JAPANESE STRATEGIES FOR GAINING AND SUSTAINING COMPETITIVE ADVANTAGE THROUGH SOFTWARE
Based on two studies:

One examined structure and development of Japanese software industry

Second compares US and Japanese firms use of software to improve competitive advantage
STRATEGIC RESULTS

Analysis strategic competition Japan's software market, reconciled certain issues:

- Persistence customization as largest market despite government policies promoting standardization. 85% or more of software expenditures are for customized software.

- Existence multiple platforms

- Strong support localization and adaptation foreign software

- Push decompilation

- User power combined shift towards flexibility and open systems

- Compatibility of user's software requirements with basic Japanese management goals
Large Japanese companies’ software requirements are currently being determined by three major forces:

1) Their competitive evolution since the 1950s

2) The historical development of the Japanese computer industry

3) Current technological trends

In this sense their decisions are path dependent
COMPETITIVE ENVIRONMENT OF THE JAPANESE SOFTWARE INDUSTRY

is also being determined by interrelated factors within an evolving technology. The most important seem to be:

- Large computer systems firms' administrative heritage

- Users' process and systems integration

- Constant foreign product innovation and development
CUSTOMIZATION COMMITMENT

Currently, 85% of more of Japanese market software expenditures are for customized software. If internal expenditures are included, the amount is significantly higher. This is five times the level of the US and even more compared to Europe.

This is not just a mainframe phenomena but even extends to PCs. Thus, it is a defining characteristic of the Japanese software market whose persistence must be both managed and explained.

Standard explanations argue it is an historical accident continuing against technical and economic forces. An unfortunate expensive problem that Japanese managers must accept while gradually managing a solution.
AN HISTORICAL ANOMALY?

The historical legacy argument notes that:

The Japanese Government’s computer industry policies in the 1960s and 1970s led to multiple platforms and operating systems. Further, the large integrated producers gave away software. This “free good” combined with internal expenditures to greatly increase customization. The total amounts to billions of lines of code.

Still, despite this large installed base, there is currently strong support for localization and adaptation of foreign packaged software combined with a shift in users’ preferences towards flexibility and open systems.
however:

Even these localized foreign software packages and open systems are being customized at great expense

- To maintain and integrate large firms' systems and computer heritage

- To constantly introduce foreign product innovation and development

- And to improve their unique operating systems
COMPANIES' SOFTWARE HERITAGE

- The multiple systems, incompatible platforms due to various historical ties have left a situation which is strategically difficult to change, especially for the large mainframe systems that support large firms’ mission critical applications.

- This has resulted in multiple licensing arrangements and software strategies that “lock-in” customers.

- Competitive advantage in hardware has followed a global product cycle but has promoted foreign entry in software. Competitive compulsion among hardware producers has encouraged them to defend existing customers and markets in ways that fragment the market.
## SIZE/GROWTH JAPANESE SOFTWARE MARKET

Estimated Growth Rate 1990-94

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<th>Custom</th>
<th>Packaged</th>
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<tr>
<td>Mainframe software</td>
<td>5.0%</td>
<td>7.2</td>
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<tr>
<td>Mini Computer software</td>
<td>7.3</td>
<td>11.8</td>
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<tr>
<td>Work Station software</td>
<td>13.3</td>
<td>34.7</td>
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<tr>
<td>PC software</td>
<td>10.3</td>
<td>12.0</td>
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Mainframe sales and mainframe software are growing much more slowly than minis, workstations, or PCs and their related software. Also, mainframes are being used more for distributed processing.

So though mainframe software market is large (estimated at Y2409 billion in 1992) of which Yen 2233 billion is customized with growth for 1991-94 estimated at 5.0% p.a., customized mainframe software sales should stay stable while growth opportunities are in downsizing and related applications both custom and packaged.

However, one cannot conclude from these figures Japanese firms are abandoning customization and moving aggressively towards packaged software solutions. Rather they are quickly shifting to semi-customization, where packaged software purchases entail substantial customization.
MARKET FORECAST

This is because,

packaged software starts from a low base and customizing it runs about 70 percent of total cost, compared to customized software’s current 85 to 90 percent of the market. Therefore, packaged software seems to be gaining share rapidly. But it will level out at twenty to twenty-five percent, not including internal development costs.

Customized & Packaged Market (Yen billions)

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<th>1992 (Estimate)</th>
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<tr>
<td></td>
<td>Custom</td>
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<tr>
<td>Total</td>
<td>3635</td>
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<tr>
<td>Mainframe</td>
<td>2233</td>
</tr>
<tr>
<td>Mini</td>
<td>550</td>
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<tr>
<td>Work Station</td>
<td>545</td>
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<tr>
<td>PCs</td>
<td>305</td>
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DIFFICULTIES AND COST OF CONVERSION

- Installed mission critical mainframe systems supporting data bases and key operating systems involve hundreds of millions of lines of code. Also, these systems work, while the risk of a failure is unacceptable!

- Firms have limited programmers and system engineers familiar with new languages able to check converted systems. At the same time, they are needed to develop new systems or to adapt and integrate purchased programs to the corporate system.

- Conversion programs from COBOL to C++ do not exist, while new programs must be checked and run in parallel.

- Most programmers and system engineers have few incentives to learn new languages and systems but are needed to maintain existing ones and monitor the overall system.
BENEFITS OF CUSTOMIZATION

However, even though Japanese managers recognize these high costs and historical legacies, they are also conscious of several benefits from customization which

- Institutionalizes and incorporates the firm’s tacit business knowledge and processes (rules and routines) from the shop floor and other areas into an integrated whole, yet maintains secrecy and restricted access.

- Through permanent employment permits firms to realize on the cost of training in the unique features of their proprietary systems, including the operating system, without raising employee mobility concerns.
- Compensates for Japan’s relatively weak education in computer science through specialization and OJT in the firm’s unique system for an extended period. This includes learning to use and manage its finely tailored adaptation to the firm’s business, processes and operating needs.

- Creates, develops and uses dedicated software subsidiaries

- Adapts software to business and competitive needs rather than just accommodating the purchased system
INSTITUTIONAL SUPPORTS

- Intra-industry strategies of large established firms in transportation, steel, electronics, finance and power

- Weakness Japanese Government

- Weakness education in software development and computer science

- Historical emphasis on process versus product innovation supported by specialized software development

- Experience and skill at adopting and adapting foreign technologies to achieve sustainable advantage

- Emphasis continuous improvement for processes, including software support and use of new technology

- Development of “Software Factory”
PERSISTENCE CUSTOMIZATION

Leading companies in Japan’s most competitive industries have generally gained competitive advantage by adopting and improving products invented elsewhere.

They have usually done this by process innovations that have not only enabled them to acquire competitive advantage but to sustain it through their ability to do high quality precision manufacturing in volume at constantly lower costs.

Apparently, customized software has been a fundamental aspect of this development, especially when closely linked and integrated with corporate culture and organization. Therefore, their commitment to customization is not going to change!
LOCALIZATION AND CUSTOMIZATION

Semi-customization and a “three tier” hardware system seem to be key to achieving such integrated, customized and continuously improving software systems.

Within this localization, software is the element that integrates minis, PCs and workstations into the overall system.

Keeping the total system current technologically means using more advanced or specialized foreign software. But it must be adopted and adapted to the customized system. There appear to be three parts to this:

- Language and format localization
- Conversion to the system suppliers’ mainframe platforms
- Customization to the user’s unique process and other business needs
CUSTOMIZATION COSTS: TOTAL COST CONCEPT

- Customization costs 10 -15 times a localized package or 20 -30 times its import value. A semi-customized product is 5 - 6 times imported value. So even using localized software with the 20% increased installation cost typical of US firms would reduce software costs at least 60 -70 percent.

- This could save Toyota, for example, about ¥3500 per car or over US $150 million per year.

- There is a potential cost, though, i.e. reducing manufacturing and delivery productivity or increasing inventory and floorplanning costs to US levels. Similar effects apply to steel and consumer electronics. A packaged solution available to everyone could thus prove very costly competitively.
HUB AND SPOKE HYPOTHESIS

- Competition takes place in new growth segments not between basic systems or operating platforms used by core customers which market shares remain stable. High growth segments (WS, PCs, networks) are at center of a hub and spoke diagram representing industry structure while systems' market (mainframes and minis) are on outside of the wheel.

- New growth markets are dominated by foreign high performance software, often incorporating downsizing and open systems. E.g. in work stations, HP and Sun have 38% market share and are largest suppliers.

- Yet, customization persists as way to control customers and market share for systems and hardware, forcing localization and conversion of software innovations and upgrades along spokes.
USER REQUIREMENTS

- User attitudes towards software providers reflect market segments. While cost a concern shift is from emphasis user/industry contacts and knowledge to flexibility, neutrality and technical expertise

- Basic sales and manufacturing systems are established but now need to use IS for planning and competitive advantage

- Currently 16% of companies see such software needs but 57% see shift. Networking will rise to 8% from 2%

- Conversely firms primarily requiring manufacturing and sales support will drop from 57% to 3.5%

- Those needing software for internal information will remain about 23%
USER ATTITUDES

- Conservative mainframe mentality

- Cost conscious but risk averse; systems change incremental basis due high organizational integration

- Strong supplier relations basic sales and manufacturing systems; networks and new functions use new technologies

- Little interest pushing EDP innovations. Want maintain lagged technical parity assuring reliable debugged product

- Expect low personnel turnover with good tacit knowledge supplier and user.

- SW development efficiencies achieved by user/industry commonalities

- Developers part users' industry and dependent users' economic success
USERS' PROCESS AND SYSTEMS INTEGRATION

- Incorporating tacit learning from the shop floor, permanent employees and captive customer/supplier base.

- Maintaining special or unique system and process advantages where software is both an important input and institutional arrangement. Indeed, customized software appears to be one way Japanese firms incorporate and institutionalize continuous process innovation, competitive advantages, and tacit knowledge.

- Software development is part of a firm’s competitive evolution from imported technology and products to global competitiveness, including its organization and the integration of suppliers and customers into a network. This closely links corporate culture and software systems.
FUTURE COMPETITIVE DYNAMICS IN SOFTWARE

- Continued heavy customization aided by the Hub and Spoke Strategies of foreign software developers

- Maintenance and further development of customized systems as barriers to entry, including incorporation in FDI. This has implications for foreign firms emulating lean production or NICs following the product cycle.

- Customers and systems suppliers will push towards alliances and exclusive licensing with foreign firms in new software technologies and formats to try to tie or control their entry and use in Japan. The goal is to improve the firm’s market advantage given a total cost or business viewpoint.
- Emphasis on maintaining parity in technology including localization, conversion, and customization of foreign software. This implies little independent R&D except for games.

- Effectively this will subsidize entry and presence of foreign vendors in Japanese packaged software market.

- Management pressures to reduce cost per line of code rather than increase revenues or the user base

- Fragmented operating systems and software application pattern will persist. Non-customized standard packages will not be used except for some operating and network systems for workstations and PCs.

- As strong Yen will continue and may get stronger, self development of software will be very expensive.
- The added cost of localization and customization will keep even converted foreign software high cost.

- This means Japanese software must be integrated into a manufacturing process to be competitive.

- The government’s roll and influence in this process will be minimal.

- Software industry will be composed primarily of profitable niche players affiliated with foreign firms. They will adapt new software products developed abroad for local use.

- Large clients will customize and integrate it into their proprietary systems for competitive purposes.

- Hardware producers will assist use with their platforms and customers directly and via alliances.
NEXT STAGE

SOFTWARE USERS’ STRATEGIES FOR

GAINING COMPETITIVE ADVANTAGE
EXAMINING USER PARADIGM

Recognition of user driven paradigm focused policy and research attention away from software developers and systems providers to firms’ using SW to achieve competitive advantage

Sloan study explores extension of research results including expected growth and increased importance of vertical application and embedded software

It does this by comparing leading firms use of SW in autos, insurance, retail and investment banking, food and apparel retailing, pharmaceuticals, steel and semiconductors
HYPOTHESES

Preliminary results indicate while some strategies are industry specific others cut across industries and countries:

- Inventory Control

- Interactive data base management to improve product performance, quality and delivery

- Integration telecommunications

- Integration organizational structure

- Integration product or service R&D with production, marketing, delivery and after sales service

- Technology strategy part business strategy extending recruitment, training, and business development
- Senior management for IS is from value added part of business

- Embedded software is integral to firm’s SW strategy and interlinks with data base management

- SW adds value product and service; not just cost.

- Outsourcing decisions critical to overall competitiveness

- Some Japanese firms are very sophisticated using software to gain and maintain competitive advantage
SUCCESSFUL USERS

- Maintain and integrate systems and computer heritage with management strategies to capture tacit knowledge and institutionalize organizational strengths on an iterative basis

- Constantly introduce product innovation and development on an incremental basis with organizational evolution. Recently this has involved selective use of packaged software managed via customized systems, including customized middleware

- Use SW to enhance core competencies including improving unique/successful operating systems

- Do not change their organizations or strategies to use software, though cultures technology oriented
STRATEGIC DECISION ENVIRONMENT

- Installed mission critical mainframe systems support data bases and key operating systems with hundreds of millions lines of code. Systems work and any risk of failure unacceptable!

- Firms have limited resources to develop new systems or to adapt and integrate purchased programs.

- Programmers and system engineers must maintain existing programs and monitor the overall system.

- Choice customized or packaged driven competition 1st and initial cost 2d. Selection criteria precise.

- Firms refer mission statement and competitive environment. Clarity of business/industry vision is sharp

- MIS is organizationally integrated part management. There is no independent MIS department
BENEFITS

The benefits of specialized strategic systems viewed as:

- Institutionalizing firm’s tacit knowledge and processes (rules and routines) from shop floor and other areas such as captive customer and supplier base into integrated whole, while maintaining restricted access. SW development part of competitive evolution closely linking corporate culture with information systems supporting overall business goals.

- Captures cost of training personnel in unique features of their proprietary systems, including operating system, without raising employee mobility concerns.

- Adapting software to business and competitive needs rather than just accommodating a purchased system.
- Packaged solutions available all cannot improve competitiveness unless linked or part of a larger proprietary system that contains benefit features

- Conversely integrated systems act as barriers to entry.

- They also build automatic beneficial loops via reduced costs, cycle times, and quality improvements

- Possible development of “controlled” production
CONTROLLED PRODUCTION

Controlled production differs from:

- Mass production which achieved economies through scale using standardized parts or

- Lean production which reduces costs through more continuous manufacturing processes as it seeks through using information technology to control:

  All aspects of delivering a product or service including after sales and repair.

This can lead to cost reductions through breaking assembly line or using options models to make investment decisions.
“We are experiencing a new industrial revolution, one more powerful than any before it. In this emerging digital world of the Third Millennium, the new currency will be information. How we harness it will mean the difference between success and failure, between having competitive advantage and being an also-ran.” (Seagate Technology)
“I now have discussed three watersheds in the history of the automobile industry. Each time, a new business model changed the ground rules for the industry. Each time the new model seemed invincible. And each time, it gave way to changing circumstances and a new business model.

Our old business model is breaking down for four main reasons. One, we need to decentralize our manufacturing and R&D activities ... Two, the product and process paradigms that Henry Ford established are themselves breaking down ... Three, information technology is transforming the inner workings of the automobile. It is also transforming the way we develop and make and sell our products. And four, the changing product paradigm and the growing role of information technology will open our industry to a vast array of competitors.” (Mr. Okuda, president of Toyota)