

The Fabric of Success

As an export-driven economy with limited natural resources, Japan has sometimes run into trade disputes with other countries. The adverse effects of such trade friction have usually been felt most keenly in Japan's textile industry. In the face of import restrictions in overseas markets, followed by the rise of other Asian economies, the sun appeared to set on the industry. But thanks to Japan's rich tradition of craftsmanship, the sector has not only survived but flourished. By competing on quality and value rather than price, Japan's textile industry has achieved an impressive recovery. Here, Japan Echo introduces two companies and the challenges they overcame on their way to success.

Sato Sen'i Co., Ltd.

Spinning a New Yarn

Yamagata Prefecture in northern Honshu is a land with a harsh climate, where almost the entire prefecture is covered by deep snow during the winter months. It was here, in the town of Sagae, that Chonosuke Sato started a spinning company using wool from locally reared sheep in 1932. Sato Sen'i Co. continues to flourish today.

An Eye-Opening Trip

The textile industry is highly competitive, and many companies struggle just to stay afloat. The 1990s were a particularly difficult time, as the industry in Japan came under pressure from lower-priced competition in other Asian countries. Sato Sen'i was no exception: Sales plummeted to just a third of what they had been at their peak, and the company lost half its workforce. "I knew there was nothing wrong with the quality of our products, but they just weren't selling," says Masaki Sato, the compa-

ny's fourth-generation president. Sato put himself in charge of sales and began looking for a way to turn the company's fortunes around. He took a trip to Italy, where he visited a trade fair and toured local textile factories.

"I had always thought of a spinning company as a subcontractor, producing a product according to the instructions of the end client," he recalls. "But the attitude of the Italian companies was quite different. The workers were passionate about their jobs and took immense pride in the fact that they were creating the foundations of fashion. I was astonished not by the quality of the thread or the manufacturing methods but by the spirit and attitude of the workers."

Sato says the experience gave him sleepless nights. "I would lie awake asking myself: 'What have we been doing all these years?' And 'How are we going to face the future?'" After much soul-searching, Sato decided, "We should concentrate on offering a product that no one else can make. We'll make



Masaki Sato

the things we want to make and find a market for them ourselves."

The ideas for new products came quickly enough: extra-fine threads, a light thread with a soft, cotton-like texture . . . but turning these ideas into reality was not easy.

"The hardest thing was changing the thinking of our craftsmen," says Sato. "I would go to them full of new ideas, but they would just shrug their shoulders and tell me it couldn't be done. They were ex-

tremely good at their jobs, but they placed so much weight on the traditions of their craft that they weren't very open to new ideas." Even so, the company began little by little to introduce innovations. Sato brought in some old machinery and with the help of his workers set about making adjustments to the machines himself. Older machines had simpler designs and were easier to improve. They had also been designed in an age before efficiency became an overwhelming priority and were therefore well suited to the kind of painstaking, high-quality designs Sato had in mind.

Another point Sato was particularly insistent on was the quality of the raw materials. He traveled the world in search of materials that were not available on the regular market, hunting down the finest mohair from South Africa, alpaca from Peru, and cashmere from Mongolia. Today he still travels to several countries a year, dealing directly with farmers and returning home with the finest and rarest wools he can find.

"The commitment and dedication of the farmers is quite amazing," enthuses Sato. "The fleece from animals that have been properly cared for is in a class of its own." Sato values the time he has spent getting to know the farmers who produce the raw materials. "We go hunting together, maybe enjoy a few drinks together in the evening. We may not have a language in common, but we share a commitment to craftsmanship and to the idea that we should try to make the best product we possibly can."

The combination of top-grade materials and specially fine-tuned machinery made possible new types of thread that had never been seen before. Even the originally

skeptical craftsmen were converted to the merits of the new approach when they saw the results of Sato's innovations before their eyes.

The company's output may be limited in terms of volume, but since opting to concentrate on offering added value and innovation to his clients, Sato has come up with an impressive range of new products. These include ultra-thin threads just half the thickness of conventional threads, threads dyed in 30 different colors, and glossy, shiny threads made from a combination of rare natural materials and artificial fibers. Combining the lightness and springiness of *washi* paper with the softness of cotton creates knitwear that is pliable and form-hugging and does not lose its shape. Previously, 1 gram of mohair could be spun out into a thread of no more than 27 meters in length. By using new technology that spools out the thread uniformly, Sato succeeded in producing an ultra-fine thread with a length of 52 meters. The fine mohair thread proved an immediate hit and was soon being featured in the collections of top brand-name designers. The firm now produces some 150 types of thread.

The distinctiveness and quality of the company's fabrics have brought it to the notice of clothing companies around the world. Sato supplies knitwear materials to famous brand names, such as Chanel and Nina Ricci. The cardigan worn by Michelle Obama at the presidential inauguration in 2008 was just one of many made from the company's yarn.

Branching Overseas

In 2007 the company exhibited for the first time at the Pitti Immagine Filati, the trade fair in Italy that

Name: Sato Sen'i Co., Ltd.
Address: 1-19-1 Motomachi, Sagae-shi, Yamagata 991-0053
President: Masaki Sato
Business: Manufacture and sale of worsted wool, knitwear, and original brand-name apparel
Capital: ¥54.1 million
Employees: 100
Website: <http://www.satoseni.com>

had made such an impression on Sato when he first visited there years earlier. Sato was confident that his products were up to scratch but was worried about whether they would have the visual impact they would need to stand out against the competition. He went to the fair with modest expectations. "Absolutely the most I was hoping for was that I might come out of it with one contract with a European luxury brand."

The company was allocated a booth in a corner of a basement room—hardly the most promising of locations. But Sato came up with an ingenious way of making the booth more conspicuous. He covered the booth with white cloth and turned off the lights inside, using a spotlight instead to focus attention directly on the products, so that they would catch the eye even at a distance. The idea worked, and the booth attracted a steady stream of visitors. Word of the unusual booth began to spread, and by the afternoon large crowds had gathered. There were even more visitors on the second and third days. Buyers representing Europe's famous brands stopped by, and Sato spent several busy days exchanging business cards and explaining his products.

The company appeared at the fair again the following year. This time it was given a booth in the center of the main exhibition area. The booth was twice as big as the previous year's, and the number of

visitors was such that Sato and his co-workers were scarcely able to attend to them.

In this way, the company's thread became an international success and won the support of

some of the world's leading brands. It was almost 10 years since Sato's first visit to Italy.

Hirose Paper Manufacturing Co.

Weaving Traditional Paper Technology into Synthetic Fibers

Ever since the Heian period (794–1185), the city of Tosa in Kochi Prefecture has been a leading center for the production of *washi*, or Japanese handcrafted paper. Local Tosa *washi*, made thin and strong using techniques unique to the area, has even been presented as a gift to the Japanese emperor. One factor that has helped foster the city's sophisticated *washi* industry is the purity of water from the nearby Niyodo River. Of all the rivers on the island of Shikoku, the Niyodo ranks second from the top in terms of water quality.

The forerunner of locally based Hirose Paper Manufacturing Co. was a *washi* factory, but now the firm boasts 50% of the domestic market and 30% of the international market for the electrical insulating paper that prevents shorts from occurring in the positive and negative terminals in AA and AAA alkaline batteries. It has evolved into a leading-edge company with technology for mass-producing low-cost nanofibers.

Turning Point

By the 1950s, the region's traditional Tosa *washi* industry had entered a period of decline. Younger

workers were turned off by the manufacturing process, which required placing their hands in water for hours on end, even during the chilly winter season. Hirose Paper was left with fewer and fewer employees to carry on its techniques. The wave of industrialization after World War II that drained Japan's rural areas of younger workers only exacerbated the shortage.

The late Shinji Hirose, the company president at the time, sensed the danger this decline posed to his factory's future. Together with Hiroshi Inagaki, a professor at Kyoto University (now president of the Japan Kenaf Association) whom he met at a lecture in 1950, he set about research into using Tosa *washi* technology to make synthetic fiber and enrolled at Kyoto University. In 1958 he finally succeeded in developing a wet nonwoven fabric made entirely of vinylon. Using this breakthrough, Hirose established Hirose Paper Manufacturing to produce synthetic fiber paper and began selling Papiron, a 100% vinylon, wet nonwoven fabric.

Japanese production of nonwoven fabrics had begun in 1956, using US-made machinery to dissolve and bond fibers in what is known as dry processing. With the help of a steelmaking company,



Shigehiko Komatsu

Hirose developed a machine for producing fabrics that incorporated handmade *washi* techniques. The machine employed a “wet process,” wherein finer fibers were mixed with water and a wire net was used to turn the mixture into fiber sheets, which were then dried. This allowed for the creation of fibers with uniformly minute pores. Since the base material was composed entirely of vinylon, it had the advantage of being free of wood pulp and other impurities and was resistant to alkalis.

But the technology had yet to find a market. “We were barely scraping by making things like toilet paper and translucent paper for *shoji* [sliding partitions],” recalls Shigehiko Komatsu, the company's current president.

The turning point came in 1959, with the invention of the alkaline battery in the United States. While these new batteries possessed roughly four times the power and lifespan of manganese

ones, their electrolytes contained an alkaline solution that corroded conventional separators made of natural fiber, causing them to short-circuit. This gave birth to the need for alkali-resistant separators.

As Hirose Paper's 100% vinylon nonwoven fabric also proved highly resistant to heat and abrasion, the company soon began receiving inquiries from major domestic electronics manufacturers, and its new fabric began being used for separators in alkaline batteries. The company also succeeded in reducing the size of the pores in its fabric to less than 30 micrometers in diameter (1 micrometer is equal to 1 millionth of a meter), which extends the batteries' life by allowing the electrolyte to pass through efficiently and without waste. It is now the exclusive provider to several major Japanese electronics firms. Separators have become the main product in the company's lineup, accounting for 60% of its overall sales.

Another Breakthrough

The development of lithium-ion and other rechargeable batteries, however, touched off a price war among makers of parts for alkaline and other disposable varieties.

"Led by Chinese-made batteries, prices have declined by around 20 percent compared with two to three years ago," explains Hideki Ishikawa. Ishikawa is president of Techno Hirose Manufacturing Co., an affiliate involved in heat treatment and other secondary processes. "But in a price war, stamina is going to be the deciding factor."

This sense of crisis prompted the company to begin developing a separator for rechargeable batteries, for which demand was increasing, to become the new main product in its lineup. The pores in the

separators for these new batteries, however, had to be between 0.5 and 1 micrometer in diameter.

"We couldn't make the vinylon and other fibers any smaller with the production method we were using at the time," says Komatsu. Although the diameter of the pores could be reduced by layering the nonwoven fabric, this would make the material too thick. That was when the company hit upon the idea of using a nanofiber, a fabric whose diameters are measured in nanometers (1 nanometer is equal to 1 billionth of a meter).

The conventional process for making nanofibers is called electrospinning. It involves loading a polymer solution, the raw material for making the fiber, into a syringe-like nozzle and applying an electrical current. Electrostatic repulsion causes a stream of liquid to erupt and dry in flight, thereby creating the nanofibers. With this method, however, there is the risk of having to halt production if the nozzles become clogged. "In addition," notes Hirose Paper Co. Director Keiji Ueda, "around 100,000 to 200,000 nozzles are required for mass production. These have to be maintained, which leads to higher production costs."

Ueda's staff attempted to improve upon this process and set about experimenting with ways of producing nanofibers without using nozzles. After many failed attempts, they developed a process whereby an electric current was applied directly to a container of a polymer solution and a metallic target charged with the opposite voltage was passed over the container, resulting in the entire surface of the target being coated with the nanofiber. Using a conveyor belt to move the target over the container enabled the fiber to be produced in large volumes. Says

Name: Hirose Paper Mfg. Co., Ltd.
Address: 529 Hei, Takaoka-cho, Tosa-shi, Kochi 781-1103
President: Shigehiko Komatsu
Business: Manufacture, processing, and sale of nonwoven fabric and other compound fiber products for industrial use
Capital: ¥20 million
Employees: 30
Website: <http://www.hirose-paper-mfg.co.jp/index.html> (Japanese only)

Ishikawa, "We averaged 15 square centimeters a day using the old technology. But with the new method we can produce 10,000 square meters a month, and there's no need to worry about clogging. We've also been able to reduce our manufacturing costs by a third." In addition to being used for separators in rechargeable batteries, the nanofiber can be sprayed directly onto the company's main product, vinylon nonwoven fabric, to give those products additional functionality. The company hopes this will find applications in desalination filters and medical devices.



Alkaline battery separators.

© Hirose Paper Manufacturing Co.

With the twin achievements of developing advanced technology based on traditional techniques for making *washi* and brand new approaches to the mass production of nanofiber nonwoven fabrics, Hirose Paper Manufacturing has its sights set on new product development challenges. 