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## Top 10 Technologies in Asia in 2030

ITRI IEK Consulting conducted a survey of major Asian countries and identified the 10 most crucial advanced technologies that will affect the Asian region. Through the report, we could understand the differences between Asia and the rest of the international community in terms of long-term technology prospects and market demands.



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# ITRI TODAY 🤧

Summer Issue 2019



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#### » Feature





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## 2030 Advanced Technology from an Asian Perspective

Asia has become a pivotal hub for driving global economic growth. To explore its future outlook and harness the tech trends that may transform lives, ITRI has been collaborating with ten Asian countries to ascertain how technology will have advanced in their respective countries by 2030. The research report was published in the Institute of Electrical and Electronics Engineers Computer Society (IEEE Computer Society). It is expected that this report will aid in understanding the differences between Asia and the rest of the international community in terms of long-term technology prospects and market demands. Government, research institutes, or enterprises can thus invest early and prepare for new challenges and opportunities coming in the next decade.



IEEE Computer Society board member Dejan S. Milojicic welcomes the 2030 report by ITRI.

ITRI IEK Consulting conducted a survey of major Asian countries and identified the 10 most crucial advanced technologies that will affect the Asian region. These technologies are 1) Artificial Intelligence (AI), 2) 6G Mobile Network, 3) Autonomous Vehicles, 4) Industrial Robots, 5) Service Robots, 6) Blockchain, 7) New Energy Vehicles (NEVs), 8) Renewable and Biodegradable Plastics Materials, 9) Solid-state Batteries, and 10) Nanomaterials. The ranking is illustrated in the figure below.



The ranking of 2030 top 10 technologies in Asia.

This report aims to assess the 2030 market perspectives and policy plans of major Asian countries. The research results included five key findings:

- 1. Most countries focus on breakthrough technologies; however, Asian countries focus a little more on living technologies.
- 2. For technologies with a higher score in the impact index, economic development is the most important consideration in Asia, and that scored significantly higher than other categories such as society, environmental protection, safety and security, and infrastructure.
- 3. In investment priority, most Asian countries agree that governments should invest significantly in AI, 6G mobile networks, and autonomous vehicle technologies.
- 4. Some technologies have a high impact but a low investment priority. This indicates that these important technologies may be imported from abroad and not developed locally.
- 5. Green technology and biotech are ranked lower in Asia because a large amount of R&D investment is required. They carry a high risk, and there is a long payback period.

According to the report, the 2030 Asia scenario shows a clean and convenient human—machine collaborative society that uses green energy and renewable materials. However, the research also found that the 2030 Asian top 10 technologies focus little on green technology and biotechnology but have demands regarding a clean environment and healthy lifestyles as its society is aging. These gaps between technology development and local needs might point to good potential business opportunities.

To read the full report, please visit https://ieeecs-media.computer.org/media/tech-news/2030-advancedtech-asia-perspective-itri.pdf

### Q IEK Consulting

IEK Consulting is a consulting service provided by ITRI's Industry, Science and Technology International Strategy Center. With more than 200 technology and management analysts and professional consultants, IEK Consulting aims to provide customers with valueadded, multi-disciplinary information and services using its extensive research skills and practical experience. It also works with the 6,000 experts from ITRI's laboratories and research centers in a form of joint research to offer one-stop, high quality solutions. In addition, it cooperates with outside scholars to ensure its research quality. IEK Consulting helps its clients achieve high performance and create value; meanwhile it plays a unique role as a government think tank for advising on the nation's industrial development policies.

### » Spotlight







## **TWBM Addresses Unmet Clinical Needs with Innovation**

According to Technavio, the global medical devices market size will grow by US\$119.98 billion during 2018-2022. How do entrepreneurs seize these thriving business opportunities? How do startups such as Taiwan <u>Biomaterial Company (TWBM)</u> position themselves in the biomedical industry? In this issue of ITRI TODAY, Dr. Chun-Jen Liao, CEO of TWBM, discusses his experience in founding and leading his company.



TWBM CEO Dr. Chun-Jen Liao (center) and his team.



TWBM, an ITRI spinoff dedicated to implantable medical devices, was

listed on OTC in Taiwan this June. The company works closely with surgeons to explore unmet clinical needs and deliver innovative solutions. Featured products include the world's only foamy dura substitute, stroke interventional treatment devices, and tissue repair and regeneration technology for early degenerative arthritis.

Seven years ago Dr. Liao left ITRI to found TWBM. At that time, he explained, his goal was not to find applications derived from existing technological core competence. Rather, he focused on discovering market demands and trying to integrate technologies needed to develop products that fulfill the niche. "At TWBM, we do not limit ourselves to certain R&D topics; we go for anything that is worth addressing," said Dr. Liao. This explains why the company has diverse product categories, from surgical solutions for brain dura reconstruction, to a pump system to remove blood clots and enzymatic treatment for knee cartilage degeneration.

In Dr. Liao's view, the key to a successful business is envisioning the future of the company first. "You start at the end of the story, and work backwards to the beginning," he said. "This way you can ensure all the bits you are envisioning will be accounted for, reducing the risks of getting lost." By integrating global and local R&D value chains, the company strives to jointly develop the world's leading high-end medical devices, hoping to establish a profitable business model for Taiwan's biotechnology industry.

Dr. Liao pointed out that the major challenge of running a startup like TWBM is that in the medical device industry, time-to-market is very long usually more than a decade. "You don't even know whether you will succeed or not. The results are unpredictable," said Dr. Liao. "Our foamy dura substitute, which was transferred from ITRI, took nearly 10 years to acquire approval from the Taiwan Food and Drug Administration (TFDA); now it is a 'Me Only' product." Dr. Liao stressed that despite uncertainty and high risks, persistence in R&D, innovation and funding is required. "It's all about making the impossible possible. You are doomed to fail if you think things are impossible," said Dr. Liao resolutely.

With its eye on the U.S. medical device market—the largest around the world—TWBM has been collaborating with its U.S. partner to keep up with market demands and find new market spaces that transcend competition. Through its partnership with Incept from Silicon Valley, TWBM is the third company to develop the pump system for stroke interventional treatment. Moreover, TWBM adopts the "R&D in Taiwan, manufacturing in U.S."

approach, in which it takes advantage of the well-established biomedical industry chain in the U.S. to enable fast production. TWBM continues to maximize its value through processes such as proof of concept, translational research, patent portfolios, GMP pilot manufacture, clinical trials, and regulatory certification.

As Chairman of TWBM Arthur Lu stated: how big you dream, how far you go. With its commitment to saving lives and helping the world, TWBM tackles every milestone and hurdle on the way of becoming a role model for Taiwan's medical device industry. "I always feel that Taiwan needs a company like TWBM," said Dr. Liao in earnest.

#### **Highlight Products**

#### Foamagen, the Foamy Dura Substitute

This revolutionary technology was developed for dura reconstruction after brain and spinal surgeries. High-pressure gas and collagen are mixed in the spray gun to produce a highly porous foamy gel that is lightweight and watertight. The ergonomic foamy gun allows medical staff a natural hand posture and stable grip, thereby replacing the time-consuming and technique-sensitive surgical procedure for dura mater repair.

#### **Stroke Interventional Treatment Devices**

The devices that TWBM developed for stroke interventional treatment include an aspiration pump system and nickel-titanium alloy guide wires used for clot removal in ischemic stroke. The former has received the FDA 510(k) clearance, and the latter is expected to do the same next year.

## Early Degenerative Arthritis Tissue Repair and Regeneration

TWBM uses enzymes to partially dissolve the cartilage matrix of the knee joint in order to achieve cartilage tissue regeneration and repair. This technology enables one-time surgery, which reduces pain and recovery time for patients.



#### »R&D Focus

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## Make Electric Scooters Smarter



The Self-Learning Dynamic Power Estimation Technology incorporates AI and enables an accurate display of remaining battery value and estimated mileage.

Always worried that your electric scooter's battery will run out of juice halfway to your destination? Or not believe in the battery level shown on the dashboard? These concerns will now be a thing of the past with the launch of the Self-Learning Dynamic Power Estimation Technology, an innovation co-developed by ITRI and KYMCO. Earlier this year, the two parties signed an agreement on electric scooter energy management systems that covers cooperation on 36 patented technologies to develop next generation AI-powered electric scooters.

The Self-Learning Dynamic Power Estimation Technology is developed due to the fact that the longer a battery for an electric scooter is in use, the greater the error in power forecasting. To alleviate riders' anxiety about how much distance they can expect from the battery, ITRI's technology incorporates AI and enables an accurate display of remaining battery value and estimated mileage. Riders can thus get rid of the habit of conserving

power and avoid mileage loss.

The Self-Learning Dynamic Power Estimation Technology features three main characteristics:

#### 1. Import of AI

The built-in power management AI system in electric scooters operates on the basis of what it has learned from different riding habits of scooter owners, providing the precise mileage and motor output accordingly, thereby greatly enhancing vehicle safety and reliability.

## 2. Display of accurate battery power and remaining mileage value

Unlike the imprecise battery percentage displayed in current electric scooters, ITRI's technology shows actual battery value and provides estimations of remaining mileage expected from the battery, incorporating power consumption analysis. The technology can accurately estimate remaining mileage to within 5% regardless of the age of the battery.

#### 3. Power failure alert

Battery discharge is limited in overly high or low temperature environments when a battery's remaining charge is low. The system will proactively display the horsepower limit and will maintain a safe state for the vehicle to avoid triggering abnormal power failure protection. Even when a battery is running low or when start-up protection occurs, a poweroff alarm message will be displayed before power is cut. This avoids sudden braking and other safety issues that are experienced in current electric scooters when batteries are depleted.



ITRI and KYMCO signed an agreement to collaborate on the development of electric scooter energy management systems earlier this year.

ITRI Executive Vice President Alex Y.M. Peng remarked that the technology developed by ITRI provides precise forecasts as to how far an electric scooter can travel on its battery, and the range of error in the prediction is less than 5% no matter if the scooter is operated in tropical or temperate regions. In addition, the battery can be monitored on a remote basis. When a rider is driving outside, the scooter company can monitor the health of the battery. This differentiates the product and gives it a competitive advantage, he said. The cooperation between ITRI and KYMCO marks the beginning of a new era, and it is hoped that the smart battery technology will help bring the Taiwan brand to the world, Dr. Peng added.

KYMCO President Ting-Yi Wang stated that the cooperation between his company and ITRI dates back over 20 years. Recently, the two have worked to strengthen power systems, control systems, motor cooling systems, and anti-theft systems. These enhancements are being used to bring their electric scooters to AI level.

Dr. Tzong-Ming Lee, ITRI Vice President and General Director of the Material and Chemical Research Laboratories, commented that the Self-Learning Dynamic Power Estimation Technology puts riders' minds at ease so that they can drive greater distances. At present, test scooters equipped with this technology have been developed, and he is confident that the actual production of a scooter built with this technology in cooperation with KYMCO will offer consumers an entirely new experience.

The Self-Learning Dynamic Power Estimation Technology is applicable in all electric vehicles and energy storage systems. It has already been introduced in electric buses, high-voltage energy storage and other largescale battery systems that require high safety and reliability.

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#### »R&D Focus

## **Early Detection of Diabetic Retinopathy in Fundus Images**



ITRI's technology is developed to enable early diabetic retinopathy screening.

The prevalence of diabetic retinopathy (DR) is increasing at an alarming rate worldwide. However, early detection and timely treatment of DR remains a challenge due to the shortage of ophthalmologists, who are responsible for carrying out fundus image examination for DR. To bridge the gap, ITRI developed an AI decision support technology for detecting DR features in fundus images, equipping non-ophthalmologists with an effective tool to provide early DR diagnosis for patients rapidly.

ITRI's technology is the only in the world that uses AI to detect four major DR symptoms, including microaneurysms, hemorrhages, soft exudates, and hard exudates, to identify lesion locations, and to help doctors determine disease severity. The technology is developed for primary care physicians or endocrinologists to conduct early DR screening. Once early signs of DR (not merely microaneurysms) are detected, patients can be referred to the division of ophthalmology for further diagnosis and medical treatment. According to Grace Liu, an engineer of ITRI's Computational Intelligence Technology Center, ITRI's AI decision support system, in

cooperation with non-ophthalmologists in DR screening, is expected to increase fundus examination rate by 20%.

This AI-based support system for DR applies deep convolutional neural network and ensemble learning strategies. Besides lesion localization, a lesion detection model is used to assist front-line medical doctors in severity level classification. The system provides a 5-level classification model for DR (i.e., normal, mild non-proliferative, moderate nonproliferative, severe non-proliferative, and proliferative). Moreover, it produces a binary classification model regarding the eye doctor referral decision. "We're eager to contribute more detailed information in DR severity scale for Taiwan's Diabetes Shared Care Network. Therefore, patients will be able to enjoy better healthcare solutions," said Dr. Liu.

By combining human and artificial intelligence, this system has a positive impact on protecting human health in several ways. For instance, it reduces diagnosis time for DR with the help of AI. Moreover, the use of the system in primary clinics means that more patients can benefit from DR early screening. As a result, the increase of the early detection rate for potential patients may reduce healthcare and social costs. The system is also able to enhance the efficiency of diagnosing small lesions and eliminates the inconvenience of referrals to ophthalmologists.

From the industry point of view, the new system can be incorporated with and provide additional value to existing hardware. ITRI's innovation has assisted manufacturers to upgrade their technological competence and helped create a high-end medical device market.

ITRI has already obtained more than 150,000 fundus images through cooperation with medical centers, with ophthalmologists' expertise in interpreting the retinopathy stage of these images followed by massive input to the computer for AI training. ITRI's AI technology on assistive diagnosis can also be applied in various other fields such as new drug development, colorectal cancer diagnosis, and telemedicine. It is hoped that the AI popularization from industries to daily life can allow the general public to enjoy AI-enabled medical care services.



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### » Collaboration

## **ITRI and IDEA Consult Sign MoU**



ITRI and IDEA signed an MoU to collaborate on the evaluation of S&T resource allocation.

Early this year, ITRI signed an MoU with European think tank IDEA Consult. This collaboration on science and technology (S&T) policy research will not only provide far-reaching policy recommendations, but also promote the development of mutually beneficial relations between Taiwan and Europe.

Hsiu-Ya Yang, Director General of the Ministry of Science & Technology's (MOST) Department of Foresight and Innovation Policies, commented that it has long been a policy objective to effectively utilize Taiwan's limited resources to achieve the greatest benefits. "Small Country, Big Policy," as she said, has been the overarching idea in policy formation by MOST, which has promoted the Plan for Developing a Systematic Approach to Allocation of S&T Resources. This systematic approach enhances understanding of Taiwan's innovation-oriented R&D and industrial development characteristics, while promoting the development of operational evaluation mechanisms that drive innovation and enhance Taiwan's international competitiveness.



*The MoU Signing Ceremony between ITRI and IDEA Consult took place in January 2019.* 

Stephen Su, ITRI's Vice President and General Director of Industry, Science and Technology International Strategy Center, remarked that in recent years Taiwan's primary economic goal has been to enhance its competitiveness. To this end, Taiwan has actively promoted and supported the R&D of emerging technologies. Annual expenditures for this purpose have continued to increase, with budgets reaching NT\$116.3 billion in 2019, a rise of 5.12% from 2018. To provide reference for the review and evaluation of resource allocation in Taiwan, ITRI is implementing MOST's Plan for Developing a Systematic Approach to Allocation of S&T Resources to further explore international policy formulation trends and systematic research effectiveness evaluation mechanisms.

ITRI has long been acting as a government think tank and working closely with key public policy makers. Since 2015, it has cooperated with European consulting firm IDEA Consult, which assists the European Commission in promoting its Key Enabling Technologies policy. Stephen Su stressed that the signing of the MoU with IDEA Consult is expected to pave the way for in-depth interaction between the two sides, which will enhance the quality of research and help produce credible policy recommendations.

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### » Collaboration



## UKTW I<sup>2</sup>P Celebrates First Successful Year of UK-TW Science **Research Cooperation**



UKTW I<sup>2</sup>P applicants shared their experience of their research and work exchange in the UK in an event held by ITRI and British Office Taipei.

The UK-Taiwan Innovative Industries Programme (UKTW I<sup>2</sup>P), which was launched in March 2018, has fruitful results in promoting UK-Taiwan science research bilateral cooperation activities. ITRI and British Office Taipei hosted an event to recognize the first successful year of the program.

UKTW I<sup>2</sup>P is the first UK government-funded programme of this kind, aiming to strengthen UK-Taiwan collaboration in key areas such as biotechnology, AI, robotics, clean energy, and autonomous vehicles. In the first year, the majority of the funding - £200,000 (NT\$8 million) - was allocated to support Taiwanese researchers to conduct research at UK universities and R&D institutes, with additional funding for sector analysis and bilateral visits.

Administrated by ITRI, the program for the first year has successfully attracted a total of eleven Taiwanese researchers, six of them from

universities and five from R&D institutes, including National Cheng Kung University, National Central University, National Chiayi University, National Sun Yat-sen University, National Yunlin University of Science & Technology, and ITRI.

"Over the last year the UK-Taiwan Innovative Industries Programme has created a step-change in the collaboration between British and Taiwanese researchers. Eleven talented Taiwanese researchers undertook joint research at British institutions. The projects they initiated have significant potential across a wide range of areas, from medical devices to digital economy & advanced manufacturing. We expect these projects to benefit innovation in both the UK and Taiwan, and to create links that will last for many years to come. We are very grateful to ITRI for their professional and enthusiastic support in the delivery of this programme,"said Catherine Nettleton, Representative of British Office Taipei.

As a key delivery partner of UKTW I<sup>2</sup>P, ITRI has been working closely with the British Office Taipei to foster a deeper science and research connection between Taiwan and the UK. Dr. Pei-Zen Chang, ITRI's Executive Vice President, stated that UKTW I<sup>2</sup>P provides a great opportunity to enhance UK-Taiwan scientific partnerships, and that many potentially beneficial research topics have already been identified since the launch of the program. In the future, he said, ITRI would devote even more efforts to paving the way for new topics and cultivating further the existing collaborative projects.

ITRI researcher Jih-Yang Chang, who participated in UKTW I<sup>2</sup>P, shared his experience of conducting research and work exchange in the UK. "Through this project, I collaborated with the British AIE Rotor Engine Company to integrate a rotary engine into the hybrid electric power system of an ITRI-developed UAV to reduce weight and improve fuel efficiency. The end result of this joint effort was phenomenal, and we were able to achieve the project's goal successfully!" Chang also visited Sheffield University and Imperial College London to make some great connections with their network of high payload and high duration commercial drone technology. He indicated that during his stay in the UK, he was impressed with the professionalism of the British research teams and glad to exchange valuable ideas with his British counterparts.

Another researcher, Shih-Chun Lin, who is from the Department of Nursing at National Cheng Kung University, also shared her experience with the program. "UKTW I<sup>2</sup>P provided me with a meaningful platform to examine pediatric palliative care from different cultural perspectives and health care policies. Through my visits to ten British pediatric care organizations and talking with various specialists, I was able to share my views with the British pediatric hospice care professionals on the culturallysensitive end-of-life care for families with Chinese-ethnic background while gaining valuable insights to input more international standpoints on Taiwan's pediatric hospice research and education," Lin said.

### » Activity





## ITRI President Dr. Edwin Liu Speaks on Futuristic Society

The 2019 Smart City Summit & Expo (SCSE), Asia's largest annual smart city tradeshow, took place in Taipei during March 26-29. This year SCSE focused on the value in AI applications in smart cities, featuring 337 exhibitors, more than 60 tech forums, the Smart City Mayor's Summit, and the AI 50 Campaign for startups. The event gathered 128 city leaders and representatives from 45 countries and over 350 specialists to present their smart city solutions. Dr. Edwin Liu, President of ITRI, was also invited to deliver a keynote speech on "Futuristic Society" in the opening ceremony.



ITRI President Dr. Liu was invited to deliver a keynote speech at SCSE 2019.







Dr. Liu in his speech emphasized the power of Mother Nature and the importance of developing smart city solutions. He illustrated several cases of how intelligent systems and technologies have tackled global challenges such as air pollution, traffic problems, and waste management, making cities more livable. He went on to share some efforts that Taiwan and ITRI have made in promoting smart city applications. For instance, there are national urban-rural projects that center on water resources, green energy, digital technology, and long-term care, and in 2018, three Taiwanese cities were named among the top seven intelligent communities by the Intelligent Community Forum (ICF). Meanwhile, he stressed the prowess of Taiwan, indicating that its leading position in ICT industry will give it a competitive advantage in the AIoT era, making it an inevitable partner to the world when it comes to the development of smart cities.

Dr. Liu further pointed out that ITRI, on its part, delivered a diversity of innovative solutions in areas such as autonomous vehicles, intelligent healthcare/medicine, and circular economy. According to Dr. Liu, ITRI's Mid-size Autonomous Bus, AI Decision Support Technology of Fundus Image in Diabetes, Energy-efficient Smart Houses Demonstration Project in Shalun, and LCD waste recycling system are all examples that create new possibilities for smart living, quality health, and sustainable environment.

Finally, he concluded that human beings should seek co-existence with nature and that the co-creation from cross-sector players will bring about a synergy effect for a better future.

All in all, SCSE offers a great opportunity to spur innovation and international cooperation. Participants, home and abroad, gathered to share their vision of the future and experience in shaping smart cities, with the ultimate goal of leading to sustainable development for society.

### SCSE 2019

In its sixth year, the 2019 Smart City Summit & Expo (SCSE) has become the largest IoT solution exhibition in Asia, serving as an influential platform for the demonstration of global smart city solutions. SCSE featured state-of-the-art technologies in different areas such as transportation, healthcare, education, energy efficiency, sustainability, and architecture design through exhibitions, forums, and networking events, attracting over 33,000 visitors from across the world.



### » Activity



## iRoadSafe Wins a 2019 Edison **Award**<sup>™</sup>



ITRI accepted the 2019 Edison Award in New York.

ITRI won Silver in the Transportation & Logistics category at 2019 Edison Awards<sup>™</sup> with its V2X system solution iRoadSafe. ITRI representatives accepted the award in New York City on April 4. The Edison Awards<sup>™</sup> have been honoring and fostering innovation and innovators to create a positive impact in the world in the spirit of Thomas Edison since 1987. Being recognized with an Edison Award<sup>™</sup> is one of the highest accolades a company can receive in the name of innovation and business success. Other winners this year include IBM, 3M, and the Dow Chemical Company.



ITRI researchers posed with the silver trophy at the 2019 Edison Awards.



iRoadSafe is the world's first V2X safety system solution integrating V2V/V2I communications, roadside sensing, and CMS (Changeable Message Sign) technologies to provide safety warnings for all road users, including those without on-board unit (OBU) installation. The system supports U.S. and Europe DSRC (Dedicated Short Range Communications) standards in 5.9 GHz. To break through the limitation from OBU installation, iRoadSafe integrates advanced roadside sensing technologies (e.g. radar, LiDAR, and cameras) to detect all moving objects on the road, and broadcasts extensive V2V Basic Safety Messages (BSM) through Roadside Units (RSUs). iRoadSafe can even issue alerts through roadside CMS, to improve intersection safety and protect all road users such as vehicles, motorcycles, cyclists, and pedestrians.

Frank Bonafilia, Executive Director of Edison Awards<sup>™</sup>, considered that iRoadSafe has the potential to create a safer transportation experience for people living within cities. Meanwhile, he believes that through the technology, we can get valuable information beyond safety data and understand the trends of both how people are interacting from the transportation standpoint and the different ways they are living their lives today.

"We're thrilled that iRoadSafe has been recognized by the Edison Awards<sup>™</sup>," said Dr. Tzi-Cker Chiueh, ITRI's Vice President and General Director of Information and Communication Research Laboratories. "It is an innovation that addresses the emerging trends of smart transportation and will play a vital role in vehicular communication and furthermore in integrating with autonomous driving," he stressed.

"iRoadSafe provides a safety solution to road users without V2X equipment and thus overcomes the market penetration challenge of OBUs," said Dr. Tsun-Chieh Chiang, Division Director of ITRI's Information and Communication Research Laboratories. "We will continue to refine its design based on user needs and market demands, making it applicable in more cities around the world," he added. The ITRI team also visited Dr. Mohamad Talas, Deputy Director of Systems Engineering/Traffic Operations of NYC Department of Transportation, to exchange experience in implementing and improving V2X systems.

The DSRC equipment of iRoadSafe, IWCU, has been tested by the US Department of Transportation and selected to be on the research Qualified Products List (rQPL). iRoadSafe has been deployed in accident-prone sites in several cities in Taiwan, including a trial with a bus service and light rail transit system. The initial results have shown that it has a substantial impact on cutting down the accident rate. A video of iRoadSafe is available here:



Video of iRoadSafe.

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## **ITRI Named a Top 100 Global Innovator for Third Time**



ITRI at the Derwent Top 100 Global Innovators 2018-2019 Award Ceremony.

ITRI was named among the Derwent Top 100 Global Innovators 2018-19 by Clarivate Analytics early this year and was presented with the award in mid-April in Taipei. It is the third time since 2014 that ITRI has been honored, making it the most awarded research institute for the Top 100 Global Innovators in Asia. Amongst the top 100, ITRI, Fraunhofer, and the French Alternative Energies and Atomic Energy Commission are the only three government-sponsored research institutions to make the list.

Now in its eighth year, Derwent Top 100 Global Innovators identifies and celebrates the world's most innovative organizations who successfully develop valuable patented inventions that also have strong commercialization potential based on originality, market reach, and opportunities for spin-off inventions. "We are pleased to see that ITRI has been nominated again as it has well demonstrated its impact in driving industrial innovation. We sincerely hope more Taiwanese organizations can show their innovation capabilities to the world in the future," said Nathan Fan, Head of Derwent, Greater China and General Manager of

Taiwan, Clarivate Analytics.

ITRI President Dr. Edwin Liu commented that winning the Top 100 Global Innovators award once again is a great acknowledgement of ITRI's constant efforts in intellectual property (IP) value creation. He indicated that the Institute has been named an Asia IP Elite for six consecutive years. It has been deploying global patent strategies that reflect future market demands, while delivering high-quality patent portfolios to assist Taiwan's industry in leveraging the value of IP assets and creating blue oceans. By 2018, ITRI has accumulated 17,303 valid patents, 98% of which are invention patents, showing its substantial R&D capacity and IP legal expertise, Dr. Liu added.

The Derwent Top 100 Global Innovators are selected for their excellent patent performance across four criteria: volume, success, globalization and influence. Winning this award represents outstanding effort not only in the quantity of filed patents, but also success in obtaining granted patents, breadth of filing of inventions, and external citations. Besides ITRI, winners this year include international companies such as Amazon, Google, and Microsoft. To view the full Derwent Top 100 Global Innovator 2018-19 report, please visit: https://www.clarivate.com/top100innovators.

### Q Derwent

Derwent powers the innovation lifecycle from idea to commercialization – with trusted patent data, applications and services including Derwent Innovation, Derwent World Patent Index, Derwent Patent Citation Index and Derwent Data Analyzer. It builds solutions for inventors, patent attorneys and licensing specialists at start-ups and the largest global innovators, legal professionals at the leading intellectual property practices, and patent examiners at more than 40 patent offices. These solutions are used to monitor technology trends and competitive landscapes, inform FTO opinions, prosecute patents, monetize and license assets and support litigation activities.

### Clarivate Analytics

Clarivate<sup>™</sup> Analytics is the global leader in providing trusted insights and analytics to accelerate the pace of innovation. Building on a heritage going back more than a century and a half, it has built some of the most trusted brands across the innovation lifecycle, including the Web of Science, Cortellis, Derwent, CompuMark, MarkMonitor and Techstreet. Today, Clarivate Analytics is a new and independent company on a bold entrepreneurial mission, to help its clients radically reduce the time from new ideas to lifechanging innovations. For more information, please visit https://clarivate.com.

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## 2019 International Symposia on VLSI



The 2019 VLSI-TSA and VLSI-DAT Symposia attracted nearly 900 participants.

The 2019 International Symposia on VLSI Technology, Systems and Applications (VLSI-TSA) and VLSI Design, Automation & Test (VLSI-DAT) was held by ITRI in Hsinchu, Taiwan during April 22-25. Discussions at this year's event centered on the developmental status and future trends of AI, 5G, autonomous vehicles, semiconductor heterogeneous integration, and 2D materials. Experts from leading organizations including Intel, IBM, TSMC, Arm, Micron, Qualcomm, the University of California, Berkeley, and National Taiwan University, gathered to share their insights. Many were optimistic on the outlook for Artificial Intelligence of Things (AIoT), which would drive demand for chip computing power and computing volume, and spark a surge in the processing of real-time data that gives rise to edge computing.



Dr. Ghavam Shahidi from IBM Research delivered a plenary speech on the topic "Slow-Down in Power Scaling and the End of Moore's Law?"

Dr. Chih-I Wu, VLSI-TSA Co-chair and ITRI's Vice President and General Director of Electronic and Optoelectronic System Research Laboratories, remarked that AI is an important goal for national development for countries all over the world. Dr. Wu explained that the pace of AI chip development will determine how quickly AI changes society, adding that Taiwan plays a crucial role as a consistent leader in the semiconductor industry. In this respect, ITRI integrates Taiwan's industrial, academic, and research capacities by focusing on the design of flexible chip architecture, low-cost heterogeneous sensor integration, standard low-power computing frameworks for different chip specifications, and the integration of multiple AI chips to expand computing time and shorten design timeframes. Altogether, ITRI is able to address the demands for AI chips and establish a globally competitive AI chip industry chain.

Dr. Tzi-Cker Chiueh, ITRI's Vice President and General Director of Information and Communications Research Laboratories, stated that emerging technologies such as autonomous vehicles and drones rely on the real-time computing power of the AI chip, which supports functions like avoiding obstacles and route planning. However, AI chips do not have standardized specifications and thus require the ability to customize chip architectures based on actual system applications. The AI Chip Architecture Design and Software Translation Solution developed by ITRI can help Taiwan IC design houses address this challenge and open up new avenues to the market. The 2019 International VLSI Symposia have attracted nearly 900 individuals representing heavyweight manufacturers from Europe, North America, Japan, Korea, and Taiwan. At the Symposia, the Pan Wen Yuan Foundation also announced the 2019 ERSO Award winners, including Sino-American Silicon Products Inc. Chairman Ming-Kuang Lu, Winbond Electronics Corp. Chairman & CEO Yu-Cheng Chiao, M31 Technology Corp. Chairman Hsiao-Ping Lin, and Wiwynn Corp. President & CEO Emily Hong.



Four ERSO Award winners were honored at the Symposia.

### 2019 ERSO Award Winners

The ERSO Award, established by the Pan Wen Yuan Foundation in 2007, honors individuals who have made outstanding contributions to Taiwan's technology industry. This year, the award recognizes the success of Sino-American Chairman Lu in creating a specialized wafer production line, with a comprehensive product series that is provided domestically to the information, communications, optoelectronics, and energy sectors. Chairman Chiao of Winbond was also applauded for his dedication to the production and design of memory products as well as IC technology development. Award recipient Chairman Lin founded M31 in 2011 to provide high-speed transmission interfaces and basic component IP, which have helped major semiconductor foundries and IC design houses reduce the chance of failure in the course of product development. Lastly, President & CEO Hong of Wiwynn was praised for the development of cloud-based basic framework products, Big Data centers, and system solutions for cloud-end customers.

### » Activity





## Forum on International Trend of Metrology

To echo the historical changes in the International System of Units (SI), ITRI and the Bureau of Standards, Metrology & Inspection (BSMI) coorganized a forum on International Trend of Metrology in Hsinchu, Taiwan on May 20th, when the redefinition of the SI came into effect and the World Metrology Day (WMD), an annual celebration of the signing of the Metre Convention, took place.



Featuring the same theme as the 2019 WMD, "The International System of Units—Fundamentally Better", this year's event included keynote speeches, a summit forum, and a lab tour session, gathering experts from the industrial, academic and research communities. Dr. Takashi Usuda, Secretary of the International Committee for Weights and Measures (CIPM), and Dr. Chia-Seng Chang, Director of the Institute of Physics at Academia Sinica, were invited to be the keynote speakers and present their views on "The Background and Impact of the Revision of International System of Units" and "Trend of Modern Metrology and Quantum Physics" respectively. Six panellists shared their perspectives on the challenges and responses to the innovative application of new metrology development. The afternoon session was a tour to the new SI laboratory, where methods associated with the new standards for four SI base units were introduced, including the Si-Sphere for mass standards, acoustic/microwave resonant chamber for temperature standards, Josephson voltage system and the quantum Hall resistance system for electrical current standards, and the isotope measurement system for mole standards.

ITRI Chairman Dr. Chih-Kung Lee stated that precision measurement has a profound impact on various sectors and is closely associated with industries involved in semiconductors, energy, aerospace, and medical technology. In response to the revision of the SI, ITRI has been working to bring in new metrological techniques to enhance the calibration and measurement capabilities of the National Measurement Laboratory. This practice can ensure the traceability and global conformity of the national standards, and in turn, will secure the leading position of Taiwan's hightech and precision industries.

Dr. Lee also expressed his gratitude for the participation in the forum of local and foreign experts in metrology. He believes that joint engagement in the SI revision will drive scientific development towards higher accuracy and precision, which will positively contribute to the growth of technology and innovation and further assist in industrial transformation and competitiveness enhancement.

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