

Japanese industrial research

Small-scale industrial research in Japan stands out for its pursuit of excellence and for its willingness to devote time to fundamental investigations — if only to show customers what they might also achieve.

Tsukuba

WHAT makes Japanese high-technology industry so successful? What follows is inspired by curiosity about that question, but should not be mistaken for an answer to it. Rather, it is primarily an account of a visit to a handful of research laboratories at this “science city” ninety minutes by bus from Tokyo, but so different from it (or from any other Japanese city), with parks, four-lane highways near the centre and buildings with a room for a little landscaping around them that it is possible to believe the tale of a family that declined to move here because it preferred that its children should be brought up in a Japanese environment.

Tsukuba has changed a lot, and quickly. It was conceived, two decades ago, as a means of decanting research people and their families from Japan’s crowded cities and downtown laboratories. At the beginning, it is said, there were people who preferred to commute every day rather than to abandon their familiar haunts in the biggest city. But now, the city has a university of its own, what some among the 250,000 residents say is a thriving cultural life and, collectively, such a strong thread of intellectual ambition that Tsukuba’s public schools have become among the best in Japan — yet parents still send their children off (by bus, for the day) to even more highly regarded schools elsewhere.

On this particular visit, the reasons for visiting Tsukuba proved in the end to be spurious. Dr Chikara Hayashi, the physicist chairman of the high-vacuum company ULVAC, had mentioned at a party that there were two Chinese engineers working at his Tsukuba laboratory and several others at another at Chiba, on Tokyo Bay. Might they have something interesting to say about the state of Chinese research, China’s relationship with Japan or even about the future of their government?

Hayashi had explained that the people concerned belonged to academic institutions at which he had made friends on his travels in China, and that they were proteges of friends of his. The two engineers, with the family names of Wang and Chang, are from Peking and Shanghai. They like it in Japan, and believe it would be better if they could stay for three years rather than the two they have contracted for. ULVAC, in the person of laboratory director Dr Sonoko Tsukahara, agrees to the

extent of saying that much of the first year is spent learning Japanese.

But Wang and Chang, diminutive people in their thirties with eyes sparkling with intelligence, quickly undermined their potential uniqueness by explaining that there are some hundreds of Chinese students at Tsukuba University. But that may be significant. If Japan cannot increase the enrolment of young Japanese in university engineering and science courses, may it have to look to the mainland to sustain the torrent of innovation of the past few years?

Earlier, Hayashi had been philosophical on that issue, recounting arguments in which Chinese had assured him that China would be “ahead” in fifty years. He smiled and shrugged his shoulders at the recollection, implying that he did not think it would be that simple, but that if it were, he would be the first to wish the Chinese well. He acknowledges that there is weight in sheer numbers.

Meanwhile Hayashi’s company is a creature that would not, now at least, exist elsewhere. Its business is to make and sell high-vacuum equipment (not simply the boxes designed to contain less than nothing, but the pumps that empty them). Evidently the demands of the electronics industry in the past few decades have been immense, sufficient to sustain ULVAC in a growth phase. But is it not dangerous to rely on a single kind of customer?

Of course. That, says Tsukahara, is why one of her laboratory’s main tasks is to find new uses for high vacuum techniques. The first objective is to make the potential market grow by showing potential users that the company’s advanced technology has something they had not thought of to offer them — how to make magneto-optical storage disks, to coat anything with almost anything or to make magnetic recording tape with high coercivity, for example. Customers pay for the cost of answering the questions they are obliged to ask and the laboratory recovers some of its own costs by selling technical reports expensively to others who may be interested.

The company’s laboratory is one of those at which you must exchange your shoes for plastic sandals at the front door. Another is the research laboratory of Hamamatsu Photonics, on the same site, whose stock-in-trade is the detection of single photons. Building on early experience with photomultipliers, the company

now reckons to be able to play its tricks in any region of the spectrum that may be of interest, and to be able to beat most of its competitors in sensitivity.

So what does Hamamatsu show off in its research laboratories? A tank filled with seawater, with sea-urchins clinging to the sides. The company has developed a technique for doping the membranes of growing sea-urchin embryos with fluorescent dyes so that their shape can be instantly determined (in “real time”) from the patterns of single photons they emit. With the combination of such sensitive dyes and detectors, you can follow the rupture of a single lysosome membrane on a television screen. Who knows where that may lead? That is evidently the calculation behind an instrument maker’s surprising support of basic biology research. But that seems typical of Japan.

The lessons from these and other tales are quite simple. The simplest route to success is to be able to do something that others cannot, counting single photons for example; but if you manage something in that category, you must always be conscious that there will be others treading on your trail, seeking to be a little better. The second route is that you must follow when you know your skill is not unique, and that you can succeed only by being better than another; then you follow another’s trail, but hope to be quicker on the journey. That, of course, is nothing but a description of some kind of market. Japan’s distinctiveness is that the criteria of success are defined in technical language — a resolution, an intensity or a stability may give you the decisive edge.

Japan has thus become the society in which only the best is passable, and in which the second-best is second-rate. These are stiff criteria, and potentially enervating as well. That is why it is as well that a group of liberally-minded amused people such as Hayashi are still in the vanguard of innovation. Between them, they settled for Tsukuba at which to build what is called the Tsukuba Research Consortium, a kind of science park sustained by the willingness of its founders to belong. (There are also satellite members, who rent space, and foreign members, who pay \$1,500 a year for access to data and the weekly seminars). Whatever happens across the Japan (or China) Sea, there seems no limit to its potential.

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