The Secret of Japanese Creativity

By Makoto Kikuchi

Made in Japan

Back in 1947 I saw the American movie, "The Princess and the Pirate." Driven into a corner on the deck of a ship, the pirate, played by Bob Hope, pulled a pistol from inside his jacket and squeezed the trigger. Nothing happened. He kept on squeezing, but no bullet came out. Looking at the pistol, Hope sneered, "No wonder, it's made in Japan."

In 1960, I was working in a research laboratory at the Massachusetts Institute of Technology. Professor Alexander Smakula, a physicist specializing in ionic crystals, told me one day, "Japan had better work to produce quality products instead of making cheap, inferior goods. If Japan makes good products, the whole world will buy them."

For a long time, the phrase "Made in Japan" was shorthand for good-looking but shoddy products. But today things have changed completely. One of my friends at the Bell Laboratories tells me that "Made in Japan" now means "high in quality and low in price."

It was a great achievement for Japan to turn the meaning of "Made in Japan" completely around in the past 35 years, all the more so in as sophisticated a field as electronics. Yet even so, a perverse writer friend of mine persists in taunting me, saying, "But after all, Japanese technologies are all copied. There isn't a single original technology developed in Japan." I frankly do not agree with him; my friend, I fear, lacks historical perspective.

Japan has begun to attract worldwide attention for its remarkable progress in technology, as can be seen in the case of semiconductors, products which have now become a source of trade friction with other countries. At first, the tendency abroad was to criticize everything Japan did. But after a while, Americans and Europeans began to feel that Japan's success was so wonderful that they should also try to learn from it. My impression is that both hasty judgments stem from misunderstandings and exaggerated evaluations of what has really gone on.

The 35-year chase-up

The birth of the transistor was announced three years after World War II, in June 1984. It was the bell tolling the dawn of modern electronics. That same year I graduated from the physics department of a Japanese university and entered the state-operated Electrotechnical Laboratory. I immediately started research in this exciting new field.

Japan was very fortunate in the timing of its plunge into the stream of electronics technology. Since then its progress in the field has followed the course shown in Fig. 1, which resembles a mountain climber's arduous ascent.

In the 1950s, when Japan had just started climbing the electronics mountain, it trailed far behind the more technically advanced United States and European countries. It was only a few years after the end of the war. The devastation had yet to be cleared away, and there was an acute food shortage.

However, we Japanese had one important asset: enthusiasm. Despite the postwar poverty and hunger, I devoted myself to transistor research with sparkling eyes. Sessions of the Physics Society filled me with more excitement than I would feel when sitting in a movie theater waiting expectantly for a film to start. Nor was it only me. All my friends shared this feeling. We all felt that nothing could equal the pleasure and delight of learning about a vital new field. This feeling was the most important source of energy in Japanese postwar society.

Some American and European government officials hold the misguided view that Japan has succeeded because the bureaucrats of the Ministry of International Trade and Industry (MITI) forcibly pulled Japanese industry along behind them. This is a serious misjudgment of the relative importance of the factors involved. Japan's real strength lay in the Japanese people, and was inherent in its society. What MITI officials did was merely to skillfully guide a horse which was already straining at the bit. It is wrong to think that the government had to push a stalled car to get its engine turning over. Let me cite an example.

The development process of the transistor radio was shown on the panel at the product announcement session for the TR-55 transistor radio in 1955.

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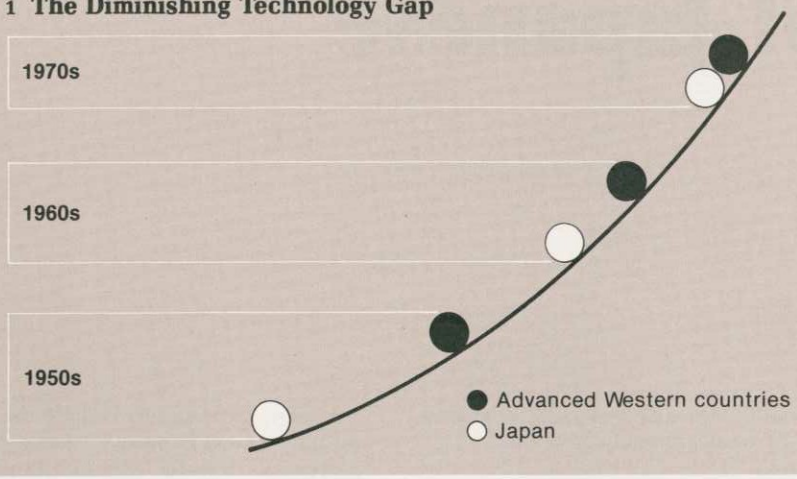
Fig. 1 The Diminishing Technology Gap



Creation of the transistor radio

Masaru Ibuka, the founder of Sony Corporation, is still full of youthful curiosity at the age of 76. When he first heard back in 1947 that a transistor had been developed in America, he immediately asked himself, "What significance does this news have for Sony?" And again immediately, he arrived at his conclusion: "A radio that can fit in a pocket!"

One day in the early 1950s, Ibuka was invited to lunch in New York by a Western Electric executive. When asked what he planned to do, Ibuka answered without hesitation, "I'm going to make an all-transistor radio that a consumer can put in his pocket." All the people at the table immediately burst into laughter. In the eyes of the American executives, Ibuka must have appeared like a boy with a fanciful dream. In those days no-one even knew the transistor's true nature and high frequency characteristics.

As soon as he returned to Japan, Ibuka organized a team of engineers. The leader of this group was Kazuo Iwama, who later became president of Sony. This group was given a clear-cut target—make the world's first radio that can fit in a pocket.

Japanese scholars and engineers are unparalleled at technological development once they have been given a target and a hint about how to reach it. And it is the aforementioned "enthusiasm" which feeds that ability.

Iwama's engineers were stimulated by the target—the world's first pocket-sized transistor radio. But they soon encountered a major snag. They found that they could not proceed further without developing a transistor with superior high frequency characteristics.

In those days most transistors were so-called alloy transistors. It was impossible to make a radio with these devices, because the highest frequency they could handle was only one megahertz (10^6 hertz).

The Sony engineers eagerly took up this new challenge. They had to commercialize the grown junction transistor, and that required coming up with their own innovations. Just one example was new technology for doping phosphorus into germanium crystal.

A thesis published by the Bell Laboratories around that time cast doubts on this method. The Sony engineers, however, had once, but only once, obtained encouraging data in their research. Iwama told them: "If you obtained good data even once, pursue your research with confidence. I will take full responsibility."

The upshot was that the engineers achieved high frequency characteristics of 70 megahertz. In this result alone, Sony's research had already surpassed that of the Bell Laboratories.

Thanks to the painful efforts of its engineers, Sony was able to put transistor radios on the market in 1955. Regrettably, it was not the world's first pocket-size radio but the world's second, next to Regency of the U.S. But this single example still shows to perfection the special characteristics of the Japanese-style approach to creativity.

Sony's first transistor radio TR-55, first marketed in 1955

Learnability

At the base of Japan's development capability is a "learnability" which stems from enthusiasm. It was this learnability which enabled Japan to narrow the gap with the advanced countries ever more quickly through the 1960s, 1970s and 1980s, as shown in Fig. 1.

But there were two other important factors which made it possible for Japan to catch up with the West. One was simply that Japan, running in second place, was always able to observe the front runner from behind. This rendered Japanese research and development consistently more efficient than that of the leader.

For example, the United States spent as much as $30 million researching electronic cooling using the Peltier effect, and achieved virtually nothing. Because Japan was able to observe this U.S. effort from behind, it did not need to waste so much money itself. The pioneer always has to pay such a "tax," which the second runner can often avoid.

The other factor is equally straightforward: research and development become correspondingly more difficult as electronics technology as a whole matures. There is less possibility of making new discoveries, and the budget and manpower needed to undertake research and development increases without limit. The front runner is always affected by this factor first. Its speed falls, making it easier for the second runner to catch up.

Japan has achieved great success in combining existing ideas to produce new product variations. The product development of video recorders is one good example.

Why, then, do the Japanese have such high learnability? One answer is graphically presented in Fig. 2, which is a mental picture of my concept of Japanese society (a) and Western society (b). My picture shows Japanese society as a cluster of small stones linked together with strong springs, while Western society is composed of big, heavy stones connected with weak springs.

When one of the small stones in Japan is shaken, all the other stones start shaking at the same time. This is "consensus," which is the energy driving Japanese society.

When a single small hint is given to Japanese society, all its members become equally enthused. I am not, of course, concerned here with whether this is good or bad. I am just stating a fact.

In 1974, a prominent Japanese visiting IBM in the United States heard the phrase "future system," or planning for very large-scale integrated circuits. Within six months, this hint had dozens of outstanding Japanese engineers engrossed in thinking about very large-scale integrated circuits.

Western society, in contrast, has a long history of individualism, and respect for individual identity is more deeply rooted than in Japan. Even when one of its stones is shaken, the neighboring stones will not move so readily.

In other words, Japanese society is well suited to cooperative work. In Japan's highly homogeneous society, all the constituent members are as good as related to each other. When research begins in one technology, all the engineers in the field gather around and make a fuss about it. There is competition and cooperation. Energy naturally converges on the new project.

In Western society, with its strong individualism, you seldom see a joint undertaking accompanied by such fuss and festival-like excitement. The members of the research establishment tend to assert their individualism, and go it alone.

Strengths and weaknesses

It is a well known fact that education in Japan is astonishingly uniform. And with 120 million people of a homogeneous culture crowded into a small, insular country, furious competition naturally ensues. While the competition to send children to "a good school" can result in an undesirable frame of mind, it also has the effect of giving society an extremely uniform educational background. Herein lies the source of the Japanese people's learnability.

Looking back on the past 35 years, we should realize instantly that Japan and the Western countries each have their strengths as well as their weaknesses.

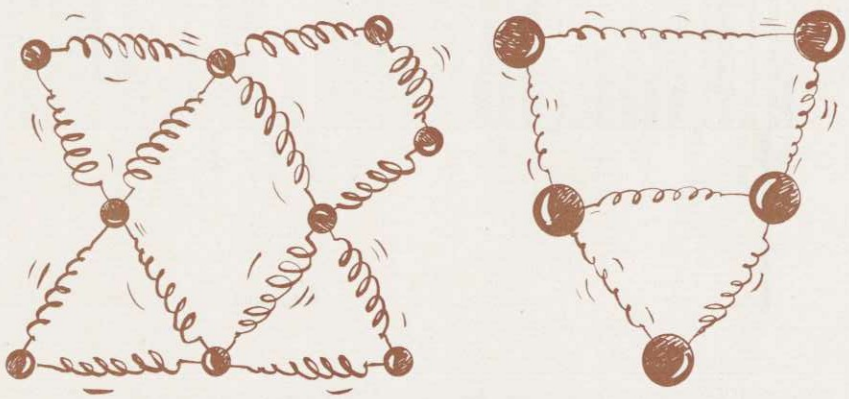
Japanese society takes up on a hint, and makes frenzied efforts to attain a given target; it is an "innovation type" society. This type of society is suited for modifying existing ideas, and it has achieved significant success in combining ideas to produce new variations.

In contrast, the "inventive" work of opening up new fields and setting new targets has been undertaken superbly by the educated elites of the U.S., Britain and West Germany. These inventive undertakings have been performed by individuals. This ability to undertake inventive work derives from the background of Western culture and history.

In fields where electronics evolution continues, Japan will doubtless continue to demonstrate her ability for years to come. However, the breakthroughs that will trigger the next revolution are far more likely to come from countries like the U.S. and Britain. It is a field where individualism and educated elites play the leading role.

This situation will not change overnight. Cultural background is relatively fixed, and not amenable to rapid change. Yet at the same time, I am optimistic that Japan will eventually realize her dream of mastering Western-style creativity. I have the evidence to endorse my optimism. But even I must admit it may be many years before this dream becomes reality. ●

Fig. 2 Patterns of Interpersonal Binding



(a) Japanese society (b) Western society