Japanese software organizations, but none of them have tried to do business with us. Why is that? Indians try aggressively to do business with us. We are open to working with any country."

Strong domestic demand

Strong domestic demand is one of the primary reasons for not pursuing business abroad. In fact, although Japan is in a long recession, the software industry is not. Based on a recent survey, a Nikkei newspaper article stated that Japanese companies invest 14 percent of their total budget on IT.

In the commercial sector, many companies prefer to build their own systems rather than buy something off the shelf. Because they have restructured—to cope with the severe economic situation in Japan—and have reduced the number of in-house software professionals, they rely on other domestic software companies to handle their outsourced work. Based on current e-government plans, central government agencies and municipal governments must build a large number of systems, at least US $84 billion by 2003. These are all a source of enormous demand. The second reason for not pursuing business abroad is the language barrier. In 1981 and 1984, Denji Tajima and I published articles on software development in Japan.[1,2] At that time, such a report written in English was a rarity. A few years later, Michael Cusumano wrote a book, in English, containing a superior subset of data from Japanese mainframe companies.[3] These helped introduce Japanese industry to the Western software community. Nevertheless, the language barrier continues to impede international trade for both sides; it is a subtle protector of Japan's market.

The third reason might be Japan's old-fashioned software technologies and development style. Because many software companies have little outside stimulation to influence their work situations, most of the development companies at the lower level of the industry lag behind the US in technology. They thus hesitate to make development contracts with overseas companies.

Strong demand is not always good news, though. Large companies simply want to buy programming power rather than sign a development contract with specifications, because they can't or don't want to write good requirement specifications. In response to such a customer's request, medium and small software companies recruit high school graduates to program. They train them in programming languages and techniques and then throw them into customers' development projects—the body-shop approach. Because companies are selling manpower, they don't need software process improvement, and they have no interest in CMM or other SPI models. Still, software companies can earn decent money.

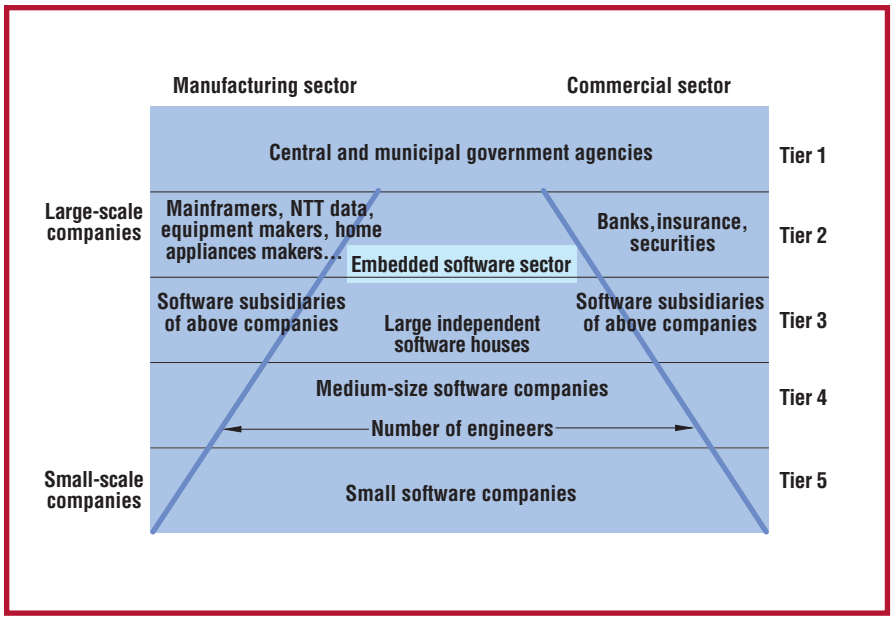

Figure 1. Hierarchical view of the Japanese software industry.

Software industry structure

Japan has a long history of industrialization, so the structure of its software industry is complex. Figure 1 shows the industry from a hierarchical point of view: it has many tiers, each with different characteristics and behaviors. Central and municipal government agencies at the top have the largest procurement power, but they usually do not employ software professionals. Consequently, they have to rely on companies in the second tier, such as Hitachi, Fujitsu, NEC, Japan IBM, and NTT Data—the largest custom software developers in Japan. Tier 2 companies subcontract subsystems with companies in Tier 3 and below. There is a clear difference between Tier 2 and Tier 3 companies.

Most Tier 3 companies are direct descendants of Tier 2 companies, and their names usually reflect that—such as Hitachi Software and Omron Software. These companies inherit development processes from their parent companies. Lower-tier companies don't have such relationships with parent companies. Companies in the manufacturing sector treat software as an industrial product; those in the commercial sector treat software as a service. Some companies have succeeded in expanding their business to overseas and other domestic markets.

Japan's software development largely depends on Tier 4 and Tier 5 companies, in terms of the number of programmers and their working hours. Almost all development projects consist of a high percentage of programmers from lower tiers. But people in lower-tier companies are generally poorly educated, and their primary skills focus on lower-stream tasks.

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Figure 1 also shows the vertical structure of industry that is peculiar to Japan. For example, Hitachi, a prime contractor of METI, divides a system into subsystems that are then subcontracted again and again—down to companies in Tiers 4, 5, and 6. Profit margins get thinner and thinner as subcontracting cascades.

Recently, embedded-software organizations (the central square in Figure 1) have realized the importance of the software process in increasing product quality. Many large manufacturing companies, such as Sony, Omron, and Panasonic, are implementing a process improvement initiative in Japan.

In fiscal 1999 (April '99–March '00), Japan's software industry (534,000 people) produced US $85 billion after a three-year downturn (1993–1995) and three years of quick recovery (1996–1998), according to METI's *Annual survey for Service Industry, 1999*. Custom software accounted for 54 percent of sales; product sales were 8 percent. Japan imports US $500 billion of COTS products but exports a minuscule US $73 million, with just a few exceptions—for example, its games are very popular, and a Japanese product for criminal DNA analysis has the biggest share of the global market, with the US Federal Bureau of Investigation as its primary customer.

Improving process improvement initiatives

In 1997, members of Japan's *Software Engineering Association* decided to improve their software processes. They initiated a project to translate the CMM v1.1 into Japanese, and it was published in 1999. The book clearly accelerated process improvement. When SEA began a software process improvement network, or SEA-SPIN, many software engineers participated. In October 2000, SEA established the Japan Software Process Improvement Consortium, whose objectives are to publish a Japanese version of the CMMI and promote SPI.

METI's CMM project

Upon surveying the US's CMM usage in government contracts, METI established the Improvement of Software Development and Procurement Committee, independent of SEA's CMM initiative. It compiled interim plans for process assessment and government procurement, put them on the METI Web site, and requested public comments. Based on the feedback, METI plans to promulgate new rules for government procurement and selection of eligible bidders by March 2002.

The industry responded in opposite ways. Many companies reacted quickly and rushed to announce plans to get higher CMM-level certification, thinking that this would be a new entry ticket for e-government contracts.

On the other hand, software engineers who had been tackling SPI in their organizations—many from the embedded-software companies producing high-quality home appliances and equipment—strongly criticized METI's plan. They complained that the CMM should be used for improvement first, not for selecting eligible organizations for bidding. If the government does the latter, they said, the results would be counterproductive—as we already see in ISO 9000 certification, where companies see assessment as a marketing tool that spoils authentic improvement efforts.

Real problems

The government plans to create an e-government by 2003—at a cost of US $84 billion—but worries about today's defect-prone computer systems. But resultant low-quality systems are the tip of the iceberg. Before the government tries to assess bidders' software processes, it must deal with some fundamental issues. Government software procurement has a lot of other problems as well:

- Government agencies do not have software professionals analyzing operational environments and writing adequate specifications.
- The government must rely heavily on big name companies for writing its proposals, specifications, and designs. This is the primary reason that 80 percent of development contracts go to large companies such as NTT, Fujitsu, Hitachi, and NEC.
- When a large company has won a contract, it is subcontracted to several medium and small software companies, but in fact it forces them person/day work rather than autonomous work.
- Engineers at the lower levels of the industry hierarchy are frequently forced to work under bad conditions.
- In the cascading subcontracting environment, a procurer as well as a bidder doesn't know the people working on the project at the lower-tier companies. In fact, there was a case where people belonging to a dangerous cult group participated in a government system development project and nobody knew until a newspaper revealed it.

The Japanese software industry has other long-lived and deep-rooted problems:

- Software organizations are relatively closed and isolated. This is also true of user organizations.
- Despite many years of English education, most Japanese hesitate to communicate with people overseas, attend conferences overseas, or read technical books written in English. This delays international technology transfer a few years.
- Management tends to view software as a tangible rather than an intangible product, and they do not understand the high complexity. They simply think software is a big source of trouble, so they complain and refuse to commit resources for process improvement.
- The software community lacks creative ideas and products. As a result, the relative amount of COTS imports and exports is lopsided.
- Academia and industry are not tightly connected.
- Almost all of the government projects for promoting the software industry, including the notorious Sigma project, failed because of their poor understanding of global IT trends.

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The bright side

Nevertheless, there is hope. The SEA and other organizations have formed to assist Japanese software developers. SEA was established in 1986 and is open to members from both industry and academia. Many SEA members were active in introducing Unix and object-oriented technologies to the country. SEA holds the annual Software Symposium for promoting technology transfer, and it is active in exchanging ideas, discussing problems, translating important documents, and teaching new technologies through symposia, workshops, meetings, and a consortium (the Japan Software Process Improvement Consortium). There are other such societies, such as the Information Processing Society of Japan, but they are more formal.

In 1987, the SEA and the Shanghai Software Center initiated the China–Japan Software Symposium, held annually in China. The symposium is now cosponsored by the United Nations University's Institute of Advanced Studies. The meeting has been renamed twice: first it was the International CASE Symposium

(1991–1995); now it's the International Symposium on Future Software Technology (1996–2001). A number of consortia have also formed to propagate new software-related technologies such as Linux, XML, Java, and Enterprise JavaBeans.

Japan has a long history of manufacturing high-quality products—ships, cameras, automobiles, and the like. Naturally, our software organizations inherited quality control techniques from those industries, including a quality-driven improvement approach called Total Quality Control. However, by installing imported models such as ISO 9000 and CMM, software engineers lost self-confidence in the maturity of their practices, and many adopted the false notion that their software quality was low. Yet, even in Japan's low-CMM-rated companies, the quality of delivered product is still high.[4] By consistently applying a quality-driven, problem-focused approach for quality improvement, we can achieve high quality.

Business with Japan

As I mentioned early, Japan has many software systems to build. When the government initiates system development for building the e-government by 2003, the gap between demand and supply will widen drastically. Because of the aggregated demands of government and industry, Japan's IT industry must finally rely on overseas suppliers.

This will be a good opportunity for Japan to expand its international business, but it will also stimulate its trading partners. If you want to do software business with Japan, you should overcome these problems:

- Build your Japanese language skills for listening, speaking, reading, and writing. Reading and writing Japanese documents will be most difficult. If you want to do this in a hurry, hire Japanese software professionals.
- Understand Japanese culture. Superficially, this society looks westernized, but beware—the Japanese way of thinking is different.
- Understand Japan's specific business rules.
- Choose the appropriate domain.
- Provide a quick feedback loop to remedy processes.

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