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## The Context for Innovation in Japan

*Kazuo Nomura\**

**T**he Japanese approach to innovation is quite unique, when compared to innovation in the United States. Let me tell you a story. One day, an American and a Japanese man were hunting in Africa. After a long day, they had used up all their ammunition, without killing any game. They suddenly noticed that a lion was approaching from the distance, but their jeep was far away. The Japanese man pulled out a pair of sneakers from his sack and started to change his shoes. The American said to the Japanese, "You cannot run faster than the lion even with sneakers." The Japanese responded, "I don't need to run faster than the lion. I just need to run faster than you." For Americans, to innovate is to run a little faster than a lion, but for the Japanese, to innovate is to run a little faster than the Americans. But is this really innovation? For Americans, to innovate is to do something creative, but for the Japanese, to innovate is to be more competitive.

The first question one must address is whether there has been any innovation in Japan. It has been said that there has been very little real innovation recently in the entire world. Although many technologies look like innovations, they are really modifications, improvements or more likely the integration of an already well-known theory or invention. Some real innovations in the past twenty years include the integrated circuit, the CO<sub>2</sub> laser, optical fibers, recombinant DNA and liquid crystals. However, none of these were invented in Japan.

In spite of this fact, no one can deny that Japan has become the leader in some leading-edge technologies. The U.S. Department of Defense last month submitted to Congress a program which listed twenty-two critical technologies. According to this list, Japan is superior to the United States in three areas: fiber optics; chemical compound semiconductors, such as gallium arsenide; and biotechnological processes and materials. In three other areas, this report states that Japan is partially superior. In fact, this assessment is quite similar to the assessment of Japan's Ministry of International Trade and Industry ("MITI").

Why has Japan become so strong not only in traditional industries, where the manufacturing processes and quality controls are dominant factors of the competitive advantage, but also in leading edge technologies? Is Japan really going to surpass the United States and become the world's technology leader in the foreseeable future?

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Let's look at the history of Japanese industry in the last forty years. After World War II, there were two very important American influences on Japan: the scientific management method and quality control techniques. These formed a strong basis for later industrial reconstruction in Japan. In developing the industrial base, all Japanese companies followed essentially the same process. The process was to import basic technologies from Western countries, then to improve and modify these technologies and apply them to products very quickly. Companies became competitive in the world market by reducing cost and increasing quality and through heavy investment in equipment, thus enabling them to reinvest profits and reach even higher technical levels.

At each stage of industrial reconstruction, Japan had different champion export industries, beginning with textiles, then shipbuilding, steel, automobiles, electronics, and most recently, semiconductors. Many other basic domestic industries prospered at different stages of industrial development and followed the same steps just outlined. In addition, there were always several companies in close competition with each other in each industry, and this competition accelerated the process.

Each company in a particular industry has been sensitive to the long-term growth and cyclical characteristics of its basic business. This is especially true for companies in industries which expect that demand for their products has peaked. Their most important goal is to diversify the business in order to keep growing, and more importantly, to retain current employees. The direction of diversification is usually into high technology areas, because diversification into established areas requires mergers and acquisitions, which have not been popular in Japan to date.

Because the situation is identical for all the companies in a particular industry, they tend to do the same thing at the same time. Fiber optics technology is being developed by Corning Glass in the United States. In Japan, all the players in this area are traditional copper communication cable manufacturers, like Sumitomo Electric and Furukawa Electric, rather than glass manufacturers. These companies were extremely sensitive to the risk that their products will be replaced by new technologies.

In the United States, gallium arsenide is manufactured by very small business ventures. The major players in Japan, and even in the world, are again Sumitomo Electric, whose traditional business was matured electric and communication cables; Sumitomo Metal & Mining, and Mitsubishi Metal and Mining, whose basic business of mining and refining is declining; and Showa Denko, which has been struggling to get rid of an aluminum refinery.

The third area in which the U.S. Department of Defense believes Japan is ahead of the United States is biotechnology. This conclusion may be questionable. Contrary to the United States, however, Japanese companies involved in biotechnology include, in addition to pharmaceu-

tical companies, food, beverage, steel and chemical companies who wish to diversify their businesses.

There are many other areas which have been developed through the diversification of companies in traditional industries. All steel manufacturers are eager to get into computer, computer software, and even chip manufacturing. All mining companies have an electronic materials division. This competitive atmosphere accelerates the process of technology development.

Throughout the process of establishing an industrial base and diversifying the business, the underlying theory of quality control has remained important to the people and companies of Japan. However, quality control is a technology to minimize deviation. If too much quality control philosophy is applied to research and development activities and management, the quality control will kill the possibility for innovation. Japanese companies' broad application of the quality control philosophy to the management of a company, whether consciously or not, on one hand increased efficiency in the process of catching up to the technology leader, but on the other hand sacrificed an ability to be innovative.

The unique approach of Japanese companies to technology development is not only the result of quality control, but also certain cultural and social issues. Since my firm, InTecTran, promotes international technology transfer, especially between the United States and Japan, I frequently have the opportunity to witness meetings between U.S. and Japanese scientists and engineers. It sounds easy for them to understand each other, and they believe they do, because they use the same technical terms. But frequently this is not true. Though using the same words and same expressions, each side is thinking of different things.

This happens partly because of differences in the nature of the languages. English is a language which is logical and conceptual, and accordingly is appropriate for analysis. Japanese is descriptive and, at the same time, emotional. It is suitable for expressing facts and emotion. When Japan was opened to Western countries 120 years ago, many new conceptual words had to be created to translate Western literature, because Japanese did not have such words. Even new ways of composing sentences were introduced.

Because English is a conceptual and logical language, one can be strategic and target-oriented. If there is some technical target to challenge, one usually establishes a strategy to reach that goal as fast as possible. In Japan, experience and examples are more persuasive than logic. The Japanese tend to adopt a step-by-step approach. Because of this, there is time to compare their technology with others and to carefully pave the way to commercialization. Although the Japanese way looks rather slow in reaching technical targets, it is faster in commercializing the technology. A recent example is high temperature superconductive materials. All the basic discoveries were made in the United States and

Europe, but Japan, by concentrating on process technology, has developed these materials to nearly the same technical level as the United States.

The peculiar competitive environment in Japan is another reason for the different approach to technical development. The Japanese usually don't like to be different from others. This is sometimes illustrated by the life style of the Japanese peasant who is dependent for his living on a narrow rice paddy. If he tries to plant things other than rice, he will not be appreciated by the government. So competition in the rice paddy depends upon how efficiently one plows and how much care is taken. The strategy is to observe very carefully what other people are doing and not to miss the timing of a specific climate condition.

This same attitude has been taken by many Japanese companies for technical development. They feel more comfortable trying to develop the same technology as their competitors, rather than trying completely different things. They compete with each other by performing faster and more efficiently than the competitors, not by being creative.

Japan, so far, has been successful in technology development because it has been in the process of catching up to Western countries. Furthermore, Japan has certain characteristics which are well suited to the process of catching-up. Now, many Japanese industries have almost caught up with the technological level of Western industries, and in some limited areas have exceeded it. Therefore, for Japan to maintain the speed of past technical development, Japanese industry must further accelerate the flow of information and the technology replacement cycle.

Today, Japan understands the need to change and contribute to world technological development by strengthening basic and creative research. Although it is very difficult to change the unique culture of one country, one solution may be to further increase the pace of the technology replacement cycle, but this is like trying to break the sound barrier.