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## **Stranger in a Strange Land:** How Homer Sarasohn Brought Industrial Quality to Japan and Why It Took Japan So Long to Learn

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Last week's column mentioned Homer Sarasohn, who among many things was at one time the chief engineer for IBM. Not many people know about Sarasohn, but even the mention of his name prompted several readers to ask for more. So this week, I'm taking a break from my series on new companies to take a look at a classic Sarasohn story. And at the same time, we get to look at the whole business of industrial quality control from a different — and I hope enlightening — perspective. This is the story of how Japan came to appreciate quality and why it took so long to happen. It's not the story you expect. And it's the sort of lesson that's so important that we as a society have already forgotten it.

Figures.

Homer Sarasohn, who lives with his wife in a retirement complex in Scottsdale, Arizona, is among many other things the father of the Japanese electronics industry. A gentle man with an owl-like face, Sarasohn never planned to go to Japan. He really wanted to be a gynecologist, but couldn't afford to go to medical school during the Depression. So Sarasohn fell back on his undergraduate physics degree, and went to work before the war designing radio transmitters. When the Second World War came along, he served as a paratrooper, then later resumed his radio work, joining the staff of the MIT Radiation Laboratory.

The Rad Lab, as it was called, was the major U.S. development center for Radar during the war, and it was Sarasohn's job to take laboratory prototypes of new radar equipment and turn them into products that could be mass produced by the radio manufacturers of the day. He was still working at the Rad Lab in 1946, when a telegram came from Washington, summoning him to Tokyo. The telegram said he was wanted by General Douglas MacArthur, head of the occupation forces in Japan.

"I thought it was a joke," Sarasohn said. He was 29 years old.

MacArthur's headquarters was divided into several sections. Each section served as a branch of the Japanese government, though with an American administrator in each leadership role. The U.S. government was MacArthur's nominal model, though he adapted it in places to suit the very different needs of both Japanese society and his own military background. There was no true president, for example; MacArthur played, instead, the role of emperor, which suited him.

When he got to Japan, Sarasohn was made chief of the Industry Branch within the Civil Communications Section. That meant he was in charge of rebuilding the communication infrastructure of Japan. MacArthur wanted to use radio as a tool of occupation — to communicate

directly with the people of Japan — and that meant setting-up transmitters, as well as building hundreds of thousands of radio receivers. Radios would be the first appliances available to the public in post-war Japan.

"There were fewer than 100 people in the Civil Communications Section, and none of us knew anything about Japan," Sarasohn said. "American bombing had laid bare the country. There were refugees everywhere. The factories were all gone. What electronics production equipment hadn't been destroyed was dispersed to the countryside. We had to find equipment and people with experience to run it, then set up factories wherever we could. The easiest way to get up and running was to bring back to life the companies that had been operating during the war — NEC, Matsushita, Furukawa, Fujitsu, Toshiba, and others. Within a year we got them organized in a primitive way."

MacArthur had abolished the Zaibatsu — the confederations of companies that had dominated the pre-war Japanese economy. These groups, the remnants of which survive today in the form of Japan's enormous trading conglomerates, created domestic cartels, manipulated supplies and prices, and generally established the long Japanese tradition of building a robust economy on the backs of submissive consumers. MacArthur blamed the war on the Zaibatsu and its leaders, who he banned from participating in their old companies, taking virtually all top managers out of the labor pool (they later returned, following the end of U.S. occupation of Japan, and ex-Zaibatsu leaders were mainly responsible for Japan's economic resurgence in the 1960s). With all the leaders gone, Sarasohn had to promote middle managers, when he could find them, into the top jobs.

Those were the days of vacuum tube radios, and when vacuum tube production finally began in the makeshift plants, the American was appalled to see that yields were typically less than 10 percent. Ninety percent of the vacuum tubes would not work. To the Japanese running the factories, this was no surprise, nor was it a cause for concern; it had always been this way, even before the war.

"The Japanese had no sense of quality," Sarasohn said. "With the exception of the Zero fighter and some aircraft engines, their designs were bad and their manufactured goods were shoddy. Having come from the Rad Lab, I was particularly appalled to see the primitive nature of Japanese naval radar. Their vacuum tubes were bad and the radios were even worse, since each was hand-wired by untrained, often unsupervised, workers. They produced goods in mass quantities, ignoring quality. The factories were filthy, and with the exception of some technology picked up from Germany early in the war, most of their production techniques dated from the Meiji Restoration of 1868."

Sarasohn called in the plant managers, asking them to identify one problem they could work on to improve quality.

"There was utter silence," he said. "They were not expected to make meaningful contributions to their companies in this sense."

Eventually, the managers began to talk with each other, while Sarasohn waited. According to the translator, they were trying to decide what answer to give that would most please the American. That was when Homer Sarasohn decided to become the Japanese electronics czar. "I had to become a dictator to get anything done," he said. "It's part of the Japanese psyche that they follow the leader. The expression they used then translated to 'pay the man in power,' which was a holdover from the culture of submission popular during the Tokagawa era of the 19th century. If I was going to get the industry back on its feet, I would have to take complete charge."

In order to play his dictator role, Sarasohn first had to learn Japanese. "Our translators were Nisei GIs, mainly farm-boys from Hawaii," he said. "They couldn't understand the technical materials they were being asked to translate. Worse still, they were distrusted by the native Japanese, who saw them as traitors since they were not really Japanese and weren't loyal to the emperor. It was easier for me to rule directly as a representative of the conquering horde than

to try to rule through translators. For the first time in its history, invincible Japan had been conquered, the emperor had been forced to say he was not a god, and I represented the force that had made those changes happen. My power was unquestioned."

Frustrated with Japanese language courses offered by MacArthur's staff, the American moved-in with a Japanese family, embracing their culture, and living as a Japanese until 1950.

Under Sarasohn's control, the Japanese electronics industry began to make slow progress. Yields rose over time as new production methods were adopted, eventually reaching around 75 percent for vacuum tubes (Sylvania, which set the world standard for vacuum tubes, had an 85 percent yield at the time). But there still wasn't a deep understanding of the need for quality.

"I remember visiting the Hirakawa Electric Company in Osaka (the company is today called Sharp Electronics). The manager wanted to show me that he understood my lectures about having a clean workplace," Sarasohn said. "He had hired a man specifically to keep the place clean. We found him in one of the big assembly areas. This fellow had a stick with a string coming from the end of it, and on the end of the string were a couple of pieces of ribbon. He was going around the assembly benches, flicking this stick, using the ribbons to push the dust around a little. The plant manager looked on proudly, thinking that his man was 'cleaning' the plant, and that I would be impressed."

On another occasion, Sarasohn made a surprise visit to the Tokyo Communication Engineering Company. He'd given the small company an important job, building a special piece of electronic equipment, but the project was long overdue. Travelling alone across Tokyo, he appeared without warning at the electronics factory, demanding to see the equipment he'd ordered. The owners were absent, parts were scattered everywhere and covered with dust. The special project, a radio station studio mixing console, lay about in pieces, barely begun. Furious with what he saw, Sarasohn exited without a word, leaving the workers in disgrace.

When they heard about the disastrous visit, the two founders of the Tokyo Communication Engineering Company hurried across the city to mollify Sarasohn. Their business was only a couple years old, and they didn't want its history to end that day.

The issue was quality. The plant was a mess. The special project was not only unfinished, the quality of work that its parts displayed was bad. Sarasohn gave them one last chance. "I told them to either mend their ways or lose their jobs," he said.

The Tokyo Communication Engineering Company later changed its name to Sony Corporation. The two men who came to plead for the survival of their company were Sony co-founders Masaru Ibuka and Akio Morita.

When the Second World War ended, American leaders thought their occupation of Japan might last forever. But by 1949, it was clear to Sarasohn that the Korean War was coming, and that the American occupation of Japan would soon end. If his work was to survive, he had to find a way of permanently instilling in Japanese industry some regard for quality.

First, Sarasohn set up the Electrical Test Laboratory, which was used to test prototype radios and other electrical gear before they could be approved for production. Later, random samples of the same goods would be taken off production lines for further testing to guarantee that quality remained at an acceptable level. If quality dropped, the production lines would be shut down, tying the success of management directly to its control of quality. The people in charge were thus personally committed to product quality, and could not delegate this responsibility.

The Electrical Test Laboratory still operates in Japan, fulfilling the same function set up by Homer Sarasohn in 1949. It serves new functions that Sarasohn could never have predicted, too, including acting as a barrier for the entry of American electronic goods that must first pass a tedious battery of superfluous tests before they are allowed in the country. Every electric fan, stereo component, and room air conditioner must be tested again in a Japanese facility, despite carrying Federal Communications Commission or Underwriters' Laboratory approvals.

After he set up the Electrical Test Laboratory, Sarasohn wanted to develop a course in American management techniques specifically for Japanese plant managers. But some members of the occupation forces opposed spreading U.S. production know-how to the Japanese.

The issue was decided in a 20-minute presentation before General MacArthur. The General had long before stopped following the letter of his original orders, which told him specifically to "not assume any responsibility for the economic rehabilitation or strengthening of the Japanese economy." Sarasohn argued that without better management, Japan would be a long-term drain on U.S. taxpayers. His opposition, the head of the Economics and Social Section, argued that the program Sarasohn was proposing could turn Japan into an economic monster that would threaten the U.S. in world markets.

"Go do it," MacArthur said casually on his way out the door, changing the course of world history.

Working with Charles Protzman, an engineer from Western Electric who had been brought in to run the Japanese telephone system, Sarasohn wrote a textbook and prepared a syllabus for what they called the Civil Communication Section Management Seminar. It was a required seminar for senior electronics industry executives, meeting eight hours per day, four days per week for eight weeks.

"The course was quality control, management concepts, and philosophy," Sarasohn remembered. "We'd ask them why their companies were in business, and they'd either look at us blankly or say that they were in business to make a profit, which was incorrect. The right answer was that they were in business to achieve some appropriate long-term goal, like taking the technical lead in manufacturing radio equipment. Unless you can come up with a reason, a motto, a clear statement of why you are in business, then you aren't in business. And we taught them that that motto had to be understood at all levels of the company."

"The example we held up was Newport News Shipbuilding, whose motto was: 'We will build good ships here — at a profit if we can, at a loss if we must, but always good ships,'" Sarasohn said.

The CCS Management Seminar was taught in Tokyo and Osaka, and covered a systems approach to manufacturing, integrating customer satisfaction into continued product development. The seminars taught industrial engineering, cost control, and the value of investing in research and development. They taught that workers on all levels of the company should be included in product development. But mainly the course stressed quality control, that it is a state of mind that can't be inspected into a product. Quality, the managers were taught, is a measure of the worthiness of their companies.

Managers who had finished the CCS course were required to teach the same lessons again to executives at their own factories, using the textbook written by Sarasohn and Protzman. After both men left Japan in 1950, the CCS Management Seminar was given for the next 25 years by the Japan Management Association. Their textbook, Fundamentals of Industrial Management, is still in print in Japan.

Early graduates Sarasohn's seminar were Ibuka and Morita of Sony, Matsushita Electric's Masaharu Matsushita, and Mitsubishi Electric's Takeo Kato.

"As you know from history, they passed the course," Sarasohn said.

So why haven't we ever heard of Homer Sarasohn or Charles Protzman? Because we have heard of American quality guru W. Edwards Deming, a master of self-promotion who was brought to Japan to continue their work after these two men returned to the U.S. at the end of 1950. Deming, who did early work in statistical quality control at the U.S. Department of Agriculture, Census Bureau, and War Department has been, in large part, taking credit for the work of others.

"Deming was actually our second choice," Sarasohn recalled. "We wanted Walter Shewart from

AT&T Bell Labs to be our quality guru, because he virtually invented statistical quality control in the 1930s, but Shewart wasn't available at the time — he was in poor health — so we settled for Deming. He's capitalized on it. I was too dumb or naive, or too busy earning a living to bother."

Sarasohn and Protzman specifically wanted an American to continue their quality campaign. There was a statistical group at Tokyo Imperial University that wanted a crack at the job, but the two Americans were wary. "The university group had elder statesman status in Japanese society, which made them risky for us," Sarasohn explained. "One really remarkable thing about Japan is the achievement of its craftsmen, who are really artists, trying to produce perfect goods without concern about time or expense. We saw some of the same artistic tendency in these statisticians, who might have got so caught up in the intellectual appreciation of the task that they could forget the point of it all, which was production. This effect shows, too, in many large-scale Japanese computer programming projects, like their work on fifth generation knowledge processing. The team becomes so involved in the grandeur of their concept that they never finish the program."

But where Sarasohn and Protzman represented Japan's conquerors and ruled by decree, Deming actually worked for the Japan Union of Scientists and Engineers. That Union eventually established the Deming Prize, which is given each year to the Japanese company judged to have made the most advanced use of statistics in quality control. While Sarasohn was MacArthur's man, Deming was perceived as the Japan Union of Scientists and Engineers' man, which helped insure his place in history.

"I was proud of the work I did in Japan," Sarasohn said, "but I never imagined the Japanese electronics industry would become dominant. I had confidence in the American business establishment, which seemed at the time to have a healthy head start. But somewhere along the line we lost our way. We forgot the very lessons we taught the Japanese. Business in this country today is done the wrong way, always thinking in the short term, trying to get rich quick. Where did we get all these MBAs? Senior Japanese executives come from the factory floors and engineering labs while we promote our executives from sales and marketing and finance. That's the wrong way."

"Where is quality today in American business?" Sarasohn asked, shaking his head. "It can't be Donald Trump, can it?"

No, it isn't Donald Trump. And it isn't some innate superiority of Japan, either. When was it, after all, that Japanese electronics and automobiles got so good? In the 1970s, right? Surely by the 1980s — 30 years and more after Sarasohn and Protzman returned to America. We can't blame those men for Japan's success anymore than we can blame them for America's apparent failure. They may have laid a foundation, but something else had to happen to explain how Japanese companies came suddenly to dominate the world electronics and automobile businesses, a full generation after they were taught how.

The rest of the answer lies in what it is we're in business to do. What variable is it that we are trying to maximize? Organizations, by their very nature, are clumsy. Take any group of more than three people and the best you can hope for is that they will do one thing well. That's why there are no marching symphony orchestras. It's that way with companies, too; they are all managed to maximize some particular variable.

From Japan's first days of industrialization in the Meiji Restoration of 1868 and for the hundred years that followed, Japanese industry was intent on maximizing production. "Paying the man in power" meant building millions and millions of things, often of dubious quality, but that was okay because these companies were territorial and they lived for market share bought with cheap production. Despite the preaching of Sarasohn and Deming, in the feudal Japanese industrial structure it still mattered more how many widgets your company made than how well they were made. Talk to any owner of a 1960s-era Japanese car for proof of that. Sure, Sony was making pretty good radios and televisions, but Sony was the exception, not the rule.

If Japanese companies were territorial, their American counterparts were predatory. Predators eat meat, and in the world of business, meat means profits. American companies were organized to maximize profits. What mattered in the 1960s and '70s — in the era of conglomerates — was the sheer number of dollars produced. By the 1980s, Wall Street had refined this approach and was concentrating on profit margins, disassembling the ungainly megaliths of the past to gain greater value for shareholders, all at the expense of long-term planning and product development.

The Japanese companies went through a similar shift, but rather than going from maximizing gross profits to gross margins, the big Japanese corporations — led by their electronics divisions — went from maximizing production to maximizing yield.

Production is making things. Yield is making things that work. For a hundred years and pretty much despite the efforts of Homer Sarasohn, Japanese companies concentrated on production and ignored yield. Then, in the late 1960s, something just happened, and the Japanese started making things that worked, and worked well, and we were in trouble without even knowing it.

"We didn't start to talk about yields until the planar process came along in the 1960s," said Yoshiro Nishi, who in those days was a junior semiconductor engineer at Toshiba.

Nishi is a sort of Homer Sarasohn in reverse. In the early 1980s he was the head of a small engineering group at Toshiba that literally took the computer memory business away from America. Toshiba's one megabit dynamic random-access memory (DRAM) chips cost American companies billions in sales, at the same time adding billions to America's trade deficit. Yoshiro Nishi can rightly take credit for that. Later, Nishi was head of Very Large Scale Integrated (VLSI) circuit design for Hewlett-Packard. Nishi, who was ostensibly on loan to HP from Toshiba, was literally handed-over as a concession in U.S.-Japanese trade negotiations in 1985

But what's this about the planar process?

The planar process was what they called the method invented for making integrated circuits at Fairchild Semiconductor in 1959. It was a way of putting several transistors on one piece of silicon. Jack Kilby at Texas Instruments had already built several discrete components on the same slice of germanium, including the first germanium resistors and capacitors, but Kilby's parts were connected together on the chip by tiny gold wires that had to be installed by hand. TI's integrated circuit could not be manufactured in volume.

Fairchild founder Bob Noyce came up with a different production method in which a layer of insulating silicon oxide was deposited on the top surface of the chip — this was called the "planar process." Then photolithography could be used to print thin metal lines on top of the oxide, connecting the components together on the chip. These metal traces carried current in the same way that Jack Kilby's gold wires did, but they could be printed on in a single step rather than being installed one at a time by hand. Using their new photolithography method, Noyce and his boys put first two or three components on a single chip, then ten, then a hundred, then thousands. Today, the same area of silicon that once held a single transistor can be populated with more than a million components, all too small to be seen.

Until Fairchild perfected the integrated circuit, Japanese and American companies alike made individual components. The Japanese controlled a portion of that market based on their lower labor costs and despite their comparatively high reject rates. Since semiconductors were, after all, just made of sand, it didn't make that much difference how many transistors they threw away for every good one.

But when the business switched from discrete components to integrated circuits, it suddenly did matter how many parts were thrown away. Fairchild's planar process took away Japan's labor cost advantage and at the same time amplified Japan's quality disadvantage, because ICs could be ruined by the slightest bit of dust. If half of the Japanese discrete transistors were bad, then the other half were good and that was okay. But if half the transistors in an integrated circuit

were bad, then the whole chip had to be rejected. Yields dropped instantly to zero, putting the Japanese companies literally out of business.

Practically overnight, the Japanese electronics industry was born again, switching from maximizing production to maximizing yield. Suddenly, they understood in a way that they never had before the significance of Homer Sarasohn's lessons in product quality. It became essential to consider any process not as discrete elements but as a total system, and the way to maximize yields is not to aim for zero defects but for zero variation. If you control the production system and eliminate variation, then you don't even have to look for defects, because their won't be any. That's the only way to increase integrated circuit yields, no matter what country you work in, but it goes far beyond semiconductors to all areas of manufacturing. That's why Canon doesn't inspect its copiers and printers — because the variation is so low that inspection is a waste of time. That's what Homer Sarasohn was preaching in 1948, and what the Japanese electronics industry suddenly came to understand in 1968, when they went from talking about quality to doing something about it, because the alternative was failure. These lessons spread, 30 years after they had first been taught, first through the electronics industry in Japan and then to the automobile industry, which put them to good use.

If Toyotas are reliable, this is why.

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