MASTER TECHNIQUES 1

from Japan to the World

Improving Public Safety through Optimizing Patrol Operations Using Demonstrative AI

– Introducing Cutting-Edge Digital Technology to the Brazilian Police to Enhance Operational Efficiency –

Brazil is a country with one of the highest crime rates in the world, experiencing numerous violent crimes such as homicide and armed robbery. While improving and maintaining public safety is a critical issue, the country faces challenges in conducting sufficient patrol and surveillance activities for crime prevention due to police personnel shortages and other issues.

Singular Perturbations Co., Ltd. (hereinafter "SP") addresses these challenges using its unique crime prediction system powered by artificial intelligence (AI). SP is a Japanese company that develops and provides CRIME NABI, a system that predicts when and where crimes will occur with high precision and speed, using its unique methodology based on theoretical physics frameworks, analyzing information such as regional crime statistics, population, weather, building structures, and road types. The company was founded by an entrepreneur who was a victim of pickpocketing in Italy, which inspired her to develop CRIME NABI. They were facing difficulties in developing a market for their product in Japan, where public safety is relatively good, but as they explored business models for overseas expansion, they eventually found opportunities in Brazil.

"Unlike Japan, which emphasizes responding to crimes after they occur, Brazil has a high need for crime prevention," explains Mr. KURACHI Takamasa, Representative/Administrator of the Brazil office. "Police organizations in growing urban areas operate 24 hours a day to prevent crime, but they are understaffed, with one person monitoring footage from 20 surveillance cameras. There is high demand for CRIME NABI, which can produce more precise and real-time crime prediction information."

In June 2023, SP began providing patrol operation support services utilizing crime prediction to state and municipal police through the SDGs Business Supporting Surveys (JICA Biz).*1 "I think a private company alone would have had difficulties in even arranging a meeting with the Brazilian municipal police," says Mr. Kurachi, emphasizing the advantages of leveraging JICA's program. "Japan's long-standing support for public security improvement in Brazil—particularly through the introduction of the Japanese-style community policing model—helped us in gaining the trust and understanding from the country's police organization."

"The police organization was cautious about providing crime statistics to external parties for security reasons. We therefore decided to provide tools that allow them to analyze data within their own organization to identify high-crime areas and times, as well as a system to formulate crime prevention surveillance operation plans," explains Mr. Kurachi, describing how the business model was adapted to local circumstances. "With CRIME NABI, if they can predict, for example, that 'at this location, under these weather conditions, crimes are likely to occur at this time,' it would be possible to conduct more efficient patrols. In addition, by supporting the formulation of prioritized surveillance camera lists, targeted and effective monitoring would also be possible."

Mr. Kurachi (on the left) participating in the signing ceremony with the Fortaleza Public Safety Department (Photo: Singular Perturbations Co., Ltd.)

Mr. Kashihara (on the right) explaining the crime prediction system "CRIME NABI" to the Amapa State Military Police (Photo: Singular Perturbations Co., Ltd.)

From August 2023, SP conducted a two-month demonstration experiment targeting copper cable theft in Belo Horizonte, the capital of Minas Gerais State, which is Brazil's second-largest state by population and third-largest by economic scale. They had turned their attention to the rapid increase of copper cable theft in the city, affecting traffic signals and power supply to factories and hospitals. As a result, the number of theft incidents decreased by 69%, from 543 cases in the two months before the experiment to 171 cases, demonstrating the system's effectiveness. From December 2023, Belo Horizonte's municipal guard*2 began its operational use of CRIME NABI. As of September 2024, when the JICA Biz ended, SP had signed trial contracts to begin demonstrative experiments with five agencies across five states, including the military police of São Paulo, where many Japanese companies are located. They are also in discussions with six agencies in six states toward signing trial contracts. Furthermore, in addition to government agencies, they are continuously discussing business development with private companies, focusing specifically on the mining and oil industries, which are prone to crime, since they handle critical resources across vast areas.

"In the future, we would like to form partnerships with police organizations in all states in Brazil. We also hope to expand our business to other Latin American countries facing public safety challenges, such as Honduras, Uruguay, and Mexico," says Mr. Henrique Kashihara, General Manager of the Brazil office, regarding future prospects.

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*1 See the glossary on page 130.

*2 Brazil has multiple police organizations, including the Federal Police, State Military Police, Civil Police, and Municipal Guards. The Military Police are responsible for outdoor patrols, while the Municipal Guards oversee city surveillance camera monitoring for crime prevention.

MASTER TECHNIQUES 2 from Japan to the World

Protecting the Lives of People in Indonesia from Volcanic Disasters with Japanese Sediment Disaster Control Technology, Known as Sabo

– Building Sabo Infrastructure for Disaster Preparedness and Use during Normal Times –

Indonesia is one of the world's most volcanic countries with 130 active volcanoes. Among them, Mount Merapi, located in central Java Island, is one of the most active volcanoes in the world, erupting every 5 to 10 years. While residents living at the foot of the volcano benefit from fertile volcanic ash soil and abundant spring water, they are also exposed to the threats of pyroclastic and debris flows.

In the wake of the 1969 eruption of Mount Merapi, the Government of Indonesia began implementing measures to mitigate debris flow disasters using sediment disaster control technology known as sabo and sought cooperation from Japan. Sabo is a technology that controls the movement of debris flows with structures*1 to protect people's lives and livelihoods from sediment-related disasters. Japanese sabo technology, developed through years of disaster experience, is renowned worldwide, to the extent that the word "SABO" is used even in foreign languages.

Japan began its support in 1970 by dispatching a sabo expert, and in 1977, assisted with the formulation of a master plan for land erosion and volcanic debris control. Based on this master plan, approximately 250 sabo facilities were constructed to date, including projects funded by Japanese ODA Loan. These facilities have repeatedly captured debris flows, protecting the lives and livelihoods of residents. However, the eruption of Mount Merapi in 2010 was the largest in the past 100 years, releasing volcanic debris equivalent to 28 times the amount estimated in the master plan, causing significant damage. Therefore, in 2015, through ODA Loan, Japan supported the construction of sabo facilities to channel and store debris flows and to revise the master plan for land erosion and volcanic debris control, so as to address issues such as debris flows occurring in rivers at the foot of Mount Merapi and unexpected debris flows caused by changes in terrain.

Mr. MIZOGUCHI Masaharu, Deputy Director General of the International Division at Yachiyo Engineering Co., Ltd., who participated in these Japanese ODA Loan projects, reflects on the challenges and how his company overcame them. He explains, "We modified the design of sabo facilities each time the surveyed terrain changed due to heavy rain or floods. Based on the characteristics of riverbed fluctuations in Indonesia's volcanic regions, we made various improvements, such as placing the foundations of sabo dams at deeper positions than those in Japan to enhance durability. Also, since there was a risk of debris flows and flash floods during construction, we ensured workers' safety by strengthening evacuation systems specifically for such events in addition to normal safety management."

Mr. Mizoguchi (second from the left) with staff from Indonesian companies involved in the construction of the sabo facility (Photo: Yachiyo Engineering Co., Ltd.)

A sabo dam that is used as a bridge during normal times (Photo: Yachiyo Engineering Co., Ltd.)

Reflecting on how Japanese technology was applied locally in response to the evolving needs of the partner government, he recalls, "In the 1980s, when Indonesia was undergoing economic development, employment was the national priority. Therefore, labor-intensive construction methods such as stone masonry utilizing inexpensive labor were widely used. In the late 1990s, when it was hit by the Asian financial crisis, there was a demand for efficient infrastructure development with limited budgets. This led to the active promotion of multi-functional sabo facilities that could also be used as bridges or intake weirs during normal times. In recent projects, as economic development progressed, to maintain higher quality structures, factory-mixed concrete transported to sites began to be used as construction material instead of stone masonry and on-site mixed concrete, which were used before." He adds, "I believe that our ability to respond to the demands of each era led to trust in Japan."

Mr. FUKUSHIMA Junichi, who has a deep understanding of field operations as the General Manager of the company's Jakarta office, says, "We also made efforts to build relationships with local governments and residents, and tried to reflect their voices by designing multi-functional sabo facilities that can be utilized even outside of emergency situations. Local residents use the sabo facilities during normal times and are conscious that these are their own facilities. We often hear from them that they are now able to lead stable lives thanks to sabo," expressing his sense of contribution to the improvement of local lives.

Mr. Fukushima with staff from Indonesian companies involved in the construction of the sabo facility (Photo: Yachiyo Engineering Co., Ltd.)

The knowledge gained through technical cooperation on sabo in Indonesia was also applied to disaster prevention in Japan, such as in the volcanic debris flow control project at Mount Unzen Fugen-dake. Mr. Mizoguchi states, "Japan's technical cooperation overseas is by no means one-sided. It brings mutual benefits. I would like to continue to be involved with a focus on mutual cooperation moving forward."

*1 Such as a dam or a levee built with stone and/or concrete, etc. to stem the flow of water or sediment from rivers and valleys.

MASTER TECHNIQUES 3

from Japan to the World

Supporting Renewable Energy Projects in Tonga with "Made in Okinawa" Knowledge and Technology

– Introduction of Disaster-Resistant Wind Power Generation (Tiltable Wind Turbines) –

Tonga, an island country in the South Pacific, has limited energy resources and a large portion of the power supply is generated by imported diesel. As an island country, transportation costs are relatively high, resulting in high electricity prices. Tonga is also vulnerable to fluctuations in international energy prices, which in turn affect both national finances and the daily lives of its citizens. In response to the two challenges that it faces—ensuring energy security and reducing global greenhouse gas emissions—Tonga has been actively promoting the adoption of renewable energy since 2010 through the implementation of the "Tonga Energy Road Map (TERM)."

In this context, Progressive Energy Corporation (PEC), a member of the Okinawa Electric Power Company Group, worked with Tonga to introduce tiltable wind turbines, as Tonga and Okinawa face similar weather challenges, such as typhoons. Since 2009, PEC has been constructing, maintaining, and managing such turbines in the remote islands in Okinawa, taking advantage of the unique features of these turbines, which can be tilted nearly 90 degrees to the ground to prevent damage or collapse from strong typhoon winds, and enable easier maintenance compared to the conventional models. After exploring the possibility of expanding their technology to the global market as part of solutions to help countries facing similar disaster-related issues to Okinawa, PEC proposed a plan to introduce tiltable wind turbines in Tonga through JICA's Collaboration Program with the Private Sector for Disseminating Japanese Technology. With the support from Japan's grant, in 2019, they completed installing five tiltable wind turbines in Tongatapu Island where the capital, Nuku'alofa, is located.

Mr. GIBO Minoru, Managing Director of PEC, reflects, "To foster a better understanding of tiltable wind turbines, we invited engineers from Tonga Power Limited to Okinawa to have them experience maintenance operations firsthand. This stimulated their interest in introducing the turbines in Tonga." Mr. CHINA Shunei, who was dispatched to Tonga as a technical staff member during the project, recalls the challenges he faced: "In addition to the language and cultural barriers I had,

A study tour of the tiltable wind turbines for Tongan students (Photo: Progressive Energy Corporation)

Assembling wind turbines together with Tongan engineers (Photo: Progressive Energy Corporation)

there were significant differences in safety awareness upon construction work in comparison to Japan. We took extra care and started from providing guidance on basic safety practices commonly observed in Japan, such as using harnesses when working at heights." PEC not only provided such technical guidance on safety but also conducted training on equipment operation and maintenance. Mr. China added, "I would be happy to see the people of Tonga take ownership and apply the techniques they learned from Japan, rather than relying entirely on the technical expertise of Japanese people."

Tonga's wind power generation facilities were completed after eight years since PEC first started exploring the business overseas in 2012. Mr. Gibo recalls, "I was impressed when Tongan students from secondary school and local residents came to visit the site. They cheered as they saw the wind turbines completed. They also expected lower electricity costs."

Mr. WAKUTA Morito, Manager of the Electric Section of the Engineering and Sales Department, says, "To my understanding, this Tonga case was Japan's first grant project of installing the wind power plants. It is an honor for a small Okinawa-based company like ours to be part of such a major project. We would love to work with other countries facing similar challenges by making the best use of the experience and know-how we obtained through this project."

Responding to such enthusiasm, five companies in the Okinawa Electric Power Group established a joint company "SeED Okinawa LLC" in 2021. It will serve as a one-stop facility to support a wider range of businesses introducing renewable energy worldwide, including not only wind power but also solar power generation. It is expected that the renewable energy technologies developed in Okinawa will be widely introduced overseas.

The Government of Tonga has set an ambitious target to achieve 100% renewable energy for its national electricity supply by 2035. By introducing clean energy solutions with less environmental impact, Japan remains committed to enhancing energy security in countries including Pacific Island countries, and working for the global reduction of greenhouse gas emissions.

MASTER TECHNIQUES 4 from Japan to the World

Safeguarding Lives and Property in Argentina through the Application of Japan's World-Class Weather Forecasting System

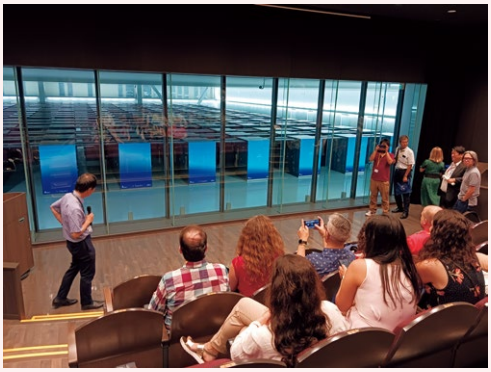
Argentina grapples with flood damage due to heavy rainfall, exacerbated by climate change and other factors. Particularly in major urban areas such as Buenos Aires Province and Córdoba Province, rapid population growth and urbanization have caused the expansion of densely populated areas, increasing the country's vulnerability to disasters. To mitigate disaster damage, it is essential to swiftly convey accurate information about when and where to evacuate, based on reliable weather data and forecasts. The development of accurate weather forecasting and disaster information systems is thus an urgent priority.

To address this situation through "the power of science," RIKEN has been working since 2022 under the Science and Technology Research Partnership for Sustainable Development (SATREPS)*1 program, in collaboration with research institutions, including the national meteorological agencies of Japan and Argentina, to develop a comprehensive solution package for observation, prediction, warning, and communication, aimed at reducing meteorological and flood risks.

Several decades ago, Japan, like Argentina today, relied on forecasters making weather predictions based on their experience and knowledge, using limited observation tools. Japan now issues warnings and evacuation information with world-leading accuracy, enabled by cutting-edge equipment and forecasting technology, including the geostationary meteorological satellite "Himawari" and observation data from the Automated Meteorological Data Acquisition System (AMeDAS). This SATREPS project aims to tackle challenges by researching and developing forecasting technologies tailored to Argentina's current circumstances. Dr. MIYOSHI Takemasa, Chief Scientist at RIKEN and leader of this project, reflects on its progress: "Although Argentina, like other developing countries, lacked sufficient equipment and technical resources, efforts were already underway to modernize its weather radar. By focusing on flood control measures in Buenos Aires Province and Córdoba Province, we strive to enhance weather forecasting accuracy through the integration of Argentina's existing infrastructure and observation data with Japan's technological expertise. Installation and operation of observational equipment and large-scale computing systems have already begun, laying the foundation for generating higher-quality information, including high-precision simulations."

Preventing disaster damage requires not only delivering collected information to residents in a timely and accurate manner but also ensuring their understanding. As part of this project, smartphone applications and websites are being developed to communicate flood forecasts and warnings. In parallel, initiatives to raise disaster awareness among the public, who are the recipients of disaster-related information, are ongoing, such as special classes at local schools and workshops for community members. For example, educational materials on flood preparedness were created and distributed to schools to support disaster education. Training sessions are also being held for primary school students, teachers, and disaster management officials of local governments in the target areas. These sessions introduce the project and offer opportunities to explore flood control measures from an educational perspective. Feedback from participants, such as their impressions of the applications and websites, is gathered to support the development of more user-friendly systems.

Disaster risk reduction education in a suburban area of Córdoba (Photo: PREVENIR Project)



Argentine researchers visiting the "Fugaku" supercomputer (Photo: PREVENIR Project)

Regarding the significance of the SATREPS project, Dr. Miyoshi explains, "This project allows us to study whether the systems we have developed can be applied in environments different from Japan, such as on a continental scale or within a Southern Hemisphere climate. Damage caused by disasters is inherently unjust, and economically vulnerable regions often bear the brunt of their impacts. The system being developed in Argentina does not require state-of-the-art facilities or vast amounts of high-quality data, making it suitable for deployment in other developing countries facing similar challenges. In this way, we can give back to society by helping to minimize disaster damage through the development of weather forecasting and disaster information systems."

Additionally, drawing on his own research journey—sparked by an encounter with an Argentine mentor during his graduate studies—Dr. Miyoshi highlights the deeper personal and professional rewards of the project that go beyond its academic and social significance, "By allowing young Japanese researchers to spend extended periods working on-site, the project enables fostering connections with their international counterparts. These relationships lay the groundwork for continued research collaboration even after the project ends. SATREPS also plays a vital role in bridging generations of researchers."

Dr. Miyoshi also shares his hopes for the future: "Forecasting severe weather is directly tied to saving lives. I hope this project will bear fruit and help protect as many people as possible. I want to contribute to ensuring that the power of science can serve to mitigate the devastating impact of these unjust disasters, even if only to a small extent."

*1 See the glossary on page 43.