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Roundtable Report on a Presentation by Professor Hajime Karatsu

Compiled from notes taken by Alan Graham, Dave Walden and Robert Wood.

1. Introducing Professor Karatsu

Professor Hajime Karatsu has made great contributions to the practice of quality and is an individual recipient of the Deming Prize.

Hajime Karatsu, who is now a professor at Tokai University, is a renowned figure in Japan. He was one of the first Japanese to learn quality management techniques from U.S. Occupation forces after World War II. He played a key role in teaching the Japanese electronics industry, as suppliers to NTT, to adopt the techniques. He has served as director and member of the board of Matsushita Electric, where he also pioneered Japanese management techniques. In addition, he has played a key role in industrial studies of the Ministry of International Trade and Industry (MITI). In recognition of Professor Karatsu's contribution to quality, he was named an individual Deming Prize winner. In particular, he has applied scientific methods to sales and marketing and has written a book on a scientific approach to obtaining new marketing data.

In May 1994, the CQM sponsored a visit by Professor Karatsu to MIT and several companies. On May 2, Professor Karatsu spoke to a gathering of executives from the CQM and CQM companies. Shoji Shiba also provided some amplifying comments.

2. Small Is Beautiful in Japan

Karatsu urged U.S. executives to "think small." He noted that Japan has more than twice as many factories as the U.S., though it has one-third fewer factory workers. Thus, the average Japanese factory employs only 16 workers, versus 51 workers in the average U.S. factory. (In Germany the per-factory average number of workers is 82.)

Many of these small manufacturing companies have disproportionately high market share. Professor Karatsu calls these small companies with high market share the "small giants."

For the past couple of years Professor Karatsu has participated in a number of government and industry studies of small businesses in Japan. He has produced several television profiles of successful "small giant" companies, and he showed several of these video profiles.[1]

The first company profiled makes pile drivers. Their revenue is $60M per year, and they are growing 15% per year. The company's specialty is quiet pile drivers for driving "sheet piles." The company saw a business opportunity in making quiet pile drivers because there was much litigation about excessive noise in locations where piles were being driven. Their new type of pile driver uses a system of hydraulic pressure to force the sheet piles into the ground, and it has a noise level of only 60dB. The pile driving is started by piling all the sheet piles flat on the ground so that they hold down the two sides of the pile driver. With this weight holding it down, the pile driver quietly forces the first pile into the ground. The second and third piles are also forced into the ground, with the pile driver held in place by the weight of the inventory of piles. Once three piles are driven side by side (they are overlapped), the pile driver is attached to the top of the three piles. In this way it is held in place while it forces the fourth and successive piles into the ground. As each pile is driven beside the previously driven piles, the pile driver moves itself into a position attached to the top of the last three piles driven, from which it can force the next pile into the ground and then move to be ready for the next pile.

The second company profiled has developed a device to accurately count people going in and out of a building. This is difficult because people are often overlapped, the same person might be counted twice if they linger in the counter's field for too long, and so on. An accurate count of people in buildings is often quite valuable. For instance, by having an accurate count of people entering and leaving an aquarium, the building temperature can automatically be adjusted in advance to what it should be for the number of visitors in the building, rather than forcing the building controls to react after the heat of the visi-

[1] Professor Karatsu's wife, Natsuko, was born in the US and lived here for a number of years before her family returned to Japan. Consequently, Mrs. Karatsu speaks perfect English, and Professor Karatsu brought with him an audio tape of his wife's translation of the voice portion of several short videos profiling Japanese companies.

tors makes the temperature of the building too high. Another use is to count how much money each person spends, for instance, in a department store. Using the counter, store personnel can tell how many people come and go from each department even if they don't buy anything, and thus obtain the correct denominator for the yen/person ratio. They can also record how long people stayed in each part of the store. This people counter can also be used as part of an anti-theft system. The company that makes these sensors has $7.5M per year in sales and 35 employees.

The third company profiled has developed a machine for putting labels on any type of container. This company has 150 employees, $24M in sales per year, and 80% of the domestic market, including 100% of the cassette tape label market. The machine is customized for the type of containers used by each customer. It can attach 750 labels per minute, using a system that causes the labels to adhere when heated.

The fourth company profiled produces gravure printers for printing on building materials, for example, for printing a birchwood pattern on wall paneling. This company has 78 employees and 90% of its market. Their technique can be used in small volume production situations.

In their study of such small businesses (for MITI), Professor Karatsu and his colleagues have come up with the following eight characteristics of the way the "small giants" operate.

1. A small company is like a small motor boat that can dart around quickly, in contrast to a giant ocean liner. The design of a small company must be completely different than the design of a large company.
2. Small companies must use every possible pipeline for gathering information. They must focus on information from outside the company—for instance, forming close relationships between the company's employees and key employees of customer companies. The alertness of "small giant" firms is central to the success of the Japanese economy.
3. The top management of a small company must play a leading role in sales. Karatsu noted that one such small company, Nippon Kodoshi, a maker of specialized papers for electronic components, had developed a dependable methodology for winning new business in three weeks. In the first week, the company's salesman visits a prospect. The second week, the company sends an engineer to visit the prospect. The third week, Nippon Kodoshi's president visits the prospect.
4. Since in a small company each person has many roles, everyone must know everything. Thus information must be shared by everyone.
5. The best people in a small company must be available for important new tasks as they come up. Thus there must be flexibility in employer assignments so excellent people can get to important jobs. The president or CEO must make sure this happens so that managers don't hold the best people in their existing jobs.
6. Problem solving is best done using systematic methods, i.e., the methods of Quality Control. Everyone in a small company, not just quality specialists, must be able to use the Quality Control tools.
7. All employees in a small company need to have knowledge of the accounting data of the company, so they can correctly make the minute-by-minute business judgments that have to be made.
8. Small companies have limited resources. Therefore, they must take advantage of outside "power" wherever they can find it, such as government-provided quality training, cheap workspace provided by town governments, and so forth.

3. Competitiveness of Japanese Industry

Professor Karatsu is now starting a study of the competitiveness of Japanese vs. U.S. companies. He stated that in Japan the industrial structure is different than in the U.S. or Europe. In Japan, small businesses are aided by the government, especially by the Industrial Development Bank, the Japanese Long Term Bank, and the Tokyo Species Bank, which particularly helps exporting companies.

Also in Japan, various ministries "gamble" $20M per year on research and development. In Japan the ratio of government to private R&D is 30/70, compared to 50/50 in non-Japanese countries, according to Professor Karatsu. As a result, more money goes to development than research in Japan than it does in other countries. In their automobile industry, Japan had $110B of added value out of $410B in sales, while in the chemical industry, the added value was $110B out of $220B of sales. These figures indicate the greater efficiency of the chemical industry. Finally, in regions like that around Tokyo, every type of industry exists, thus permitting rapid development of new products.

Regarding competitive strengths and weaknesses, Professor Karatsu quoted a study called "Gaining Ground" from the Council on Competitiveness: the U.S. is strong in CPUs, Japan is strong in memory chips, the U.S. and Switzerland are strong in biotech, the U.S. is strong in aerospace. The principle of competitive advantage was illustrated as follows: the Japanese VCR companies use a head grinding company in Germany to manufacture their machines. Similarly, by use of German machines, Japan produces better ball-point pens than Germans can. The competitive advantages of such endeavors depend on the field of application. Another example of obtaining competitive advantage comes from an auto company and its operation of a die presser, where they put graduates on the manufacturing floor and have data communicated between the designer and manufacturing floor. Education is important for achieving a high level of skill. In addition, good instincts are required for adopting new technology. Incidently, MITI is adding foreigners to study committees.

Professor Karatsu made clear the competitive imperative of effective R&D.

Professor Karatsu has studied and compared the ten-year growth and decline cycles of several consumer electronics products (radio, black and white TV, color TV, audio equipment, videotape recorders, and new video) in terms of their relative profit shares from 1955 to 1989. The need to begin development of new products has, over time, increasingly predated the attainment of peak market share of current products on the market.

In the next decade, the most profound changes in Japan will be related to the declining birth rate. The birth rate in Japan has gone down, so that 25% of the population will be over 65 by the year 2020. The Japanese economy growth rate is 1.3 over the last 10 years, but labor increases by only 1.07. Also, young people don't want to join the manufacturing sector; rather, they choose careers in finance, service, etc. They want to avoid the so called "KKK," which in Japanese means that manufacturing work is "dirty, hard, and risky."

Another issue for Japan involves "trade friction." Geographically, Japan makes up 0.3% of the entire world, and it accounts for only 2.3% of the world's population. However, Japan accounts for 15% of the world's economy. This disproportionate role in the world's GNP came from making things.

The basis of Japan's economy is illustrated by the following example: ore is purchased for $20, which yields $300 worth of steel, which yields a car costing $10,000 per ton.

High quality and high productivity are needed for Japan to compete. The necessary quality and skill evolved as follows in Japan:

Manual system (from Frederick Taylor)
↓
Statistical Quality Control (from Walter Shewhart)
↓
Quality Control Tools and Quality Circles
↓
TQM on the shop floor

One company had the following set of quality targets, which it called "TQC Challenge 0.1":

Year	Failure Rate in Market
1983	5 %
1984	1 %
1985	0.1 %

4. The Goal Is to Make and Sell Things

Professor Karatsu emphasized that we must distinguish between science and technology: the purpose of science is academic truth, while the purpose of technology is making things, not just ideas. For example, the Wankle engine was invented in Germany, but "materialized" in Japan.

In making things we must consider the importance of the following three areas: product development, manufacturing, and marketing.

Product development. Regarding ways to accelerate the product development cycle, Professor Karatsu noted that attitude is important. Karatsu urged CQM members to follow the data-gathering ways of greats like Thomas Edison and Admiral Richard Byrd.

Karatsu noted that Konosuke Matsushita, who founded Matsushita Electric and built it into the world's largest consumer electronics company, saw Edison as his hero. Matsushita had a sculpture of Edison installed outside Matsushita headquarters.

Karatsu's own teacher at NTT, Dr. E. Nishibori, had been a junior member of Admiral Byrd's Antarctic exploration team. Later, when Nishibori led the team planning Japan's own Antarctic exploration, he told his worried sponsors at Japan's Ministry of Education that one decision must be agreed on at the outset: Like Admiral Byrd's expedition, the Japanese expedition would stay the winter in Antarctica rather than coming home during the most difficult part of the year. "That was important," said Karatsu. "The future is unclear. So at the beginning, you have to study everything." Nishibori refused to consider anything less than a thorough study.

But within the context of that study, he would be open to anything.

Manufacturing. Making things is a fight every day to overcome error in machinery, worker errors, and so on.

Figure 1, below, illustrate the basic principle of quality control in manufacturing. "One can think of this as the Annie Oakley principle," says Karatsu.

One wants to narrow the distribution of shots so they all fall in the center of the target, not just on the target. We must narrow the variation of everything on the shop floor.

Professor Karatsu discussed the following example of Japanese manufacturing. A group of visitors from Europe came to Japan. They all had small (palm-size) video cameras. The chips that these cameras use are too small for a human being to handle—they must be handled by robots. "Robotization" should lead to zero defects. As a result, Sony manufactures both the camera and the robot. As this example shows, we must develop machines to manufacture goods.

Karatsu also observed that in the Japanese factory system, it is quite clean everywhere. The Japanese factory "does everything that should be done." In contrast, on a visit to the U.S. to visit the Pentagon, Karatsu looked at the front cover of an issue of *Business Week* that praised a U.S. semiconductor maker. Karatsu was able to recognize immediately that the company lacked first-rate clean-room management. He noticed that in the cover photo white clean-room suits were stored on hangers where they could gather dirt, rather than being sent to a laundry after each use and stored flat so they could be protected from airborne dust. This is careless, and Karatsu stated that carelessness always brings manufacturing problems.

Marketing. To insure the quality of a new product, it is important to *know the customer.* One must get experience with everything.

There are two ways to develop products: upstream, and downstream. In upstream development, one finds a market for existing technology, for example, the gravure process described earlier utilized HDTV. In downstream development, one looks at the market to find a demand or a difficulty that can be addressed by new technology. For example, in the case of the pile drivers, the old pile driver hit the pile with 70 tons, and one could therefore conclude that 70 tons of quiet hydraulic pressure also should do the trick. Finally, hybrid or "mid-stream" development also exists.

5. Sticking to the task in Japan

Professor Karatsu emphasized the Japanese business trait of making the necessary investment for long-term success.

RCA originally invented the liquid crystal display, but the drivers were too big, and so the United States lost interest in the project. However, calculator competition in Japan required a better display, and the necessary semiconductor technology was increasingly feasible. As a result, they built an LCD TV. (There was no effort made to build such a product outside of Japan.) To construct an LCD factory cost $500M. There are $8B

Narrowing the variation of shots has the effect of increasing the number of shots that land "on target."

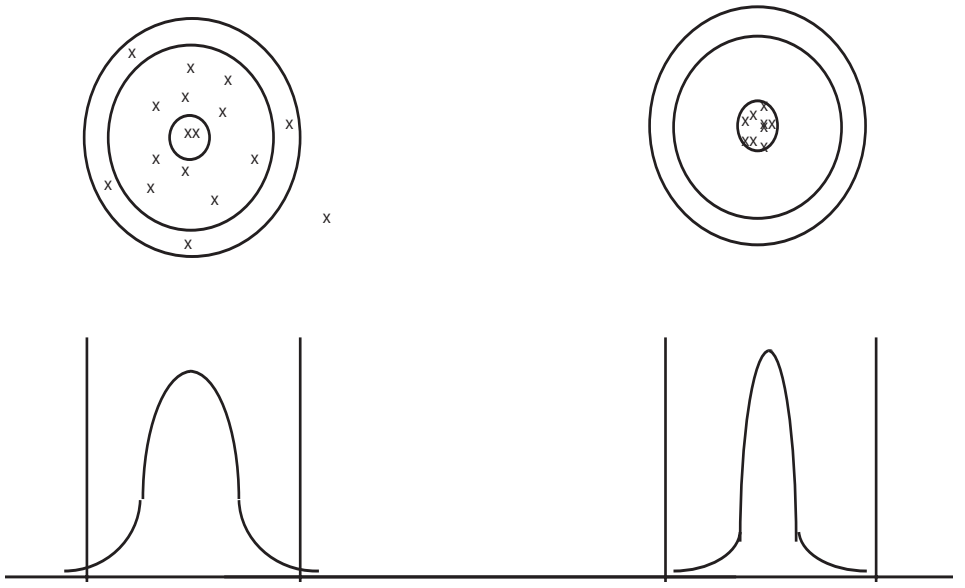

Figure 1

in LCD sales this year, and this is expected to increase to $20B in the next three years. Today, IBM and Toshiba are involved in a joint venture where IBM manufactures laptops and Toshiba manufactures flat panel displays. The biggest Kyocera LCD factory is in Silicon Valley.

Karatsu also praised the creativity of Tamiya Company, a maker of plastic models. Mr. Tamiya, the president, imported the technology for making plastic models from the U.S. after WWII. But the U.S. rivals who once led the industry have often been sold to new owners who put finance specialists or lawyers in charge as president. "The U.S. companies have not generally performed well after that," Karatsu noted. Tamiya, by contrast, has found ways to remain a leader. For instance, Tamiya buys companies that are unwilling to make the necessary investment in the future. In a non-financial dimension, Tamiya has learned that whenever Russia introduced a new tank, the Israeli government agents would always get the plans. Thus, Tamiya regularly traveled to Israel, and always had accurate models of the latest Russian tanks.

6. Dealing with economic ups and downs in Japan

Professor Karatsu notes that the economy always goes up and down in repeating cycles. Although company downsizing is now going on, the Japanese economy is gradually recovering, as of November 1993. In addition, they are moving factories overseas, to Southeast Asia. They understand what part of a business should be sent overseas and what should stay in Japan. This process has happened over only three years.

Japan was well prepared for this current downturn because the first oil crisis got them used to making changes. Today's problems are mild by comparison with the oil crisis of 1974.

7. Professor Shiba on Professor Karatsu's talk and Professor Karatsu

Shoji Shiba offered "five lessons" that he learned from Professor Karatsu's talk:

0. Professor Karatsu is always curious—for him, everything is a new discovery.
1. Imitate a great person, like Thomas Edison.
2. When collecting data, first decide to do the study. Then study how to stay or to survive in any circumstance.
3. Sensitivity is important if one hopes to notice what's happening. As in the case of Professor Karatsu noticing a subtle detail in the picture from the Pentagon, "There's plenty of information in front of us to interpret if we have enough sensitivity."
4. Karatsu always insists on going to the factory or to the customer's site to gather information. Tour the factory. Go on-site. The information and problems of the customer are important. They are what drives new products. All the examples given in the talk started from the problems of a customer.
5. Professor Karatsu's stories were all concrete examples. We must start with the concrete and move toward a global perspective. In other words, we need to make use of our two eyes (⊙⊙). ■

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