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Kyushu Semiconductor Special

WEDNESDAY, SEPTEMBER 25, 2024

Southern island's latest efforts show
Japan's semiconductor revival is well underway.

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BUILDING WITH ALLIES



Left: A new Rapidus chip plant is shown under construction in Chitose, Hokkaido, in May. Above: Lower House lawmaker Akira Amari (second from left), Taiwan Semiconductor Manufacturing Co. founder Morris Chang (center) and TSMC Chairman Mark Liu (third from right) pose with other officials at the opening ceremony for its first chip factory in Japan, in the town of Kikuyo, Kumamoto Prefecture, in February. JJI

Microchip restart a matter of global security: Amari

As society spins toward digital control, sources of safe chips will be a strategic commodity, lawmaker warns

As countries around the world continue to invest extensively in the semiconductor sector, Japan is accelerating the revival of its own chip industry, aiming not just to catch up with its peers, but to become a major chipmaker that can contribute to ensuring the stable supply of chips for the global market.

The Japan Times interviewed Akira Amari, former secretary-general of the ruling Liberal Democratic Party and the founder and chairperson of the party's semiconductor strategy promotion league. He was one of the first to advocate that semiconductors would change international power relations and to push the need for a strategic revival of the domestic chip industry.

In the late 1980s, Japan was a major maker of semiconductors and home appliances. "Back then, semiconductors were made by a section in electronics manufacturers merely as a part of their products," Amari said. However, over time they evolved into a crucial component that is now so essential that entire social systems depend on them to function.

"Chips today don't just operate vacuum cleaners and televisions. They are turning the world into an electronically controlled society. With this change, semiconductor sections became independent from electrical appliance makers and other manufacturers in the rest of the world," he said. Companies dedicated to making semiconductors began to flourish in various countries.

Japan lagged in this shift. Amari noted that Japan is now at a make-or-break point — it can either become an independent semiconductor supplier or a country dependent on others for what is essentially running society.

Amari banned together with other like-minded lawmakers to persuade the government into again becoming a major maker of microchips. In 2021, they launched an LDP group dedicated to promoting semiconductor strategies and positioning microchips as a national strategic material.

"Today's cutting-edge semiconductors are nothing like those of decades ago. We are talking about single-digit nanometer-sized circuit lines," he said. A nanometer is a billionth of a meter.

"If we don't play the game, we will have chosen to join the group of receivers, rather



Akira Amari

than the makers," he said. That would mean leaving Japan's digital infrastructure almost entirely dependent on other countries' technologies.

Many advanced technologies, including autonomous driving, quantum computing and artificial intelligence, also rely on microchips.

"The credibility of semiconductors is the credibility of society. That is why creating a supply chain among allies from the perspective of both economic and military security is important," Amari said. "More than 90% of high-end logic semiconductors are shipped worldwide through the Taiwan Strait. How much impact would the world suffer if a naval blockade were enforced in the area for some reason?"

In the midst of this revival plan, IBM approached the government about the possibility of mass-producing IBM-designed chips in Japan.

Why would IBM want its own inventions to be made in Japan instead of the United States?

"IBM wants to be a user, not a manufacturer, because their business is shifting toward providing computing services using those semiconductors. At the same time, they are aware of Japan's strong manufacturing technology and capability," Amari said.

However, existing Japanese companies were reluctant to try.

"What IBM was asking for was state-of-the-art chips" for which no one knew whether mass production was even possible, he said, implying the companies were not to blame.

Rapidus, a Japanese chip manufacturer supported by the government, decided to headhunt the nation's best semiconductor engineers to respond to IBM's request.

"From a list of the top 100 engineers' names and affiliations, we contacted each one of them and asked if they wanted to par-

ticipate in the game to get back on top in semiconductors. Most of them joined Rapidus," Amari said, noting his satisfaction with the result.

The engineers have been training at IBM's research center in the U.S. to acquire skills necessary for mass producing its new semiconductors.

"They have proven to be extremely efficient and capable, which has impressed IBM," he said.

But what are the chances that Japan, with so many years absent from this field, will be successful and lead the world again?

"The 2-nanometer chip technology is something almost entirely different from conventional semiconductor technology. Experts say that only a tenth of an engineer's experience can be useful in this new technology anyway," Amari replied.

Indeed, the evolution of semiconductors is not just about keeping up with the latest technologies, such as artificial intelligence. Reducing their energy consumption, for example, has become a must. Since every sector of our lives, from our consumption and infrastructure to administrative, medical and education services relies on advanced microchips, a critical power shortage would bring our lives to a halt.

Given the vast amounts of electricity being used by data centers, the risk of chronic power shortages already haunts many countries, Amari explained. Power-saving semiconductors are thus no longer a matter of "green" or "not green," but a matter of modern survival.

"That is why we need to accelerate the miniaturization of semiconductors and increase their speed. One-tenth of the current size is not enough. We are looking at one one-hundredth or one two-hundredth. One of

the technologies that is expected to make it possible is the optical semiconductor, a field where NTT, Japan's telecommunications giant, takes the lead," he said.

He also touched on the importance of maintaining the capability to make legacy chips.

"In recent years, we saw the U.S. imposing export controls on high-end chips and chip-making equipment to China. I instantly knew that it would lead to China's move to dominate the supply chain of the legacy chips as revenge. As we all know now, this is what happened, and we need both advanced and legacy chips for today's society to function," he said.

Another complication is that semiconductors are diversifying, Amari noted. "For example, various kinds of semiconductors are involved in sensor technology." He explained that sensors play the role of our five senses to capture information, and different kinds of semiconductors take it from there.

"Image sensors, in which Sony excels, convert visual information into digital data and send it as a signal to memory, where memory chips are at work. Logic semiconductors process data accumulated in memory together with newly incoming data. Solutions are then created, which are implemented and run by power semiconductors," he said.

However, he is not suggesting that Japan should try to be a supplier of every product that plays a significant role in the entire semiconductor supply chain.

"What is necessary is that we create a supply chain network among the countries that we trust," he said. "That way, we can win an even higher degree of trust from those countries. For instance, Japanese materials and manufacturing equipment play a crucial role in supporting the semiconductor industries of allied and friendly nations," he said.

This strategy is the basis of the support the government has been providing to persuade companies from both Japan and its allies to bring their production to this country.

Being able to provide a stable supply of chips from plants within its borders will ensure Japan commands a greater presence in the international economic and political landscape as well.

Amari stressed that it is of utmost importance for Japan to secure this position to support all other democratic nations, and for semiconductor suppliers to have a shared, universal perspective on freedom, democracy and human rights.

"We are living in such a time when it is a matter of just a few seconds for biometrics technologies to recognize the face of every single person in an entire nation. A digitalized society where everything can be electronically controlled has an exceptionally high affinity with an autocratic nation and dictatorship," he warned, emphasizing the risk of technology destroying rather than contributing to society.

He concluded by saying that democratic countries should be the ones that establish international standards for semiconductors to ensure the security and prosperity of humanity.

LEVERAGING OUR STRENGTHS

Japan plans chip revival with help from TSMC

Government pours over ¥1 trillion into alliance with industry titan as AI sends demand surging for semiconductors

The Japanese semiconductor industry is on the cusp of a revival, with a major national backing for players including Taiwan Semiconductor Manufacturing Co., a world-leading chipmaker that is setting up plants in Japan, and Rapidus, a new cutting-edge domestic chipmaker.

The Japan Times interviewed University of Tokyo professor Tadahiro Kuroda about why Japan's once respected semiconductor industry has declined and how Japan aims to achieve a turnaround and position semiconductors as a national strategic commodity.

Kuroda, who has a Ph.D. in electrical engineering, said the Japanese semiconductor industry was doing very well until around 1995. In 1988, 50.3% of the world's semiconductors were made in Japan. "Those chips were used in consumer electronics such as TVs and videos, which were also considered Japan's strength," he said.

However, trade friction with the United States began casting a shadow on the industry and Japan's market share eventually dropped to 10% by 2019.

"The trade friction was a trigger but not the ultimate cause. As the semiconductor industry grew, the amount of investment required increased from billions (of yen) to tens of billions and hundreds of billions, beyond the resources of Japanese electronics manufacturers," he said.

He also pointed out that the slump overlapped with the rapid growth in computer and smartphone usage.

"These devices deal with virtual spaces. Japan has not been very strong in business models concerning virtual spaces while it has been good at the type of manufacturing that requires the pursuit of minute details to achieve people's comfort in real space," he said.

But China gradually replaced Japan as the target of U.S. trade ire and their confrontational relationship was defined during former President Donald Trump's administration, which again led to heated competition in semiconductors between the countries.

"For the U.S., Japan was not an enemy anymore. In addition to the improvement of the Japan-U.S. relationship, Japan's semiconductor industry started to receive the blessing of the government from the perspective of national security," Kuroda explained.

The kind of semiconductor chip most needed in this era is one that can be used in technologies that integrate the real world and virtual space.

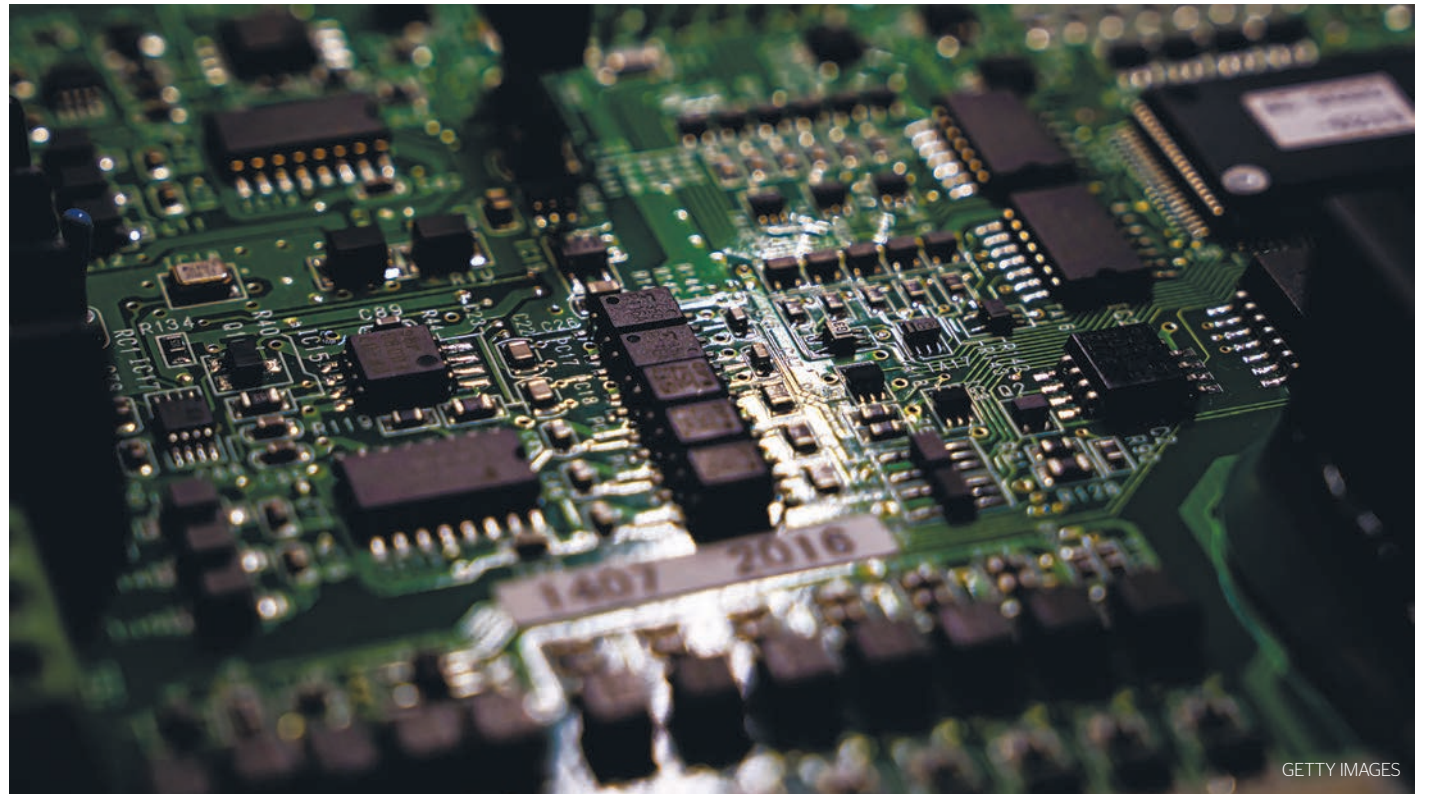
"Take self-driving technology, for example. In an instant, it completes the entire process of rotating the motor of a tire based on the optimum solution produced by future prediction based on the analysis of big data using sensors, "digital twins" and other kinds of technologies," he said.

He went on to say that Sony boasts the biggest share of the global market for image sensors and that Japan also excels in manufacturing the power electronics used in motor drives.

"As such, Japan is still good at making things used in the real world. But it loses to the U.S. in making artificial intelligence calculate at a breakneck speed in a virtual space. The two countries bringing their strengths together for the development of today's semiconductors is where I see the hope for Japan's resurgence in this field," he said.

He stressed that this kind of bilateral and multilateral collaboration is indispensable not only for the success of Japan's semiconductor industry, but also for securing a stable supply of chips for the international community.

"The major setback that the industry experienced in the past is largely attributable to the strategy to become the only winner in the global market. We should focus not on how



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to sell more than anyone else, but on how to continue providing a stable supply of semiconductors that are now used in everything from household electronics that we use every day to high-tech machines, as well as on producing what other countries have difficulty making," he said.

The massive subsidy of over ¥1.2 trillion (\$8.2 billion) granted by the Japanese government to Taiwan Semiconductor Manufacturing is significant in that it secures a commitment by the company to invest in its facilities and business within Japan's borders. Kuroda emphasized that it is important to have production capacity within the vast network aimed at supplying semiconductor chips to Japan.

He also pointed out that the expectations of the world, especially Western nations, for Japan are growing in terms of securing the chip supply network mainly because of geopolitical risks.

On the other hand, the government is also investing in Japanese enterprises. Kuroda assured critics that supporting both TSMC and Rapidus at the same time is not contradictory.

"TSMC in Kumamoto will specialize in the technology intended for making chips for products

that make up the largest market segment, such as cars, home electronics and other items that are necessary for people's daily lives," he said, noting that these are the kinds of semiconductors that are needed now and in abundance from the perspective of economic security.

The most advanced ones are for data centers and artificial intelligence. "That is where research and development is most needed because of the vertiginous speed of the technology's advancement. Rapidus is designed to play this part," Kuroda said.

It takes enormous energy to draw out the semiconductor capacity required to run state-of-the-art artificial intelligence operations.

"Considering the situation where electricity consumption is already increasing rapidly with the use of advanced technology and the necessity of cooling servers and other equipment, we need to increase the efficiency of semiconductors. That will allow more calculation to be done using the same amount of energy, or less energy to be consumed to do the same amount of calculation," Kuroda said, stressing that doing business in greener ways is essential to win the trust of the global market.



University of Tokyo professor Tadahiro Kuroda

Kuroda thinks that Japan still has a chance in this part of the semiconductor market despite the period of over two decades of no investment and no progress in the industry. "Why? It is because of the typical conventional personnel system of Japanese companies that does not lay off workers easily," Kuroda said.

He explained that some semiconductor experts who remained in companies such as electronics manufacturers continued attending academic conferences and learning from the latest research on semiconductors even after their companies withdrew from the business. "Those are the people who gathered to Rapidus," he said.

He went on to say that Japanese know-how is one of the major reasons why TSMC and other foreign enterprises come to Japan.

"In addition to the existing experts, we need to educate the young talent that will be the next generation leaders in this field. That is why the University of Tokyo formed an alliance with TSMC and signed an agreement with Kumamoto University," he said.

For those engineers diverted by Japan's two-decade slump, the Fukuoka Semiconductor Reskilling Center, headed by Kuroda, opened in Fukuoka last year to help them relearn their semiconductor skills.

"Working remotely is an option for some of the positions that could only be covered by employees working three shifts on site in

the past. This helps achieve greater diversity in human resources that today's chip industry needs," Kuroda said. This need for diversification of human resources is what prompted him to accept the position of chancellor of the Prefectural University of Kumamoto this spring.

"The focus of the university, which does not have a faculty of engineering, is to nurture people with good international communication skills," which are necessary for an industry involving increasing interstate collaboration. He also said that the university's Faculty of Environmental and Symbiotic Sciences will provide a unique strength at a time when the industry needs to address water and other environmental issues.

As the era of artificial intelligence unfolds, "It is us human beings who think what to do and what services to create using semiconductors to make people happy and to make society safe and comfortable," he said. Noting that new ideas emerge when diverse people gather and converse, he said: "That is what universities are for, and they need to continue their effort to attract brains from both home and abroad."

The revival of Japan's semiconductor industry depends on a long-term and comprehensive effort by the industry, including human resource development, international collaboration and continuous government support.

NATIONAL SUPPORT

Advanced semiconductor manufacturing essential to promote development, utilization of generative AI
Government supports expanding chip production**Satoshi Nohara**

DIRECTOR-GENERAL, COMMERCE AND INFORMATION POLICY BUREAU, MINISTRY OF ECONOMY, TRADE AND INDUSTRY



Semiconductors are a key technology for achieving digital transformation and green transformation, and they are also strategically important goods from the perspective of economic

security and Japan's overall industrial competitiveness. It is critical that Japan captures the increasing global demand for these chips.

Advanced semiconductors are especially essential for promoting the development and utilization of generative artificial intelligence in Japan. In the future, it will be important to strengthen the competitiveness of the industry as a whole by creating an ecosystem for designing and manufacturing advanced semiconductors, with an eye toward developing and utilizing generative AI as a use case, including in the automotive and other "edge-computing" domains (where data is processed closer to its source).

Various countries are undertaking large-scale measures to secure semiconductor manufacturing capacity. The Japanese government has been providing support through legal reforms and financial assistance, with a budget of approximately ¥4 trillion (\$27 billion) allocated in the past

three fiscal years. In the supplementary budget for fiscal 2023 established last November, approximately ¥2 trillion was allocated for semiconductor and AI-related projects.

With the budget established, we have promptly started executing several projects, including the second factory of Japan Advanced Semiconductor Manufacturing, which is a joint venture between Taiwan Semiconductor Manufacturing Co. and several Japanese companies, in Kumamoto Prefecture, and additional support for the Rapidus project in Hokkaido.

In the meantime, construction of the first JASM factory, which we decided to support two years ago, is progressing at an astonishing speed and scheduled to start chip deliveries by the end of the year as planned.

As for the Rapidus project, which is tasked with achieving mass production of next-generation logic semiconductors, research and development is making smooth progress and mass production is set to begin in 2027. In addition, TSMC, Samsung, Rapidus and Intel are either engaged in or planning to engage in R&D in Japan for advanced packaging technology, which is considered key to improving performance. Thanks to these projects, we are gradually filling in the missing pieces in our country's microchip supply chain.

As such, semiconductor-related companies have a strong willingness to invest in Japan. I receive daily inquiries from many companies, including foreign ones, expressing their desire to invest in Japan. We think the reasons for this momentum are not only the swift and large-scale support from

the government, but also Japan's changing position in terms of geopolitical risk, and the resilience of our supply chain for semiconductor manufacturing equipment and components, where Japan has strengths. Japanese companies still hold a large global market share in manufacturing equipment and component materials, and particularly in advanced fields, they possess many technologies that are indispensable in the supply chain.

We must continue to attract investment by maintaining and improving our technological advantage in these fields, while also fulfilling our supply responsibilities to other like-minded countries and regions. Therefore, the government is also actively working to support capital and R&D investment in these areas.

In addition to supporting facility and R&D investment, it is necessary to invest in the talent that supports these efforts. The Ministry of Economy, Trade and Industry is establishing consortiums for talent development through industry-academia-government collaboration in each region, working on talent development while encouraging the involvement of companies.

We also plan to launch projects for the development of highly skilled personnel for R&D, among other efforts. We would also like to invite skilled foreign engineers to come to Japan.

It is important to utilize advanced microchips in user industries such as automotive and telecommunications. Particularly, application-specific integrated circuits are becoming increasingly important in terms of performance and power consumption. Because Japanese companies have been

lagging in the utilization of ASICs, the ministry is launching multiple projects to support the design and development of these chips and to build an ecosystem involving user industries.

These support measures for the semiconductor industry have already shown significant ripple effects. For example, using the first JASM factory as a starting point, a positive cycle of investment and wage increases is forming in the Kyushu area, with starting salaries over ¥50,000 higher than the national average and record-breaking growth in investment. The semiconductor industry is expected to act as a trigger for revitalizing the entire Japanese industry.

Japan's semiconductor industry, once the world's No. 1, has experienced a significant decline in market share over the past 30 years and has fallen behind in advanced areas such as logic semiconductors. However, the world is once again turning its attention to Japan and investing in it. We will continue to sustain and accelerate this momentum. The Cabinet has made a decision to provide focused investment support, including large-scale and strategic investments in mass production and R&D for the AI and semiconductor sectors over multiple years while ensuring the necessary financial resources.

Japan's semiconductor policy is still only halfway there, and the real challenge begins from here. The government will continue to make every effort to revive the semiconductor industry to enhance Japan's overall international competitiveness and ensure economic security through a resilient supply chain.

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INVESTING IN THE FUTURE

Expo marks 'digital renaissance' brewing in Kyushu

Joseph Bodenheimer
CEO, FOUNDER OF SHODAI VENTURES



While many of us know what a semiconductor is and generally how small they are, it is becoming transparently obvious that these tiny chips impact many parts of our lives. Their influence

continues to grow as simple products become more complex and our world becomes more integrated. Their functions are taken for granted, from our alarm clocks to our media devices, and we should note that these chips are increasingly relied upon in the areas of transportation, communications, travel and entertainment.

Here in Japan, we enjoy a world of modern home appliances and conveniences. Take, for example, our delivery systems — when a package is delivered to our home, we have multiple options for receiving and storing the item, never meeting the person making the delivery. Zooming out to view the progress of our modern conveniences, we may wonder, "How did we get here?"

Rise and fall of 'Made in Japan'

The development of the semiconductor has moved at lightning speed. It all started in the 1940s and '50s with the transistor, and later the integrated circuit, that gave rise to the concept of personal electronic devices. Then the rapid spread of calculators, televisions and all manner of gadgets and appliances started a revolution that positively impacted societies in ways no one could imagine.

Japan was a key driver of technologies that triggered waves of new calculators. This led to a rapid increase in power while devices became smaller each year. Throughout the '70s and '80s, "Made in Japan" and semiconductors became part of our vocabulary.

Japan, historically a nation known for developing, innovating and crafting high-quality products, applied its inherent and learned strengths to semiconductor design and manufacturing. This altered the entire industry, impressing established producers in Europe and America. Driven by its expanded market share in the '80s, Japan became a leader in the semiconductor world. Its humble start in providing microchips for calculators and home appliances then led to a foray into the defense industry. Hyper-growth and the subsequent economic expansion of the 1980s provided Japan with a natural path into capital-fueled semiconductor investment — along with the support of favorable government policies.

The semiconductor industry is procyclical, so with a deep and prolonged economic recession, it came under severe pressure moving into the 1990s. Several key events disrupted development. First there was the Gulf War, followed by the 1997-1998 Asian financial crisis, both of which shocked the global economy. The late '90s were also important as the appeal of personal computers grew rapidly. During this tumultuous period, the emergence of the four "Asian tiger" economies saw explosive economic growth and the entrance of Taiwan and South Korea into the semiconductor industry, giving rise to strong competition for Japan. As a result, Japan's market share sank to approximately 20% from its once dominant 50% share.

Engineering a comeback

Fast-forward to the pandemic era, where domestic and international policy initiatives in 2021 and 2022 signaled significant and positive changes for Japan and its allies.

In May 2021, over 100 members of the Diet worked with the private sector to start building a foundation for a resurgence of Japan's semiconductor industry. Members of the private sector were invited to give recommendations along with government officials on this new project. This legislative group with senior members of the Liberal Democratic



Taiwan Semiconductor Manufacturing Co.'s first plant in Kumamoto Prefecture, run by TSMC subsidiary Japan Advanced Semiconductor Manufacturing Inc., is in the town of Kikuyo. At the upper right is Sony Semiconductor Manufacturing Corp.'s Kumamoto Technology Center. JJI

Party at its core received support from then-Secretary-General Akira Amari. This group, working with the Ministry of Economy, Trade and Industry, hammered out a series of ideas that became what we now know as the Semiconductor and Digital Industry Strategy.

This foundational effort resulted in new ideas to secure public and private investments in microchips and clearly demonstrates Japan's commitment to a future of leadership in the semiconductor industry.

Extensive collaboration

The Semiconductor Technology Expo in Kyushu, Japan, is a meeting of thought leaders and sponsors from METI, the Kyushu Bureau of Economy, Trade and Industry and the Kyushu Semiconductor and Innovation Council. These sponsors and more from Kumamoto, Oita, Okinawa, Saga and Kagoshima prefectures are coming together to discuss the future of Japanese semiconductors as they build a welcoming ecosystem for its revival.

The event will be a platform for members of the industry to not only exchange ideas, but also address ideas for university and technical college students who aspire to work in semiconductors or related industries. This exhibition is clearly an opportunity for information and technology exchange for the hundreds of professionals gathering in Kyushu, now home to over 400 semiconductor-related firms.

The expo will showcase the strengths of what some are already calling "Silicon Island" as we look toward a new renaissance based on collaboration between universities and the private sector. The words "collaboration" and "alliance" are often used when speaking to members of this ecosystem. And one can only be impressed by the long-term view expressed in the investment being made in college students who may be inspired to work in the semiconductor industry in the future. Kyushu has a long list of top universities with proven research programs and professors who understand the importance of the industry and its links to Japan's manufacturing strengths.

Masaharu Shiratani, dean of the Institute for Advanced Study at Kyushu University, said: "Historically there has been a presence of semiconductor manufacturing in Kyushu, with NEC, Sony and Mitsubishi Electric having set up their businesses here. More recently, Taiwan, which has a well-developed semiconductor industry, saw Taiwan Semiconductor Manufacturing Co. build facilities in Kyushu."

Kyushu is a natural destination for the industry because it has all the right resources to support all links in its vast supply chain.

"Kyushu has an abundance of resources that include electricity, water, land and of course human resources, that make it a natural place for semiconductor design and manufacturing," according to Shiratani. "Kyushu is about the same size as Taiwan, with about



David Semaya (left), executive chairman and representative director of Sumitomo Mitsui Trust Asset Management, poses with Bodenheimer at an investor event on Aug. 26 at the Tokyo American Club.

half the population and a long list of similar resources, making it an atmosphere that is very much like Taiwan."

Today, global leaders such as TSMC, Tokyo Electron, Ebara, ASML, Disco and Lam Research are moving staff and families to Kyushu at an increasingly fast pace, creating a building boom in Kumamoto Prefecture. While TSMC works on a ¥1 trillion (\$6.7 billion) project in Kikuyo, the neighboring town of Nankan is seeing a facility being built by Japanese environmental and industrial machine maker Ebara Corp. Imagine these waves of high-tech firms moving into Kyushu and blending in with some of the most beautiful and lush forests in Japan. As Japan welcomes firms from Taiwan, the U.S. and Europe, the common goals of environmental protection and sustainability remain at the core.

"Kyushu has a tremendous opportunity to capture and monetize two trends: One is so-called friend-shoring (when supply chain networks are established in countries considered political and economic allies). This trend has become more pronounced after the COVID epidemic. The other trend is the move to sustainable manufacturing," said David Semaya, executive chairman and representative director of Sumitomo Mitsui Trust Asset Management. "Many companies benefit from building new factories that are designed from the beginning to be sustainable, thus reducing their carbon footprint and hitting their carbon-neutral commitments."

When looking at future businesses, the base of many will have semiconductors at their core. For example, with artificial intelligence being developed at firms like Google or Amazon, there will be strong demand and a growing need for semiconductors.

"The process of designing and manufacturing semiconductors is overwhelming so one country cannot do it on its own," Shiratani said. "Now Japan is forging deeper ties with the U.S., with Holland, with Taiwan for deeper working relationships. Each country has natural strengths, so building strategic alliances with strong partners makes sense. Japan, for example, is a global leader

in materials and fabrication equipment, as well as image sensors."

Build it and they will come

Recently, in addition to all the companies coming to Kyushu, there are more people from the semiconductor industry visiting Kyushu University.

"About 40 professionals involved in semiconductors from Holland's industrial firms have come twice to our university for joint discussions and collaboration. Also, there were semiconductor professionals coming from the U.S. who are participating in U.S.-Japan semiconductor workshops, on two occasions to discuss semiconductor design from a Japanese perspective," Shiratani said.

These types of collaboration and knowledge exchange are well supported. As a part of the Group of Seven summit of leading industrial nations that was held in Hiroshima last year, the U.S. and Japan established the University Partnership for Workforce Advancement and Research and Development in Semiconductors program along with such firms as Micron and Tokyo Electron with the purpose of workforce enhancement and R&D. Additionally, the potential synergies with the semiconductor expo mean more international workshops and exchanges will be a natural outcome.

"Kyushu is strong in semiconductors and autos, with many factories such as Nissan and Toyota being well established. From now into the future, automatic driving cars and electric vehicle technologies, along with Sony's image sensors, will be important. And note that the concentration of these three technologies, here in Kyushu, makes it unique in the world. No other place has this type of development," Shiratani said.

Japan is moving toward a new age of technological innovation. Just as crude oil was the core component of the Industrial Revolution, semiconductors will now be the new resource driving forward the technological revolution of the next two decades. Japan, historically having close economic and energy security ties, as well as new technology relationships with the U.S., Europe and Taiwan, paints a bright future for Kyushu. The Semiconductor Technology Expo will work to build a foundation that will allow Japan to become an even stronger partner to its industry peers globally.

Joseph Bodenheimer is the founder of Shodai Ventures in Tokyo. He is a graduate of Brigham Young University and, after mastering Japanese in Kyoto, built a career in investment banking. He now focuses onshoring, facilitating and fast-tracking relationships in the expanding ecosystem of venture capital, startups and institutional investors. He has developed an effective system of introducing new ideas to relevant entities in Japan, with a recent interest in tech ventures and investing.

School broadens chip courses to diversify talent pool

New curricula focuses on future needs and university partnerships as pressure builds to corner microchip market

Kyushu University's effort in training human resources as well as conducting research and development in the field of semiconductors transcends academic boundaries and national borders.

The Japan Times interviewed President Tatsuro Ishibashi and Senior Vice President and Dean of the Institute for Advanced Study Masaharu Shiratani about the opportunities the university offers both students and the world of academia to accelerate innovations in microchip technologies.

Kyushu University's Education Center for Semiconductors and Value Creation, established in June, carries out research aimed at improving the performance of semiconductors and fosters talent that can create new value in this field. The center intends to train three different categories of people who can contribute to society through the development and use of these technologies from three standpoints.

"The three types of human resources are those who are specialists in the materials, design and manufacturing of semiconductors and integrated circuits, those who understand the semiconductors and integrated circuits required for social change, and those who can reflect this in the design and manufacture of future products," Ishibashi explained.

Shiratani noted that the conventional university education in Japan has taught students how to make chips and research these technologies from an engineering perspective.

"But what today's society expects from academia is to train people who can create new value and services using semiconductors in addition to fostering technological experts. The center aims to do exactly that," he said.

In other words, Japan's semiconductor industry lacks people with varied backgrounds, capabilities and expertise in other fields. "Such talents will be able to envisage how best to use chips, for example, in developing new businesses related to artificial intelligence and contribute to improving society," Shiratani said.

Thus, the center encourages humanities and social science majors as well as students from other universities and working adults to enroll. The center currently offers five undergraduate and six graduate classes. One class is attended by about 60 Kyushu U students and twice as many from other universities, on average. The working adults who participate include businesspeople, public officials and bankers who are fac-



Kyushu University President Tatsuro Ishibashi

ing a growing need for financing in the semiconductor sector.

The center also offers internship opportunities for students to gain hands-on experience that will prepare them for a career in the chip industry. In addition to internship programs provided by companies such as Taiwan Semiconductor Manufacturing Co., Micron Technology Inc. and Tokyo Electron Ltd., some students participate in a summer internship program at Rochester Institute of Technology in the United States, one of the world's leading universities in this field.

"Internship programs offered by Japanese companies are normally short-term but many of the programs we offer through the partnerships with companies and academia are long-term, lasting more than a month. This helps with the acquisition of practical skills. There is also a program exclusively for female students to promote diversity in the chip industry," Shiratani said.

The partnership agreement signed between Kyushu U and TSMC in April covers much more than human resources development. It promises a broad collaboration extending to scholarships and special lectures, as well as joint research.

Kyushu University has also been promoting partnerships with universities in Japan and abroad. "Kyushu Okinawa Open University, composed of 11 national universities in the Kyushu and Okinawa regions, was launched in March 2023 to cooperate on improving the research skills of researchers and students, sharing facilities and equipment and so on," Ishibashi said.

KOOU signed an agreement in April with the University Academic Alliance in Taiwan, a platform of 12 universities, to promote international collaboration in fields includ-



Kyushu University Senior Vice President Masaharu Shiratani

ing engineering, life sciences, humanities and social sciences.

One field in which these partnerships are expected to create positive effects is semiconductors.

"There are also further collaboration possibilities with individual universities within the networks. For example, our university and National Yang Ming Chiao Tung University in Taiwan, one of the universities that belong to the UAAT, signed an agreement in June to establish a joint laboratory in both campuses and have already started the exchange of human resources and joint research," Ishibashi said.

Shiratani explained that today's semiconductor industry cannot depend on or be dominated by just one country. Even major players in the market are not entirely self-sustainable because

they need to procure materials and equipment from other countries to make their technologies work. "It makes sense for Japan's human resources to build relationships abroad for future potential partnership," he said.

Kyushu University is also strengthening ties with the industry by addressing the urgent need for the extreme ultraviolet light irradiation and analysis services that are indispensable for advanced semiconductor manufacturing and the development of new materials. EUV Photon, a company funded 100% by the university, was established in

July to serve this purpose.

"Japan is still strong in materials, holding approximately 50% of the market share for semiconductor materials, including a 90% share of photoresist. But Japanese companies rely on a research body in Europe for testing, which is mandatory prior to sales, which incurs the risk of technology outflows, expensive testing fees, and potential delays due to the high demands of testing," Shiratani explained.

Having domestic testing capability will greatly contribute to the security, competitiveness and speed of Japan-made technologies and products. However, it is not just about owning a testing facility. The data generated by the facility needs to be analyzed and evaluated with a high degree of expertise — something that the abundant talent pool of Kyushu University's faculty boasts.

Shiratani is confident that the semiconductor industry will continue growing at a high rate.

"Semiconductors are at the heart of new technologies that have brought about social change, such as smartphones and generative AI," Shiratani said, highlighting that semiconductors that used to be considered merely a component of electronic products have acquired a value that now endows humanity with new cultures and civilizations.

"We hope that more and more talented youths in Japan will participate in this field and make an impact on the world. That way, we can shape the new era when Japan can be the creator of new values and systems of society to share with the rest of the world," Shiratani said.

This page is sponsored by Kyushu University.



Kyushu University's Ito Campus covers a vast expanse in the hills overlooking Hakata Bay off Fukuoka.



Kyushu U students walk past Shiiki Hall at the university's Ito Campus.

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