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The Competitiveness of Japan's Software Industry -- Summary of the Current Situation

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1.Classification of Software and Earlier Research

Japan's software industry is not very competitive in international markets. In the software industry as a whole imports overwhelmingly exceed exports, with the volume of exports less than ten percent of imports. Among advanced technological industries it is quite rare for a Japanese industry to exhibit such poor competitiveness. This paper will attempt to explain how and why this poor situation has come about.

What has contributed to the widening disparity between levels of competitiveness in different advanced technology industries? Would it be feasible to come up with a political approach to improve the level of competitiveness of the Japanese software industry? There are no simple answers to these questions.

To facilitate the discussion in this paper, first were should classify what we mean by software. The term "software" encompasses a great variety of categories and should not be treated as a single entity. Software can be divided into four categories: (1) packaged software, (2) custom software, (3) embedded software, and (4) online software. Moreover, packaged software

1 Packaged Software	
1a Business Software	Example: operating systems, office suite applications, Internet browsers, anti-virus applications, middleware applications, enterprise-packaged software including accounting, and database applications.
1b Game Software	Examples: PC game software, software for dedicated game consoles.
2 Custom Software	Examples: various enterprise software, banking and accounting systems.
3 Embedded Software	Examples: software for controlling cell phones, digital cameras, vehicle navigation systems and automated machines.
4 Online Software	Examples: search engine portals, online game software, social networking system (SNS), software as a service (SaaS).

Table 1. Classification of Software

can be broken up into business software and game software. The classification above is fairly standard. Online software may require some further insight as it is a new player in the software field. We define "online software" as software accessed by users via a network connection, the users themselves do not have the software installed on their local machine. Data may also be uploaded to a service provider via a network connection. This group of software consists of search engine portals, online game software, SNS such as mixi and SecondLife, and SaaS, which has drawn an increasing amount of attention recently. None are sold as packages, nor are they customized to meet individual user's needs. Moreover, they are not embedded in any hardware.

The view that Japan's software industry is not competitive refers to packaged business software and to some online software. Other software groups, game software, custom software, and embedded software, are competitive by international standards. Japanese game software is exported around the world. Concerning custom software, Cusumano (1991) noted that the productivity of custom software in Japan was higher than that in the United States, a point that attracted public attention at the time. Embedded software incorporated in hardware is essential to the competitiveness of the Japanese hardware industry and is of a high standard. In principle, when we talk about the lack of competitiveness in

Japan's software industry we are focusing on packaged business software and some online software.

A number of hypotheses have been proposed to explain this lack of competitiveness. Mowery (1998), a leading researcher on the U.S. software industry, listed the causes of Japan's poor competitiveness in the software field as:

1) Development was centered on custom software for mainframes;
2) Software was closely aligned with hardware and lacked consistent PC standardization processes (i.e., the market for business software was fragmented);
3) Intellectual property was not properly protected;
4) Failure of government-funded development projects (the fifth-generation project and the sigma project);
5) Compared to the United States, deregulation of telecommunications in Japan was slow; and
6) College education did not serve to provide people with the required expertise.

However, most of these explanations are now viewed quite skeptically. The absence of standardization (2) was addressed with the introduction of Windows 95. The protection of intellectual property (3) has developed with adequate anti-piracy policies for business software. It is true that government-funded development projects failed (4), but the government washed its hands of the fifth-generation projects some years ago. The deregulation of telecommunications (5) has progressed considerably. However, the legacy of over focus on the development of custom software (1), and poor quality of college education (6) remain valid criticisms, and government policies are still trying to address how to adequately train software engineers.

However, if Japan's current lack of competitiveness can mainly be attributed to poor standards of college education, those involved in other more successful software fields, for example custom software and embedded software, would have alerted people to the crisis, highlighting the need for improving human resources. In reality, one rarely heard such calls. This suggests that the focused approach on custom software is the dominant cause. Even so, this alone is not sufficient to be singled out as the root cause of poor competitiveness in the industry. Therefore, it is necessary to first clarify the reasons for the primary focus on custom software.

In summary, many aspects of Mowery's criticism are no longer legitimate when

considering the passage of time and perspective of the modern software industry as a whole. Yet problems still remain concerning the competitiveness of Japan's software industry and we will try to identify some of the controversial points.

2. The Characteristics of Software

The different characteristics of the software groups we introduced in Table 1 above can be summarized as follows. Table 2 summarizes these differences at a glance.

(a) Do network externalities help achieve dominance?

In the case of packaged business software, file formats and consistent user interface design may constitute a set of standards. Microsoft products have maintained their worldwide dominance through the standardization of their file formats and user interface and operations. Similarly for online software, a service that has more subscribers can provide users with better ease of use than services with fewer subscribers, thereby contributing to increased network externalities. A typical example is SNS. Search engine portals often take similar forms, resulting in similar effects. When network externalities function effectively there is a strong first mover advantage, often the first in the market with the highest share is the most competitive.

(b) Is there a genius who has lead a sector?

There have been a number of cases in the field of business software where early "genius" developers creating a new product have lead to a company becoming dominant in the industry. Microsoft, Oracle, and Lotus each owe their early success to this genius characteristic. Also, in the online software group, we can see the same effect in the development of Google and Yahoo!. The same experience is not common in the realm of custom and embedded software. There are geniuses in the area of game software but they have achieved greatness in terms of storytelling, not software engineering.

(c) Is long-term service necessary after sales?

In other words, is it obligatory and necessary to provide continuous service to clients after the sale has been made and the contract has been closed? When considering custom software and online software the answer is definitely yes. The cost of maintaining custom software can be as high as development costs and long-term service is important. In contrast, online software such as online games, SNS and SaaS continuously provide service to users, so providing

after sales support and service is integral to the nature and purpose of the software, such service is the objective of the software.

(d) Is it important to exchange information with users during the development stage?

Embedded and custom software both require the software developer and customer to work closely during the development stage. Such software is a built-to-order product with the buyer defining the basic requirements that the software must perform. In the case of business software, game software and online software, marketing involves close working with end users, but involving users in actual development processes is unusual beyond beta-testing and bug-reporting.

(e) Will the products be differentiated?

Product differentiation, where features are added to products to provide a line of essentially similar items with the same basic functionality but some different features are well suited to Japanese business practices. A high level of product differentiation and the frequent, repeated launch of new products is common in the field of consumer appliances, where the consumers quickly get tired and seek new features. Game software falls under this category. For software other than games, the same software can be used for many years while satisfying users' requirements, provided the software has neither faults nor features of a new generation of the software make the old version obsolete or incompatible.

(f) Where does Japan lack international competitiveness?

Japan lacks international competitiveness in the fields of business and online software.

Considering Japan's lack of international

Table 2. Correspondence between Classification and the Characteristics of Software

		Network externalities	Genius influence	After sale services	Information exchange during the development processes	Product differentiation	Japan's lack of international competitiveness
1 Packaged or general-purpose software	Business	○	○				
	Game					○	
2 Custom software				○	○		
3 Embedded software					○		
4 Online software		○	○	○			

competitiveness in the above table (f), competitiveness suffers when (a) network externalities come into play and (b) geniuses flourish. Genius cannot be made to order, but it can be cultivated with the support of venture capital and by providing adequate education and training. In other words, a "system" like that found in Silicon Valley. Concerning network externalities, Japanese enterprises can no longer take advantage of one of their conventional strategies of manufacturing incrementally improved versions of products at reduced costs with the aim of seeking greater market share. The Silicon Valley "system" where one person or a small team creates software that becomes a world standard and then excludes others from entering the market works against Japan's typical incremental improvement approach.

On the other hand, Japan maintains a moderate level of competitiveness when the industry requires long-term services, close collaboration with users during development processes, and is repeatedly required to rebuild products because of intensifying product differentiation. These characteristics also apply to Japan's strong manufacturing sectors, such as automobiles and consumer electronics. Japan maintains competitiveness in those software subgroups where there are similarities to other industries where Japan's traditional strengths can be brought to bear. This is a natural conclusion, this type of close information exchange in the development and manufacturing processes is called suriawase (meaning "tight coordination", Takahiro Fujimoto (Fujimoto (2003)).

3. Three Points of Controversy

Based on the discussions above, we can see three controversial points.

(I) Why is Japan centered on custom software while there is little or no growth found in packaged software?

As indicated above, one of the causes of Japan's poor competitiveness in software is that the industry is highly focused on custom software, and too little attention is paid to packaged software. As the international market is for packaged software (general-purpose software), not custom software, companies cannot become software exporters when their expertise is in custom software.

The question then becomes why is Japan focused on custom software? The answer to this question can be considered from a supply and demand perspective. From the software supplier's point of view there is no venture capital structure and there are problems with the appropriateness of college education, among other factors. Traditionally speaking, software had not

been considered an asset, and this creates an institutional or systematic barrier.

From the demand side, the question is why do Japanese users continue to demand custom software when international trends are for packaged software?
Various hypotheses can be put forward:
(i) Once custom software has established a presence in the market, opportunities for packaged software are limited, and one of the main benefits of packaged software, economies of scale, do not come into effect.
(ii) Keiretsu transactions between affiliated companies may also be a cause. A great number of software development companies are subsidiaries of larger parent companies or related groups of companies, and these groups inevitably place orders with their own affiliated companies.
(iii) Japan's tendency to develop long-term business relationships also suits the custom software model. When relationships between business partners are less permanent, there would naturally be a tendency to rely on standardized third-party packaged software. But in longer-term relationships there is less risk in relying on custom software that has been developed specifically for the partnership.
(iv) Stronger top-down leadership in the United States compared to Japan's more consensual bottom-up approach, allows Chief Information Officers and other senior management to control the direction towards standardized software. This kind of strong leadership is almost impossible in Japan and tends to lead to less change.

If the situation were explained by the hypothesis regarding the lack of economies of scale, only significant influences from external parties would be able to alter the current situation. If Keiretsu or long-term transaction practices were to blame, then weakening them could promote a trend toward packaged software. Keiretsu transactions have shown a decline, as can be seen from increased mobility in employment and the increased use temporary personnel and part-time workers. If management processes were the root cause, then measures taken to remedy the situation would depend heavily on management policies. Understanding these hypotheses will effect the future of Japan's software industry however many factors remain uncertain.

(II) Can the competitiveness of custom software, embedded software and game software be maintained?

As indicated above, Japan is moderately competitive in the fields of custom software, embedded software and

particularly game software. However, we should consider if this situation will continue in the future.

A problem often raised is the hard environment in custom software development companies. The custom software development process is tough, with long working hours and salaries can be mediocre offering little enticement to engineers. In addition, the process for developing custom software, in particular the actual coding process, is often farmed out to first-tier contractors, which in turn handover some work to second-tier subcontractors, and then to third-tier subcontractors, and so on. This scheme can be also found in major general contractors throughout Japanese industry, where hierarchical structures have prevailed. Consequently, the market structure does not encourage companies with genuine technological expertise and innovative ideas to flourish.

The field of game software is also not unassailable. Although Japan was the first to develop game software, the United States has become increasingly competitive through its dominance in the market for personal computer software and steady flow of highly qualified and motivated engineers emerging from the education system. The market share of Japanese made games in the United States market is declining.

As illustrated above, segments that have traditionally been regarded as competitive could find it difficult to maintain their past competitiveness. Taking this possibility into account, we should also consider ways to strengthen their competitiveness. Take the example of a traditional manufacturing scenario. Highly skilled technicians and engineers recognized for their craftsmanship both within the company and externally, leading to these technicians and engineers receiving positive feedback. Would it be impossible to create a similar structure for software engineers? Is it conceivable for the development technologies of game software to forge closer ties with software technologies other than games? This area of discussion can be expanded further.

(III) Can Japan's competitive problem be solved by online software?

Online software has special characteristics not found in the other software areas. Google and SecondLife were the product of geniuses and also benefit from network externalities. However, other online software, such as online games and SaaS may be less reliant on the concept of a genus innovator. Instead, consistent efforts to improve the software and to improve user services on an ongoing basis seem to be

more important. Online software seems to have intermediate characteristics.

First, network externalities increase when the number of users increases. Certainly, the role of the "genius" in starting many online service cannot be under estimated, however, online services also require long-term after-sales services as shown in Table 2. In online games, SNS and SaaS, the services are sold, not the software, and such services tend to be long lasting. When providing long-term services, it is necessary to make steady improvements and to provide stable services.

These requirements are not characteristics we would normally associate with venture capital-backed entities. They are more suitable for larger corporations with stable, large-scale operations. SaaS provides good examples. User companies upload their own data to the SaaS provider, data that may be critical to their company's operation such as accounting and contract information. Should this data be lost or corrupted in some way, or the SaaS provider went bankrupt, the damage to the customer could be devastating. Therefore, it is logical that companies seeking SaaS would choose stable and well-established service providers. Given this situation, it is preferable that companies engaged in SaaS business are large-scale with a strong balance sheet. SaaS services would seem to be well suited to the Japanese style of software service business rather than the venture driven world.

4. Conclusion

The primary purpose of this article is to provide a concise summary of the competitiveness of the Japanese software industry. However, the issues are complexly intertwined and it is difficult to sort them out at this stage. In addition, we do not have satisfactory amount of analysis based on empirical studies to achieve a solid conclusion. It is rather regrettable when discussing the Japan's software industry, Cusumano's research, conducted more than over 15 years ago in the United States, is still frequently referred. The author suggests that more empirical research should be conducted in order to improve policy-making at government level and industry response to the change taking place in software industry.

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