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NS Styrene Monomer Co., Ltd.
Oita Works

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MIND

**Using Advanced Technology to Meet the
Challenge of “New Automation”**



Special Feature

**Conversing with Nature and Expressing the Conversation in His Work:
A Sakan for a New Era**

From *Tsuchikabe* (Earthen Wall) to Art and Beyond —

Conversing with Nature and Expressing the Conversation in His Work

A *Sakan* for a New Era



A *sakan* (plasterer) is a specialist craftsman who applies coats of plaster to the interior and exterior walls of buildings. The functionality of wall finishes by a *sakan*, in which a variety of textures and designs can be achieved by human hands, is highly valued from the viewpoints of durability, air purification, and ecology.

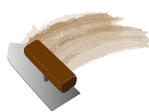
Mr. Syuhei Hasado, a *sakan*, is attracting attention from all over the world for his ingenious expressions, overturning the conventional image of a *sakan*. We interviewed him in his atelier in Hida Takayama in Gifu Prefecture.

Syuhei Hasado

Born in the city of Takayama, in Gifu Prefecture, in 1962, Mr. Hasado won the first prize in the category of plastering in the National Skills Competition in 1983.

After undergoing training in a plastering company, he established the Syokuninsha Syuhei-gumi Company in Takayama in 2001. He is currently active in a wide variety of areas, ranging from private houses to traditional Japanese buildings and even commercial facilities.

Sakan skills have evolved and changed with people's daily lives



The skills of a *sakan* have developed along with the history of construction. The use of *shikkui* (Japanese lime plaster) began in Japan approximately 1,400 years ago. It started with the technique of plastering walls with lime to make them white. The unique *shikkui* plastering method for the construction of castles for warriors was established in the latter half of the 16th century. During the 17th century, it became popular among merchants for the construction of storehouses for valuable goods that were vulnerable to heat and humidity. The merchants preferred decorative plaster reliefs created with a trowel, as well as black *shikkui* plastering to give their storehouses an attractive appearance. It is believed that it was around that time when the word *sakan* was established to refer to a skilled plasterer. However, the demand for plastered walls decreased with the spread of commercial construction materials owing to the influx of Western culture and the period

of high economic growth in the 19th and 20th centuries. Now, the work of a *sakan* is in demand to decorate the space of commercial facilities and buildings.

In this new era, Syuhei Hasado is active in creating uniquely original works to broaden the opportunities for *sakan* plasterers. He is involved in a wide range of activities, not only as a craftsman but also as an artist, organizing solo exhibitions and designing the entrance of a well-known hotel and the studio set of a TV show, working outside the box of the conventional *sakan*.

"I make what they call an 'artwork,' but I plaster the walls of private houses as well. For me, both kinds of work are the same in the sense that I work to achieve my clients' desires and needs. The only difference is that in the case of a private house, I focus on the accuracy of the finished work, whereas in the case of an artwork, the design is at the center of my focus."

A *sakan* uses materials like *shikkui*, soil, and plaster, and sometimes provides detailed decoration. It is said that there are more than 1,000 types of trowels—the *sakan*'s main tool—

varying in shape and size; Mr. Hasado owns more than 200 types.

"I was 18 when I held a trowel in my hand for the first time. Those that I have used ever since then, or for more than 35 years, fit so comfortably that I feel that they are part of my hand."

Mr. Hasado mainly works on *tsuchikabe* walls, which require natural materials. He uses soil as the base and mixes in sand, a special type of straw, and water. He sometimes starts his work by going into the mountains looking for the ideal-colored soil, which is the reason why he is dubbed the "Soil Sommelier." Viewing *shikkui* walls plastered by hand, one can enjoy their subtle changes depending on the viewing angle and the finish.

"*Tsuchikabe* walls contain water as a material, so the way in which the moisture evaporates after plastering, which differs according to the temperature and humidity, affects the resulting finish. Thus, the work of a *sakan* is incidental and organic. I'd go as far as to say that intuition is everything."

Tsuchikabe walls, which take advantage of the original color of the soil, are



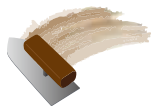
characterized by fluctuations and changes in their shades of color. It is Mr. Hasado's style to deal with *tsuchikabe* walls, feeling connected to nature and respecting the Japanese appreciation for things that are fleeting and quick to change. More often than not, he gets ideas for his work from nature. Some of the panels of the *tsuchikabe* walls that are hung on the walls of his atelier contain leaves and nuts that have been mixed with soil and plastered.

Recently, he has been active also outside Japan. He says that the skills of a Japanese *sakan* are highly valued overseas as well.

"In the United States, the *tsuchikabe* walls amazed local craftsman enough to make them exclaim 'Beautiful!' Moreover, it seemed that they were impressed by the idea of making the most of the materials. One of the advantages of Japanese skills is that we can create the best products with the least materials."

The unique thinking of the Japanese can be seen in the raw materials used. In Western countries, bricks are often used, which are clay processed with heat. It is rare for raw materials to be used unchanged, as they are in Japanese *tsuchikabe* walls.

His aims as a 21st-century craftsman



Mr. Hasado understands the work of a *sakan*, broadly defined as "the act of *monozukuri* (making of things) in harmony with nature." He has come to this understanding through his work on



With his atelier built in a greenery-rich area of Hida Takayama, Mr. Hasado often gains inspiration for his work from natural scenery.

a project in which a Western-style building built by master craftsmen in the Hida area in the early 20th century was relocated to a natural forest on somewhat less than an acre of land and renovated. He has transplanted wild grasses and flowers that grow naturally in the Hida area in the wide area around the building. He says that he has noticed, while growing wild grasses and flowers, the similarity between the cultivation of grasses and flowers and the work of a *sakan* in that both activities involve soil and water. What he is creating is not a wall or a building, but an "environment" where visitors feel the blessings of nature and the lives that live there.

"Owing to the advancement in technology, the Japanese now cannot stand scratches and irregularities. Probably,

they wish for things to be so hard and strong that any stain on the surface can be wiped off easily. If we define 'technology' as creating objects using a machine and 'skill' as creating objects manually with human hands, I am afraid that skills are being lost one after another in Japan. I believe that the skills of human hands are all the more needed in an age of remarkable development of AI and other technology."

The work of a *sakan* is no longer an essential skill, due to the increasingly wide use of panel walls. Instead, it is now considered as something special with elaborate designs.

The significance of *sakan* skills is changing with the changing times. "In the future, I would like to create objects other than walls with the *sakan* spirit. I want to see what would happen if what I am working on evolves further. I want to create something that people of the time will not overlook but rather take a look, and love," Mr. Hasado said. He looks forward to continuing experimentation with his *sakan* work.



Several types of trowels are used, depending on the wall size and plaster thickness.



The trowel on the left has been used for more than 35 years, whereas the one on the right has been used for approximately 10 years. It can be observed that the metal sections and the handles are worn.



NS Styrene Monomer Co., Ltd. Oita Works



With styrene monomer as its main product, NS Styrene Monomer Co., Ltd. (NSSM) meets a wide range of industrial needs. After repeated valve failures, the company's Oita Works plant is now introducing smart valve positioners. The plant is also using a system to improve the monitoring of valve status. In this way, by providing a mechanism to track valve failure trends, a high level of plant operation stability is being achieved.

Upgrade to high-performance positioners after repeated valve failures

NSSM meets a wide range of industrial needs with its main product, styrene monomer, which is the raw material for resins like ABS (which is frequently used in food containers and household appliances) and for aromatic compounds like benzene, toluene, and xylene.

In Oita Works' chemical plant, which is located in the Oita Petrochemical Complex, a total of four plants are operating: an aromatic production facility, two styrene monomer production facilities, and a divinylbenzene production facility.

"Each plant has been in production for many years since the beginning of operations, which was from 1977 to 1990, but many valve failures have occurred, especially since 2009. In investigating the cause, we found that about 40% of the failures were caused by age-related malfunction of the positioner that controls the opening of the valve," says Junji Yamamoto, leader of the Engineering & Maintenance Group.

In view of this situation, the plant decided to begin changing the valve positioners at each plant from the conventional mechanical type to a high-performance type equipped with a microprocessor. Azbil Corporation's smart valve positioner was selected for the job.

"At that time, Azbil was particularly advanced in making positioners smart. Azbil's positioners also have the great advantage that they can be attached to valves made by other companies, so we can use the same kind of spare parts for all the positioners," says Ryusaku Uwamukai, manager of the Engineering & Maintenance Group.

A system for early detection of valve abnormalities and for malfunction prevention

In addition to replacement of the positioners at the four plants at Oita Works, Azbil suggested the use of its control valve maintenance support system. Failure of valve operation at key points in production processes can adversely affect plant continuity and product quality, and can be very burdensome for operators. The maintenance support sys-

tem collects various types of operating data from smart valve positioners, such as the amount of deviation between the set valve opening and the actual valve opening. By detecting valve malfunctions at an early stage and presenting the information required for making maintenance decisions in an easily understandable way, the maintenance support system supports efficient maintenance operation.

"Previously, operators were not able to notice slight valve abnormalities until they became problems. But with online monitoring using the maintenance support system, it is possible to detect signs of abnormalities in operating valves at an early stage, and quickly take action to prevent problems before they occur. We decided to use the maintenance support system because we thought it would be a powerful tool for stable and safe operation," says Mr. Yamamoto.

In 2013, the maintenance support system was introduced at Oita Works after the positioners were replaced at the divinylbenzene production facility, and monitoring of 50 valves began. Thanks to the information from the upgraded positioners, early indica-



Graphs displayed by the maintenance support system's online control valve diagnosis. Checking the operating status of valves, detecting signs of a problem, and using online or offline valve diagnostic functions can all be done on a PC.



A smart valve positioner and single-seated control valve operating in a styrene monomer production facility. Data on valve operation is sent from the positioner to the maintenance support system so that warning signs of a problem can be detected quickly.

tions of valve abnormality proved to be correct, and the system was expanded to all facilities. The maintenance support system is used at each facility that has switched to smart positioners. Specifically, it is used for 150 valves of one system in the two styrene monomer production facilities since 2016 and for 200 valves in the aromatic manufacturing facility since 2018.

"Nowadays we can recognize signs of abnormality from the graphs displayed by the maintenance support system. Along with identifying the characteristics of individual valves, we are now considering how best to operate, such as what kind of behavior should be monitored and where the threshold values for alerts should be set, and we are also establishing response systems and rules for when alerts are raised," says Hidetoshi Maki of the Engineering & Maintenance Group.

Automating valve inspection to save time and effort

The introduction of the maintenance support system has had a significant effect on valve inspection. Valve operation is inspected every two years when the plant is shut down for periodic repairs. The step response test, in which the maintenance support system makes step changes in the travel setting to check the response of the control valve, is very useful.

"Until recently, we had been conducting inspections with two people, one in the instrument room and one at the manufacturing site where the valves are installed. Now, the maintenance support system automatically diagnoses the valves. As a result, inspection work that took about 7 days with two people

is now automatically completed in 2 to 3 hours. Also, since the maintenance support system can inspect 16 valves at the same time, the work is very efficient," says Mr. Maki.

At Oita Works, preparations are underway so that 200 valves running in another system of the styrene monomer production facilities can also be monitored by the maintenance support system by around 2020, at which point a total of 600 valves in the entire plant will be centrally managed by the maintenance support system.

"Azbil's support service collects valve operation data from the maintenance support system once a year and issues a report which analyzes operating trends and identifies valves that may have problems. We believe that this information will also be helpful for deciding the timing of maintenance and deciding on operating methods," says Mr. Uwamukai.

Also, in addition to the use of the maintenance support system, there are plans to increase the use of Azbil's device management system in order to manage field devices.

"With the device management system, we can monitor various field devices using HART communication.*1 In the future, we intend to collect data from a wider range of field devices—not just valves, but also equipment like flowmeters and pressure gauges—in order to achieve integrated management. In that way we can generate new value in plant operations on all fronts, such as continuity, security, and productivity. We are looking forward to Azbil's continuing support in these efforts," says Mr. Yamamoto.

NS Styrene Monomer Co., Ltd. Oita Works



Address

3 Nakanosu, Ooaza, Oita City, Oita Prefecture

Beginning of Operation

1969

Business

Production of aromatic products (benzene, toluene, xylene), styrene monomer, divinylbenzene



Junji Yamamoto
Group Leader
Engineering & Maintenance
Group



Ryusaku Uwamukai
Manager
Engineering & Maintenance
Group



Hidetoshi Maki
Engineering & Maintenance
Group

glossary

***1▶ HART (Highway Addressable Remote Transducer)**
A communication protocol for signals between field devices, controllers, indicators, etc., that is widely used in industry worldwide as a standard method of communication.

Using Advanced Technology to Meet the Challenge of “New Automation”

Azbil is applying advanced sensing technology, AI, and other technology to bolster its product development and provide new solutions that promote safety, productivity, and value enhancement at manufacturing sites

Azbil’s advanced automation (AA) business provides a wide variety of solutions for factories, plants, and other manufacturing sites. By strengthening our ability to develop products and systems that take advantage of advanced technology like high-precision sensors, IoT, AI, big data, and cloud computing, we aim to “create new automation” in order to grow and develop.

Utilizing advanced sensing technology and AI to promote smart manufacturing

Azbil Corporation’s AA business provides comprehensive solutions and services related to automation for production sites such as factories and plants—from operation monitoring systems to valves, controllers, and other field devices.

We serve a wide range of business areas, including large-scale petroleum, chemical, and steel plants; electrical/electronic, semi-

conductor, automobile, food, and pharmaceutical factories; and infrastructure facilities such as power plants, gas processing plants, water purification plants, and waste incineration plants.

In these diverse markets, the required solutions and the provided products and services can vary widely. Azbil has a proven track record of providing products, systems, and maintenance services that help customers to solve problems at production sites, in areas like production, quality control, energy efficiency, safety, and the environment, based on measurement and control technologies that have been cultivated over many years.

In recent years, our focus has been on the development of products and services that use a higher level of information processing and decision making to support automation. An example is Azbil’s approach to “smart safety” at plants.

Currently, at customers’ sites, skilled operators who have been responsible for handling maintenance are retiring and the labor shortage is becoming more serious, with the workforce expected to decline into the foreseeable future. Furthermore, many plants in Japan have aging facilities, heightening the risk of serious accidents. To improve this situation, we are making industrial safety smarter (= smart safety) utilizing the Internet of Things (IoT) and new technology like big

data and artificial intelligence (AI) in order to improve site safety, compensate for the labor shortage, and strengthen the international competitiveness of our customers. This kind of initiative is being promoted in Japan through public-private partnerships.

“New automation” becomes a source of AA business growth

For smart safety, Azbil defines “three eyes” to help customers improve site safety and productivity.

The “first eye” includes the factory’s or plant’s system for operation monitoring, as well as staff patrols.

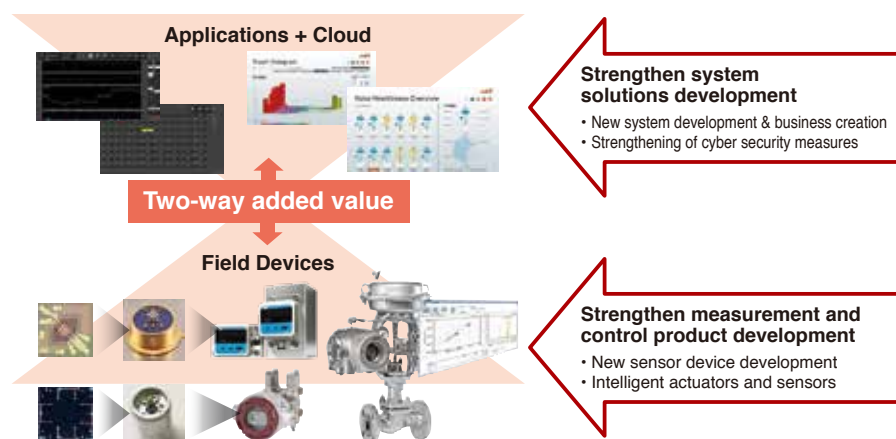
The “second eye” is the implementation of optimal maintenance based on equipment diagnosis by high-performance sensors. As an example, the positioner that controls a valve can be equipped with a highly advanced sensor that converts the operating condition of the valve into data. Accumulating, analyzing, and “visualizing” this kind of detailed data with Azbil’s control valve maintenance support system makes it possible to detect valve deterioration and abnormalities without stopping the operation of the equipment for inspections. Since it is now possible to conduct “health checkups” for the equipment, safety and productivity at production sites can be improved and the efficiency of inspections can be increased.



Yoshimitsu Hojo

Executive Director and Managing Executive Officer
President of the Advanced Automation Company
Azbil Corporation

■ System configuration for the IoT era, and the planned methods of improving azbil Group product capabilities



The “third eye” is detecting symptoms of anomalies and predicting future changes using AI and big data. Like a skilled operator who has learned to make good judgments from past experience, Azbil’s online anomaly monitoring system learns to recognize various operational patterns from big data, enabling it to detect signs of trouble in the behavior of facilities, equipment, and processes at an early stage and sound the alarm. Since our AI monitoring systems went on the market in 2015, over 1,000 have been sold.

Nowadays, as technological innovation progresses, new forms of automation are being born in each area of the market where the AA business is involved. Also, each customer has a wide variety of automation needs. Developing new automation areas that provide new value to customers is becoming a source of AA business growth.

For example, quantities that previously could not be measured accurately are now being measured by advanced technology. Azbil has developed the model F7M micro flow rate liquid flowmeter, which uses a thermal method to accurately measure the instantaneous flow rate of very small amounts of liquid. The F7M can handle tasks that were difficult by conventional methods, such as determining the instantaneous flow rate and total flow volume of minute liquid flow rates of 0.1 to 50 mL/min. By using a sensor equipped with MEMS^{*1} technology, an Azbil specialty, and applying a new production technology for bonding the sensor to a tube—which was said to be extremely diffi-

cult to do—Azbil was a frontrunner worldwide when it released this product. Introduced for use in industrial equipment, semiconductor manufacturing equipment, and pharmaceutical manufacturing, the flowmeter is providing new value and solutions for customers.

Similarly, our business strategy for the measurement equipment, field equipment, and operation monitoring systems that have been at the center of the AA business so far is to enhance development capabilities in two ways.

The first is to strengthen the development of field devices through the use of new sensors equipped with the aforementioned MEMS technology, and the combination of these devices into networks.

The second way is to strengthen the development of system solutions that will lead the way into the IoT era by fusing applications and cloud computing, as in the online anomaly monitoring system described above. By increasing the added value of products and services in both ways, we intend to create new business models and expand the “new automation” market.

Aiming to be an industry leader with technological capabilities and strengths cultivated over many years

As the times and technologies change, we face a greater variety of competitors, but I believe that Azbil has three major strengths.

One is our technology and knowledge related to measurement and control automa-

tion, which we have cultivated at numerous sites throughout many years. For example, even if you can analyze data using AI, if you do not have the knowledge and experience to know what kind of field data needs to be stored and how different types of data relate to each other, you will not be able to provide customers with optimal solutions.

Our second strength is related to the words “performance,” “quality,” and “safety.” In the field of measurement and control automation, where extremely high performance, quality, and safety are required, Azbil has accumulated the technology, systems, and know-how to provide those necessities all throughout the development process—in design, inspection, verification, etc.

The third strength is our long-term supply system for products and services. Equipment and systems installed at customers’ production sites will operate for 15 to 25 years or more. To ensure continuing quality and safety, Azbil supplies and maintains products and parts for a long time.

Azbil aims to be a leading automation company by further enhancing these strengths, which are our advantages over the competitors.

At the same time, in the global market, we are developing a business based on “solutions close to the field,” especially in China and Southeast Asia, but also in South Korea, India, Saudi Arabia, Europe, and the U.S. Overseas sales account for approximately 25% of total AA business sales, and they are increasing every year. In overseas markets, too, Azbil’s products are highly regarded for their good performance, long-term reliability, consistent measurements, lack of breakdowns, and good servicing system, especially in China and Southeast Asia, where industries are continuing to expand and business opportunities are increasing.

Going forward, in the AA business, we will strive to develop solutions and provide products and services as partners who help to enhance and increase value for our customers inside and outside Japan, based on the philosophy of “human-centered automation.”

*1►MEMS (microelectromechanical system)

A microscopic electrical and mechanical system made using semiconductor manufacturing processes. Azbil began focusing on MEMS technology in the early 1980s, when it started developing sensors for industrial applications. Currently, MEMS chips are incorporated in many Azbil products, including humidity sensors, pressure sensors, and magnetic sensors.

Automation of administrative work by a software robot. It is highly effective when applied to routine tasks on a computer such as data transfer and tabulation.

Automating routine manual tasks, especially in the financial industry, is accelerating

At manufacturing sites, robotic automation (factory automation) has progressed, and some factories are now manufacturing unattended. Since the 1980s, office automation using computers has become widespread in offices. The creation of documents and account books is now done by computer, freeing people from writing by hand and completely changing the office environment.

However, even if office automation has expanded, tasks that require manual work, such as data entry, still

remain. If anything, the amount of data to be handled and the related work are currently increasing due to the creation of new business along with progress in IT.

Robotic process automation (RPA) can automate routine manual work on a computer. Although the word “robot” is used, RPA does not mean that a mechanical robot arm or humanoid robot operates the computer. It refers to a *software* robot, also known as a bot, that runs on the computer and does the work. RPA is also called digital labor (or a virtual worker).

By using RPA, routine manual work can be done efficiently, and human error can be reduced. While bots

are working, people can do other work. What’s more, a bot doesn’t get tired or make mistakes like a person, and it can keep working all day long.

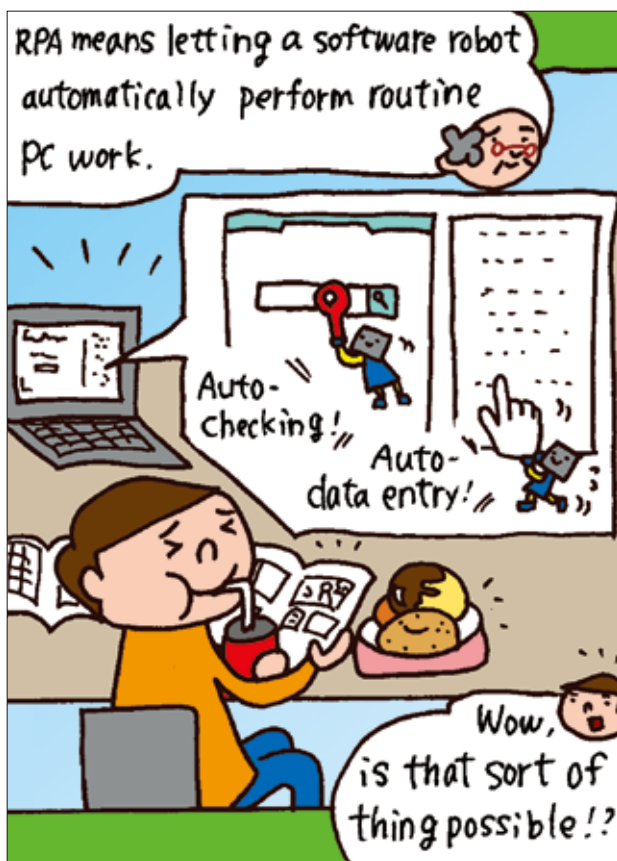
Doing work that is creative rather than routine

Currently, a bot is created using dedicated RPA software. Once it has been created, the bot can repeat the specified task. For example, to transfer data from a database to a specific website, every single task, such as entering the URL, ID, and password in order to display the website, and selecting and transferring only the necessary lines of the database, is learned by the bot.

When a task is being automated, specifying and analyzing the task is more important than the method of using the RPA tool. To promote the use of RPA, it is essential to prepare by “visualizing” the workflow, identifying, and eliminating unnecessary work, standardizing work procedures, and creating a proper manual. You must be careful, because if the bot learns the wrong procedure, it can only repeat the same wrong procedure that was input.

RPA aims to reduce routine manual work and allow more creative work to increase, while helping to ease the labor shortage.

By improving your work efficiency, you may be able to spend more time learning, enjoying hobbies, and being with your family. In this way, everyone can have some time for personal fulfillment, creating a space where new ideas can be born. It seems that RPA bots will become encouraging assistants, helping us to realize better ways of working.



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