Taiwan Tech Arena strives through the integration of various resources to boost innovative startups by linking them with international accelerators and expanding global reach to create more business opportunities.

TAiWAN TGCH ARENA

THE STARTUP FEVER IS CATCHING ON WORLDWIDE

Taiwan should strive to be the hub that bridges global giants and Asia, attracting potential strategic partners to open up collaboration opportunities

COMPETITION BRINGS NEW OPPORTUNITIES FOR TAIWAN

Taiwan continues to retain a key place in the global community as its industries evolve to meet emerging demands and adapt to new economic trends

TAiWAN TGCH ARENA

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COLLABORATION BUILDS STRONG FOUNDATIONS FOR THE WAY FORWARD

Local startups become the representatives of Taiwan's core values as they use their technological strengths to forge partnerships worldwide

DRIVING INNOVATIONS: PUBLIC AND PRIVATE SECTORS WORKING TOGETHER TO BUILD TAIWAN'S STARTUP ECOSYSTEM

Taiwan was second only to Silicon Valley in the US in terms of investments and entrepreneurial activities during the 1990s. Nurtured by a steady flow of venture capital, the island's semiconductor and ICT industries flourished and gained global leadership status in that period. However, Taiwan later missed out on the shift from hardware to software in the technology sector after the turn of the millennium. VC firms also suffered substantial losses in the Internet bubble of the early 2000s; and Taiwan's industries, in turn, lost their momentum for innovation over the next decade due to the conservative investment climate.

Initiatives worldwide show that the push to foster technology startups often begins in the public sector. Israel, for example, has made startup creation its national mission. Besides loosening regulations to promote entrepreneurship, the Israeli government has also taken the further step of assuming some of the risks in funding new ventures. Consequently, the country has a thriving ecosystem of young companies that are eager to take chances. With a population of only eight million, Israel now boasts of giving birth to around 1,500 new companies every year. Its success story can be emulated by Taiwan, which has three times the population along with other advantages including abundant resources and highly matured industries. Our government has therefore set the short-term goal of helping to launch 3,000 local startups.

Taiwan's government and private sector over recent years have made adjustments to spur innovation. Laws have been amended to stimulate VC investments. To cultivate local talents that can lead the next digital revolution, the public education system has also adopted new approaches, such as strengthening students' knowledge of coding. On the cultural front, the government is working with various organizations to instill the spirit of creativity and openness among the citizenry. With this attitude, the Ministry of Science and Technology has formed a national team of ambitious startups to demonstrate Taiwan's capacity for innovation. The ministry has brought these startups to major trade fairs and technological exhibitions around the world, thus providing them with exciting opportunities to present their groundbreaking ideas and products on the global stage.

The market for technological innovations is now entering an intense phase of development, with breakthroughs happening in many fields such as AI, 5G, self-driving cars, and biotechnologies. Taiwan's industries have to make the necessary transitions to adapt to these new technological trends. Going forward, domestic enterprises will need to build on their foundations of hardware manufacturing by incorporating elements of these emerging technologies. AIoT and 5G, in particular, are expected to make vital contributions to local businesses and become major pillars of economic growth in the near future. To achieve progress in these two areas, the government will be supporting ICT firms' ongoing R&D efforts and the development of innovative services by startups.
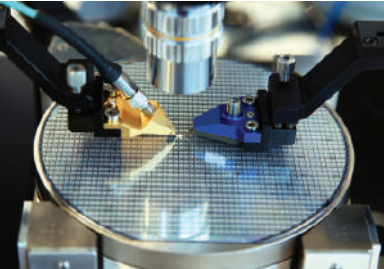
Dr. Liang-Gee Chen

Minister, Ministry of Science and Technology, Taiwan

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COMPETITION BRINGS NEW OPPORTUNITIES FOR TAIWAN

Taiwan continues to retain a key place in the global community as its industries evolve to meet emerging demands and adapt to new economic trends.

❚ Recycling solutions for advanced industries developed by ITRI researchers are contributing to Taiwan's ongoing efforts to establish a Circular Economy.

❚ Biotech startups are seeking regulatory approvals for their R&D platforms and companion diagnostic products in a bid to enter the precision medicine market.

❚ Taiwan's semiconductor industry aims to maintain its leading position through constant technological improvements and strategic IP acquisitions.

THE CIRCULAR ECONOMY IS THE FUTURE FOR TAIWAN MANUFACTURING

In the traditional Linear Economy, raw materials are made into products with any waste material thrown away after use. By contrast, the Circular Economy is restorative and regenerative by design, relying on system-wide innovation to redesign products and services to minimize unnecessary material waste and negative impacts to the environment.

Stephen Su

Taiwan Brings Important Advantages to the Relatively New Field

In comparison with two other recent technology megatrends – Industry 4.0 and Artificial Intelligence – the Circular Economy is more of a mid- to long-term vision. Its full economic value is not yet fully defined due to difficulties in measuring the total impact on society and the environment. But unlike Industry 4.0 where Germany and Japan are indisputably recognized as the two country leaders, and Artificial Intelligence where the United States and China are in the lead, currently, no country dominates the Circular Economy.

Today only some European countries have developed advanced applications and sustainable business models in the Circular Economy, which indicates that there are still opportunities for countries or enterprises to invest now and aim for world leadership in the future.

Taiwan has many advantages that may enable it to become a leader in the Circular Economy.

First of all, the Circular Economy often requires multiple industries to share recycled waste. Taiwan has a lot of well-developed manufacturing industries located in clustered regions, including the oil refining, chemical, steel and automotive industries.

Second, many breakthroughs in technological innovations and cost management will still be needed for the Circular Economy to succeed. Taiwan's industries are adept at integrating new developments into the manufacturing process, while at the same time rigorously pursuing cost management. For example, TSMC, the world's largest semiconductor foundry, can currently recycle every drop of its water by an average of 3.5 times, an impressive achievement by world standards.

Lastly, many Taiwanese manufacturing companies operate factories elsewhere, opening potential opportunities to spread viable Circular Economy solutions to overseas markets after they have been developed and proven at home. Besides the sales opportunities, companies developing Circular Economy solutions will find that it helps improve their manufacturing competitiveness.

For Taiwan to lead the world in the Circular Economy, according to research by the Industry, Science and Technology International Strategy Center (ISTI) at the Industrial Technology Research Institute (ITRI), Taiwan's largest applied technology research institute, a total of seven key reforms will be needed to carry out a paradigm shift to build new manufacturing ecosystems:

Re-Thinking: The Circular Economy will require adopting a new mindset – chiefly that the product lifecycle does not end with product usage, but extends into a recycle period for the calculation of complete lifecycle cost.

Re-Environmenting: The impact on the environment must be taken into account as part of the evaluation of potential benefits and costs. For example, the cost of a product should include the carbon emissions during the manufacturing and transportation processes.

Re-Servicing: New business models will be needed to provide services to new customers. For example, the sharing economy business model changes the own-by- user concept to one of pay per usage and service. The concept applies not only to transportation services and lodgings but even household goods such as washing machines, air conditioners, lighting, etc.

Re-Innovating: New designs and technologies will provide innovative solutions for products and services. For example, new materials can be engineered to provide longer-lasting product lifecycles or easier recycling of product materials after usage.

Re-Manufacturing: Manufacturing processes and systems will have to be redesigned to reduce electricity usage, material consumption, or carbon emissions. For example, 3D printing can be used in manufacturing to reduce material waste.

Re-Cycling: Waste materials after product usage will need to be collected and re-used in new production. For example, recycled plastic bottles can be re-composed into materials for special sports jerseys.

Re-Generating: New methods will be called for to generate or conserve energy. For example, manure from farm animals can be collected and processed into methane to generate electricity.

Since 2008, ITRI has been an annual recipient of R&D 100 Awards from R&D Magazine in the United States in recognition of its revolutionary innovation and commercialization achievements. Among these awards there have been three related to ITRI's interdisciplinary integration efforts for the field of Circular Economy.

LCD Waste Recycling System (2017 R&D 100 Award and Special Recognition Award)

The problem: LCD panels for various displays like TV and mobile phones contain liquid crystal, indium, and other heavy metals that present a risk to people and the environment. An increasing number of countries have classified used LCD panels as hazardous waste. The current disposal methods used for LCD panels such as burying, burning, and physical disposal have negative environmental impacts. Every year about 21,000 metric tons of used LCD panels are discarded around the globe.

Re-Cycling and Re-Innovating: ITRI has developed an LCD waste recycling system solution that can recover LCD panel materials for reuse. The system employs an innovative and recycling approach based on a six-step process of separation, extraction, purification, scrubbing, concentration, and transformation. The process separates three main components of LCD panels – liquid crystal, indium, and glass – and recycles each component for new use.

The liquid crystal can be nearly 100% recovered to be reused in new LCD panels. The indium can be recovered up to 90% to help produce new thin films for electrodes used in display panels, solar cells, and other products. The glass can be recycled to produce green construction material or heavy-metal adsorption material.

Currently, ITRI is collaborating with the leading LCD panel manufacturers and e-waste recycling companies to build an LCD waste recycling pilot plant.

Carbon-negative Bio-butanol Production Technology (2013 R&D 100 Award)

The problem: The transportation sector currently accounts for over 20% of global CO2 emissions. Producing biofuel from cellulosic feedstock is regarded as the ultimate solution, but the current production method using microbe metabolism still causes one-third the amount of carbon emissions during the fermentation process. This production method also reduces biomass yield and increases the feedstock requirement and associated costs.

Re-Manufacturing and Re-Innovating: ITRI has developed the first carbon-negative bio-butanol production technology, ButyFix, which uses cellulosic feedstock to produce biofuel with near-zero carbon emission. This technology removes a small amount of CO2 from the atmosphere – producing what is called a negative greenhouse gas (GHG) emission – due to surplus energy from the lignin-rich biomass.

The result is a bio-butanol with a GHG emission reduction three times more efficient than with corn ethanol and with a carbon conversion rate 2.7 times that of the traditional process. In 2014, ITRI spun off a new startup company, Green Cellulosity Corp. (GCC), to commercialize this technology with greater production scale.

High-Efficiency Calcium Looping Technology (HECLOT) (2014 R&D 100 Award)

The problem: Coal-fired power plants are still the primary choice for developing countries for electricity generation because of the direct cost advantage. In response to the growing global concern over CO2 emissions, Carbon Capture and Sequestration (CCS) is the only available solution to reverse the CO2 emission trend by retrofitting existing power plants. However, most CCS technologies under development are either not efficient for retrofitting or not cost-competitive.

Re-Innovating and Re-Environmenting: ITRI has developed the High-Efficiency Calcium Looping Technology (HECLOT), an innovative technology for reducing carbon emissions from fossil power plants. This technology is the first affordable and energy-efficient solution to achieve a CO2 capture rate near 90%. A power plant using HECLOT reduces energy consumption, enabling coal-fired power generation to become clean electricity and saving more than 50% in costs compared to a fossil-fuel power plant.

The contribution that the Circular Economy can make towards a better world for human beings and the surrounding ecosystems seems more certain than ever. Unlike Industry 4.0 and Artificial Intelligence, Taiwan has a good chance to transform its manufacturing industries to become a dominant leader in this field, and Kaohsiung City will be an important flagship for Taiwan to create greenfield zones over the next 10-20 years. As part of the global science and technology community, ITRI will also continue to create value to help shape the future Circular Economy.

INTENSE COMPETITION AHEAD FOR THE TAIWANESE SEMICONDUCTOR INDUSTRY

The year 2018 marked the 60th anniversary of the invention of the integrated circuit (IC). The semiconductor industry in Taiwan has not only spearheaded the development of Taiwan's high-tech industries, but also the creation of economic prosperity. Indeed, the semiconductor industry in Taiwan plays a pivotal role in the global ecosystem.

Mao-Jung Peng

Starting with the technology transfer by RCA from the U.S, the Taiwanese semiconductor industry has greatly surpassed RCA's technological levels. There is currently a highly integrated supply chain in Taiwan, from the upper stream to downstream.

The specialized division of labor in Taiwan is unique in the world, known as a disruptive power to the traditional world of IDMs (integrated device manufacturers). The creation of foundry, IC testing and packaging companies in Taiwan collectively offers state-of-the-art technology to IC design houses around the world.

Demand Growth and Mergers & Acquisitions (M&A)

The development of the Taiwanese semiconductor industry mirrors the prosperity of the domestic economy. During the past three decades, the industry grew along with the booming of the PC and smartphone markets.

Going forward, the industry will continue to serve the consumer electronics market, under the guidance of the government's 5+2 Industrial Transformation Plan and by riding on the wave of Internet of Things (IoT) innovations. The industry is expected to generate an annual revenue of US$ 127.5 billion by 2025.

There have been a slew of M&A activities in the global semiconductor industry over the past few years. Leading players have maintained their growth momentum and mapped out future strategies via acquisitions. The semiconductor companies in Taiwan were part of this trend. In 2015, Mediatek acquired four companies, Alpha Imaging Technology, Chingis Technology, ILITEK Corp, and Richtek Technology, to enhance its silicon intellectual property in image processing, touch panels and power management. The merged ASE Test and SPIL have been listed as a holding company and has great potential.

In general, M&A activities help to enhance the competitiveness of the Taiwanese semiconductor industry. According to the research institute IC Insights, the M&A transactions in the global semiconductor industry in 2015-2016 reached US$100 billion. Whether this will continue depends on the level of integration among leading players in new applications such as AI and IoT.

Given the trend for smart connectivity, the semiconductor companies in Taiwan are likely to focus on the following domains: artificial intelligence, 5G, Internet of Things, Industry 4.0 and smart machinery, connected cars and autonomous driving, augmented reality (AR) and virtual reality (VR), high-performance computing, software and networking services. The diversity
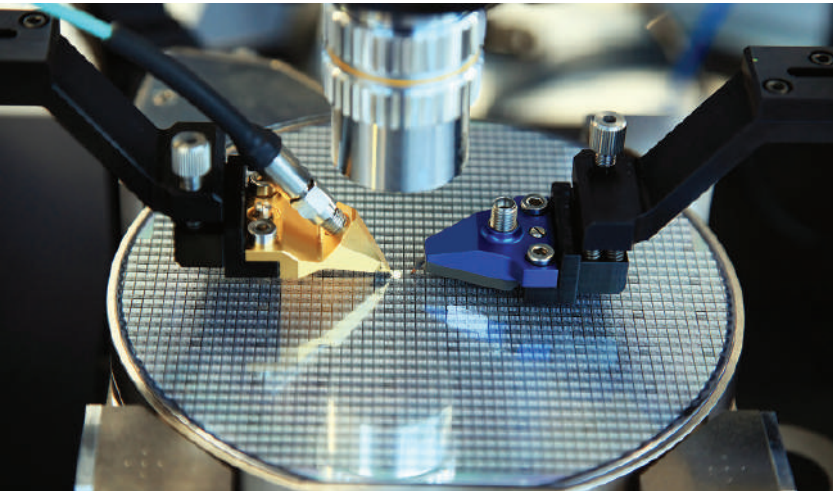
of IoT applications means not everything requires the most expensive semiconductor processing. Some applications may be feasible using 90nm or micro/nanotechnology. The low-cost threshold gives room for small IC design firms as long as they can offer innovative services and applications. This will drive the diversity of the fabless industry.

Both IDMs and Foundry Model Have Their Advantages

Thanks to the over 60% price increase of memory during the year, 2017 saw the global semiconductor market exceed US$ 500 billion, up approximately 20% from 2016. The IDMs as a group enjoyed the strongest growth and accounted for over 60% of the global supply chain. The semiconductor industry in the US, South Korea, Japan and Europe are centered on IDMs. In Korea, IDMs contributed to over 95% of the industry's output. Samsung, a leading IDM, reported higher revenue than Intel for the first time and became the world's largest semiconductor company.

In 2017, foundries accounted for 49% of the Taiwanese semiconductor industry's output, IC design houses 25.1%, IC testing and packaging 19.4%, and memory 6.5%. The whole industry generated a total revenue of US$ 81 billion, the third-largest in the world, next only to the US and Korea. The foundries in Taiwan had over 70% of the global market share (the largest in the world), generating a total revenue of US$ 39.7 billion in 2017.

The foundry model in Taiwan is distinctively different from the rest of the world. This is the advantage of the Taiwanese semiconductor industry. IDMs
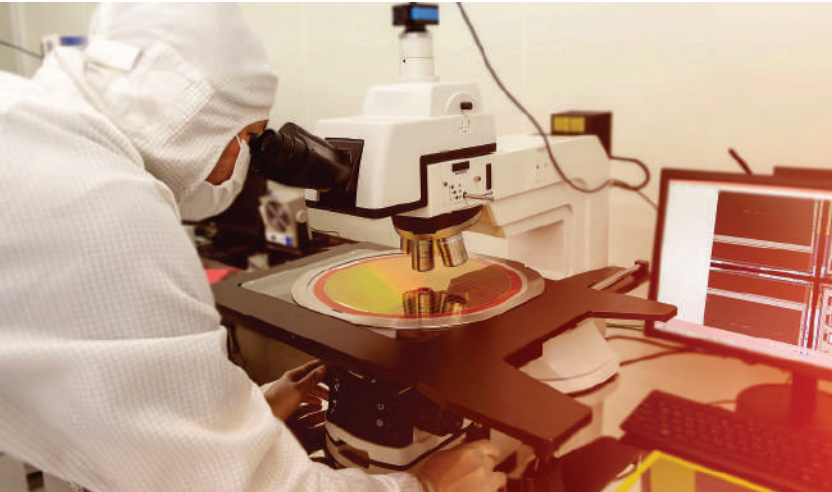
work independently by launching their own branded products. Foundries work closely with IDMs, IC design companies, testing/packaging service providers, and electronics OEMs. The foundries in Taiwan help their customers to launch products by offering high yields and low costs. Both IDMs and foundries have their advantages. The key to their success in the future depends on technology.

Taiwan Should Be Proactive in Response to the Rise of China

Given China's status as the world's largest producer of electronic products and systems, the Chinese semiconductor market contributed to an increasing percentage of the global demand, at around 30% in 2017. Driven by the government's support for localization, the Chinese semiconductor industry has been growing rapidly. The fabless industries in China have already increased their global market share to approximately 10%.

With leadership in technology and market

share, the Taiwanese semiconductor industry remains competitive in the global landscape of co-competition. However, the Chinese semiconductor players have been catching up in terms of revenue given the government support and capital access. The localization of the Chinese semiconductor industry is expected to create revenues of more than US$ 95.4 billion by 2020, and will gradually become a formidable competitor to Taiwan.

The cutting-edge semiconductor technology has moved to the 5nm level. In addition to continued miniaturization, the industry is also pursuing the integration of highly heterogeneous chips. The competition for new materials has started, such as superconductors for quantum computing and carbon nanomaterial, in an attempt to reach beyond the limitations of silicon today. With the arrival of the smart connectivity era, a plethora of applications will be focused on 5G, AI, IoT, intelligent cars and high-speed computing. The semiconductor companies in Taiwan should act fast to secure their future.

TOWARD PRECISION MEDICINE: A NICHE MARKET FOR TAIWANESE PLAYERS

Many countries have directed significant investments in research related to precision medicine since 2011. In July 2017, FDA approved the first companion diagnostic product centered on Next Generation Sequencing (NGS), marking the beginning of the precision medicine era with gene sequencing results being used as the basis of medication decisions.

Pei-Fen You
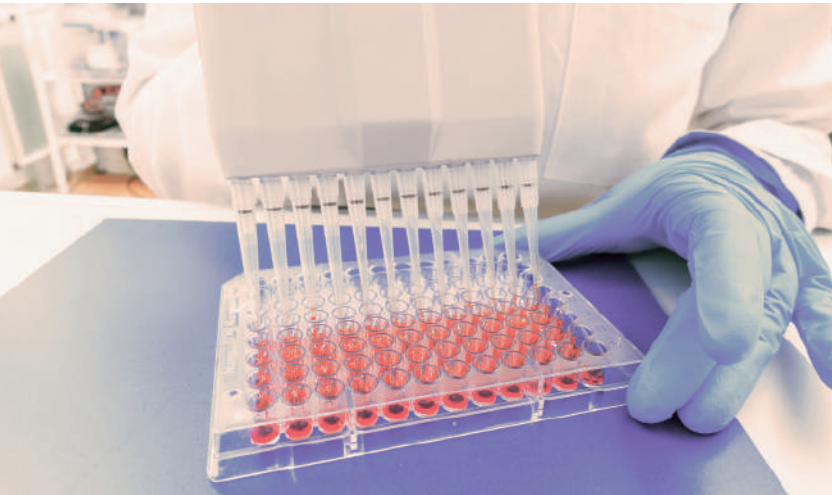
The modern medical system administers treatments based on symptom descriptions and the findings of routine examinations. This approach can deal with most illnesses but has been ineffective in terms of early diagnostics, precise treatment and risk control for genetic diseases, cancers, communicable and chronic diseases.

Precision medicine is about the offering of tailored preventive and therapeutic measures to patients by taking into account the differences in genetic profiles, social environments, and lifestyles and applying molecular biology tools in complex disease analytics. The purpose is to ensure the optimal treatment for all the sub-groups of

patients for different diseases by staying on top of the incidence, progression and genetic variances.

Precision medicine aims to provide patients with customized and suitable doses of medication at the right time based on complete disease information. The insight gained from biobanks and genome analytics on parameters regarding treatments, daily activities and follow-up care enables not only personalized treatments but also disease risk control and health promotion. This is the ultimate goal of precision medicine.

There is a wide range of new diagnostic techniques required for precision medicine to enhance treatment

efficiency and even disease prevention. Examples are Next Generation Sequencing (NGS), liquid biopsy diagnostics, sample preparation, a platform for co-development of drug and companion diagnostics, and gene/physiological data analytics.

Companion Diagnostics as the Top Priority

Companion diagnostics as the direct tool for treatment strategies nowadays is the first priority for precision medicine. Research in 2002 indicated that the response rate from patients grouped by the biomarker HER2 to Trastuzumab, the target drug used in the first-line therapy, increased from 7% (without biomarker tested) to 34% (grouped with biomarker). This shows the dramatic improvement of medication precision and effectiveness from using biomarker grouping.

Meanwhile, the clinical statistics released in 2016 by the U.S. Biotechnology Industry Organization suggests that biomarkers can increase the success rates of drug development toward clinical trials. The success rates of clinical developments with biomarkers are three times those without biomarkers throughout the clinical trial stage. These biomarkers become companion diagnostic products when the drugs enter market.

Companion diagnostics have already been widely used for the screening and selection of cancer drugs and pharmacovigilance. As the development of companion diagnostics and precision medical drugs are interrelated, the pharmaceutical companies and diagnostics providers will collaborate much more closely.

Next Generation Sequencing (NGS) Drives the Rapid Growth of Genetic Analytics

Biopsy has been widely used for genetic sequencing to unveil the complex causes of diseases to establish a full picture of treatment strategies.

In addition, liquid biopsy has attracted significant attention as the sensitivity of Next Generation Sequencing (NGS) and circulating cell separation techniques improve over time. As liquid biopsy supports periodic sampling and tracking, more use cases will emerge for the detection and inspection of genetic diseases and the follow-up post-treatment. This, in combination with the technology of genetic profiling, can serve

as the basis for comprehensive and precise treatment strategies.

The rapid progress of Next Generation Sequencing (NGS) has slashed the cost of human genome sequencing from US$ 7.14 million in 2007 to US$ 1,363 in 2015. The cost reduction has opened up the possibility of many applications and contributed to the rapid rise of genome profiling and analytic services.

Accurate sequencing is the foundation for precise diagnostics. This requires the integration with a plethora of biomedical information tools for contrasting, comparisons and analysis to convert a massive amount of sequencing data into complete and personalized medication advice and treatment.

With the maturing of artificial intelligence technology and the support from advancing hardware and software, many vendors have launched products and services for biomedical information analytics. In addition to helping pharmaceutical companies in the development of biomarker/diagnostic products and target therapeutics, such

services/products are being used in precise diagnostics and personalized drug administering.

Taiwanese Industry Players Should Establish R&D Platforms Based on Its IVD Industry and Straightly Focus on Specific Disease Applications

Given the foundation of the in vitro diagnostics sector in Taiwan, the industry could refer to the footsteps of international companion diagnostics companies to build R&D platforms for specific disease applications, as well as for liquid biopsy and multiplexed assay.

Some companies in Taiwan seek to enter the Next Generation Sequencing (NGS) market by leveraging their advantages in semiconductors and electronics. However, the oligopoly structure of the market and the acceptance of Taiwanese brands pose challenges. It is suggested that Taiwanese players may seek cooperation with academic and research institutions in R&D for next-generation technologies. Efforts should focus on the products and applications that require high speeds, long sequencing fragments, and high fault tolerance. This will enable the capturing of business opportunities for innovative applications in the international market.

Currently, Taiwanese companies are active in the upper, mid and downstream of precision medicine. However, they are all in the early stages, and their activities are rather scattered across the value chain. Most of these companies are still start-ups or small-to-mid sized. Seeking more collaborations domestically and overseas are necessary for the industry to grow and prosper.

NEW OPPORTUNITIES IN EIGHT FIELDS ON THE 60TH ANNIVERSARY OF THE IC

2018 marks the 60th anniversary of the invention of the integrated circuit (IC). Semiconductors are a key component in most electronic system products. The semiconductor industry is very important to Taiwan, which is the key to Taiwan's position as "Silicon Island," and the technology of Taiwan's semiconductor industry has a pivotal position in the world.

Mao-Jung Peng

In the past, the market for computer electronics and smartphone devices drove the development of Taiwan's semiconductor industry. However, Taiwan is facing rapid changes in technology. In addition to the continued deepening of the traditional 3C electronics market, the government's 5+2 industrial innovation plan and all the innovative application of AIoT are expected to lead the industry to new heights.

Taiwan's Semiconductor Industry Can Seek Opportunities under the Trend of AIoT

The ISTI, ITRI predicts that under the trend of AIoT, Taiwan's semiconductor industry can seek opportunities in eight fields in the future, including artificial intelligence, 5G wireless communication, Internet of Things, industry 4.0/ smart machinery, Internet of Vehicle/ autonomous vehicles, augmented reality/ virtual reality (AR/VR), high performance computing (HPC), and software and network services. We expect to see the diverse application of AIoT in the future. New applications can be developed in the 90-nanometer field, or even the micro-nanometer field. Under the trend of lowered cost threshold, small IC design companies are expected to rise and conquer the market with innovative application services, driving the diverse development of the IC design industry.

In addition, mergers and acquisition have become a trend in the global semiconductor industry. Many large companies maintain their growth through mergers and establish a layout for future development. For example, MediaTek had four mergers and acquisitions in 2015 to strengthen its technology and intellectual property of core memory and image processing.

Mergers and acquisition have helped enhance the competitiveness of Taiwan's semiconductor industry. According to a survey conducted by IC Insights, the scale of mergers and acquisitions in the semiconductor industry reached US$ 100 billion between 2015 and 2016.

The International Semiconductor Industry Association (SEMI) announced that the value of goods shipped by North American semiconductor equipment manufacturers in March 2018 was US$ 2.42 billion, a slight increase from February and a record high in more than 17 years. In 2018, with the continued investment in memory and foundry, the industry remains optimistic about the continuous growth of the semiconductor equipment market.

Looking at Taiwan's IC design industry in 2018, MediaTek continually developed new mobile phone AP products (P60/P65) in the first half of 2018, and

with the increased demand for SSD, networking devices, and design services, and the trade war between China and the US heating up, some Chinese-based brands have started to look for alternative solutions to US-based ICs. This will benefit Taiwan's IC designers. It was expected that after the end of the second quarter, the market would slowly increase demand for these goods and gradually magnify the output value of IC design. The annual output value of Taiwan's IC design industry in 2018 is expected to be NT$ 645.5 billion, a 4.6% growth from 2017.

Taiwan Has to Keep Advantage of Being Well Recognized as the Silicon Island

For Taiwan's IC manufacturing industry in 2018, thanks to the rapid growth in HPC, IoT and automotive electronics, especially the increased demand for advanced processes from cryptocurrency mining equipment, AI, GPU and other chips covered by HPC, the output value of the foundry industry is expected to grow by 1.7% to NT$ 1.227 trillion. For memory, DRAM has become an indispensable component with great demand due to the expansion of AI, IoT, smart vehicles, HPC and other applications. For NAND Flash, the significant demand from the downstream smartphones, PCs and server customers

also drove the increase in price and output. The output value of memory and related products is expected to grow by 25.2% to NT$ 203 billion. Combining the growth momentum of foundry, memory and other manufacturing, the output value of Taiwan's IC manufacturing industry in 2018 is estimated at NT$ 1.43 trillion, which is a 4.5% growth over the previous year.

For Taiwan's IC packaging and testing industry in 2018, the output value of the whole year is expected to be NT$ 474.5 billion, a 0.5% annual reduction. This is because the increased global economic uncertainty in the second half of 2017 affected the sales of electronic terminal products plus the low price competition strategy due to the increased capacity of China's advanced packaging and testing after the mergers and acquisition of big packaging and testing companies. Combining the relevant data, the output value of Taiwan's IC industry in 2018

is expected to be NT$ 2.55 trillion, an annual growth of 3.6%.

China has become the world's largest assembly base for electronic system products. In 2017, China's share of the global semiconductor market already rose to 30%, and its IC design industry now accounts for 10% of the global market share.

So far, Taiwan's technology and market share are still in the lead and thus are still competitive. However, under the policy support and capital-intensive advantages, China has been catching up and has gradually become a serious competitor of Taiwan.

In particular, competition in semiconductors has now entered the 5-nanometer arena. In addition to the continual pursuit of process miniaturization, highly heterogeneous integrated chips will be developed at the

same time. Moreover, the competition for future new materials has started; for example, superconductors and carbon nano-materials required for quantum computing will break through the limits of today's silicon materials.

Taiwan already has the basic advantage of being the "Technological Silicon Island", and Asia is going to be the most important market in the world in the future. From its key position, Taiwan should leverage its existing advantages in semiconductors to develop an innovative technological "eco-island" with a cultural heritage to meet the human-oriented demand. In the era of AIoT, technology will be closer to people's lifestyles and customers' demand will drive the industry to promote open innovation and serve as a demonstration field for innovation. The innovative eco-island will be an environment for talent gathering, industrial clusters, diverse funding and continual innovation.

THE STARTUP FEVER IS CATCHING ON WORLDWIDE

Taiwan should strive to be the hub that bridges global giants and Asia, attracting potential strategic partners to open up collaboration opportunities. This is what makes Taiwan valuable.

Eden Lien

Twenty years ago, venture capital was a key catalyst to the continuous improvement of Taiwan's industry. It propelled Taiwan to a world-leading position in semiconductor and high-tech manufacturing and established the world's most complete supply chain system. However, due to tremendous success in the past, Taiwan has missed the opportunity for industrial transformation since 2000. The number of investments in recent years has plummeted.

To compensate the lack of early-stage investments and push Taiwan's venture capital industry into a new phase of growth, the national investment company Taiwania Capital was founded. It is jointly funded by the National Development Fund of the Executive Yuan and private enterprises, focusing on promising startups or early-stage companies and mainly invests in key industries of the government's 5+2 plan. In this special issue, we interviewed David Weng, the CEO of Taiwania Capital. David Weng is also an angel investor and professional investment manager who works closely with startups in Silicon Valley and Israel. We interviewed David and asked him to discuss the startup opportunities in Taiwan based on the overall trends in the venture capital industry.

In general, what Taiwan needs the most is early-stage investors, that is, from angel to B-round. There have been some changes in the past few years. The government has spent a lot of resources on the angel round. The Ministry of Science and Technology, the National Development Council and the Ministry of Economic Affairs have all invested heavily in startups. However, compared to other countries, early-stage investment is still lacking. That is why one of Taiwania Capital's missions is to become the leader in the pre-A to B round bringing the venture capital industry to a new level through Taiwania Capital's investments.

1. What do you think about Taiwan's venture capital industry in recent years?

Actually, the venture capital industry in Taiwan has thrived in the past. In the 1990s, it was the second most active venture capital market in the world after Silicon Valley. However, in the past decade, the number of Taiwanese investments has plummeted, both in amount and companies. Most investments are in the late stage, pre-IPO and even IPO.

Why has this happened? It is mainly because we used to be very successful in the semiconductor and ICT industries. The return on investment for hardware such as PC and notebook is low yet still sufficiently profitable. After 2000, the industry transitioned to software and the Internet, but we failed to take advantage of industrial transformation. Additionally, Taiwan lacks experience in developing large-scale software.

The other issue is talent. The success of semiconductors attracted a large number of talents to hardware giants like TSMC and MediaTek, but there weren't enough software talents. There is a lack of software framework leadership and standards stipulating the rules engineers need to follow in the development stage.

2. Besides the shortage of early-stage investments, are there any highlights of Taiwan's domestic investments? Which fields do you find promising?

In the past few years, Taiwan's investments have been in high-tech manufacturing, semiconductors and ICs. I believe Taiwan is trailblazing in these areas and is hard to compete with in the world today. Quantum computing is the future, but it requires hardware. If we want to reach the level that others can only dream of, we need to maximize our strengths and attract potential strategic partners. This is what makes Taiwan valuable.

Investments and industrial developments in the past focused on "quantity" and "efficiency", but at the same time experiencing "low returns." Therefore, Taiwan needs to transition from efficiency-based to innovation-based. For example, using software and artificial intelligence to continuously optimize or reinvent the entire manufacturing process, thereby intellectualizing manufacturing and ultimately achieving full automation.

In addition, we also excel in the medical field, making Taiwan a major hub for clinical data studies or gateway for international pharmaceutical giants to break into the Asian market. Drug manufacturing requires a lot of funding and we have excellent researchers. If Taiwan can reach a certain level in drug manufacturing, we can partner with global giants potentially leading to mergers or acquisitions.

Taiwan should also continue with low-earth-orbit satellite development, referred to as 6G in the United States recently, which focuses on how to use low-earth-orbit satellites to connect all remote areas. Taiwan has the opportunity to become a partner in antenna and communications technology.

3. Silicon Valley is the venture capital icon of the world. Taiwania Capital has been in close contact with Silicon Valley since its inception. What are the current startup and venture capital trends over there?

At present, most of Silicon Valley's venture capital investments are in enterprise software, accounting for more than 80%. Investments in hardware have been compressed to 10%. Another major change is the rapid growth of corporate venture capital (CVC), which has surpassed traditional ventures three years ago. This means that corporate ventures have exceeded professional venture capital firms. Google, Cisco, and Intel all have their own ventures and large fund sizes. These companies invest in holding shares or mergers and acquisitions, which is why they do not need to develop a lot of new products and technologies themselves. By investing in startups and M&A, they drive company growth becoming sources of innovation. Currently, the M&A proportion exceeds IPO several times over, which is not a common trend in Taiwan.

4. You just visited Israel with your team. Please share with us the opportunities you saw during your visit.

Taiwan and Israel are similar in many ways. They are both small countries. Israel's population is one-third of Taiwan's and its surface area is smaller than Taiwan's. What I find unique is that Israelis are very cooperative and they value the cultivation of the younger generation. We visited two very important places in Israel this time. One of them was Jerusalem Venture Partners (JVP) and the other Ben-Gurion University of the Negev (BGU), a major university in the southern desert of Israel. Next to the university is the famous Unit 8200. Each year, the best talents from high school graduates in the country are selected for training in all aspects of digital combat.

Initially, no one wanted to go to where BGU is located. Israel's first prime minister believed that this desert, which occupied more than 60% of Israel's land, was the future of the country. He decided to establish a university there and promote local development. Founded in 1969, BGU is now the fastest-growing university in the world. It is home to the world's leading information security center. The university has a very flexible education system that can be incorporated with industry and future trends. The courses and teaching methods are very adaptable, unlike Taiwan's departmental system.

When it comes to investing in startups, the Israeli government is willing to take chances. For example, quantum computer development is very risky, but the government is willing to take the risk and pool the resources in one specific industry to cultivate a national army. While in Israel, we were invited to a quantum computing startup that took 15 years to develop by an R&D unit similar to a nonprofit research organization in Taiwan. Interestingly, ventures first invested US$ 10 million in the company, then the Israeli government gave the company a US$ 10 million grant without holding shares. In addition to investing in future industry trends, the Israeli government also takes on half of the venture capital risks.

It is worth mentioning that Israel is looking for investment from Taiwan because of our hardware and advanced manufacturing technology that other countries do not have. This is very important in quantum computing. Although Israel has sufficient funding, the country still welcomes Taiwania Capital's investment and hopes to connect with Taiwan's impressive industry chain through Taiwania Capital for greater success in the future.

5. This year, the international trade climate has been turbulent. With the China-US and Japan-South Korea trade wars, how should Taiwan seize the opportunities?

The China-US trade war is also a technology war. In fact, it is

an IP (intellectual property) war. Taiwan is a legal state and we value intellectual property, so does the United States. Although the Chinese market is huge, if they do not uphold intellectual property and open the market, it will be a chance for Taiwan to come into the picture.

We see that China has completely withdrawn its funds from Silicon Valley in the second half of 2018. The United States forbids China from investing in key technologies unless the market is open and both countries respect intellectual property. Moreover, a few cutting-edge technologies from the United States cannot go to China; for example, artificial intelligence and biomedicine are shut out of the market. This is a good opportunity for Taiwan to invest, start a business or even to establish strategic partnerships. We need to make the most of the changes in the industry.

Many top universities in the United States are also rejecting Chinese funds. Stanford and Berkeley are not accepting Chinese students as well. This is also a good opportunity for Taiwanese companies and research centers. We can make up for this void. This year, Taiwania Capital has organized a delegation to visit the laboratories of several top universities in the United States. The delegation introduced advanced technologies to these VP-level entrepreneurs and built relationships that can open up investment opportunities.

6. Have you ever met an impressive startup team or talent while investing?

We have invested in a domestic environmental gas detection company called Tricorntech. This company takes an incredible amount of time to produce top-notch products. In fact, no one in the country dares to invest because this is a long-term investment. You will not make a lot of money after just one year. It takes at least three to five years or more.

Tricorntech made it into TSMC's most advanced manufacturing process. Since harmful impurities in the air affect the manufacturing process and yield, the air quality needs to be monitored constantly. Tricorntech's products can also be used for regular surveillance. Taiwania Capital has helped them to find an experimental field in Kaohsiung industrial park for collecting data. Later on, Tricorntech published this data in international journals. The company also worked with the California government to stipulate air quality standards. I believe Tricorntech currently makes the world's best air quality monitoring products, and when improved, Tricorntech will become the industry leader.

7. Investments from well-known ventures reflect future technology trends. For example, Taiwania Capital and Bosch ventures are the lead investors in 3D holographic technology in the US. What other investments are worth mentioning in recent years?

We are beginning to invest more and more in new drugs. The first company we invested in was Frequency Therapeutics, which works on hearing restoration through cell regeneration. This technology comes from Harvard and they're about to be listed on the NASDAQ. This investment shows Taiwania Capital's mission to invest in startups. We hope that all the new technologies we have invested in can be linked to and even implemented in Taiwan's industry. Technologies will be introduced to Taiwan through investments in new biotech drugs. Clinical trials can also be carried out in Taiwan. Taiwan can then nurture its drug manufacturing skills and become the hub through which European and American giants break into the Asian market.

Lastly, big data and cloud centers have increased the demand for data storage. The storage must be large, the computing must be powerful, the volume must be smaller, and dissipate heat. We are keeping an eye out for new technologies that can overcome these challenges. 🔋
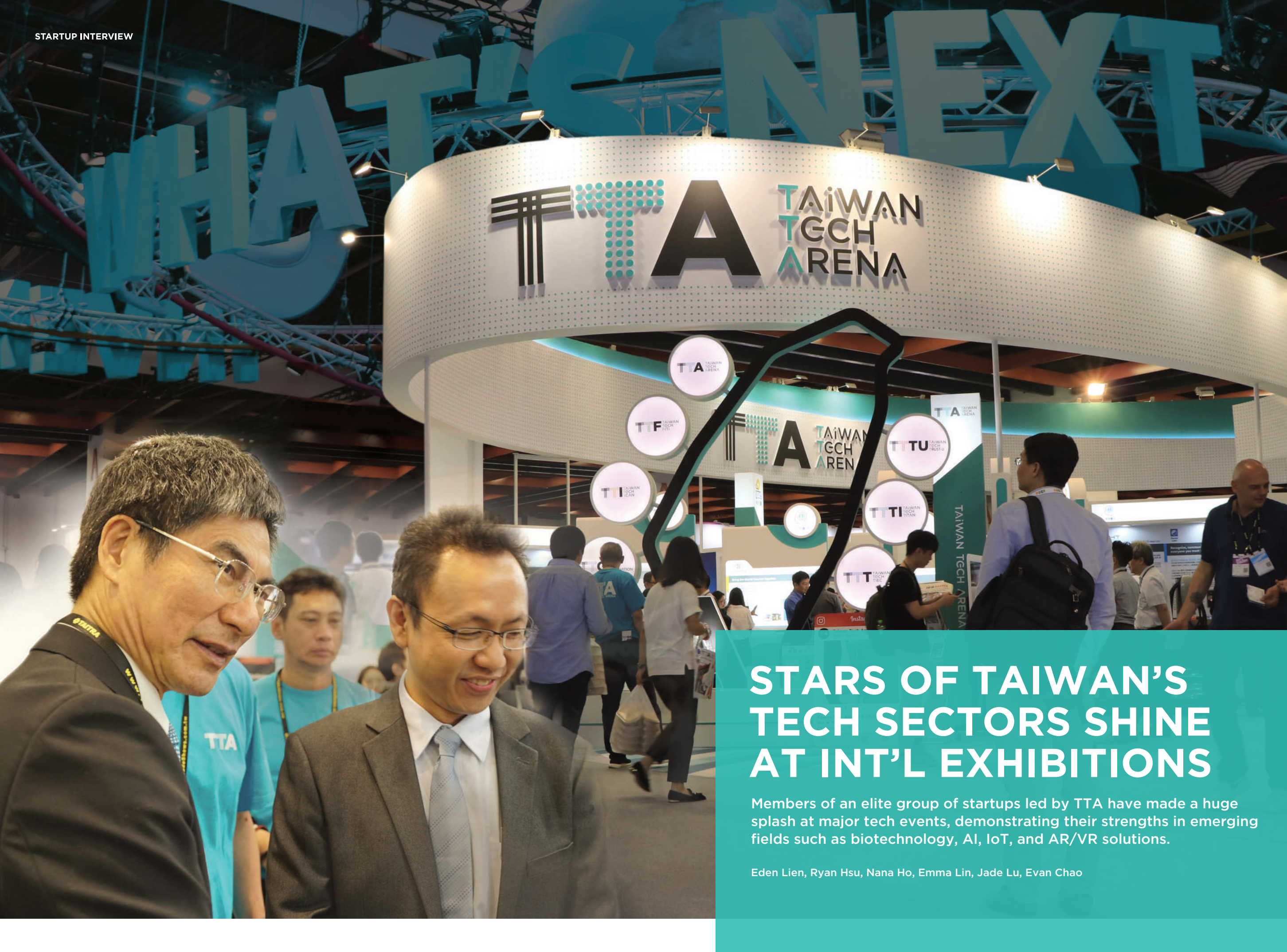
STARS OF TAIWAN'S TECH SECTORS SHINE AT INT'L EXHIBITIONS

Members of an elite group of startups led by TTA have made a huge splash at major tech events, demonstrating their strengths in emerging fields such as biotechnology, AI, IoT, and AR/VR solutions.

Eden Lien, Ryan Hsu, Nana Ho, Emma Lin, Jade Lu, Evan Chao

MAKING DIAGNOSIS OF DEPRESSION MORE OBJECTIVE

HNC's system for Stress EEG Assessment can help investigate the biological basis of depressive disorders and improve the psychiatrist-patient relationship

Psychiatric disorders remain an unfamiliar and often misunderstood topic for many people. On the other hand, mental health issues have never been this close to us on account of increasing social and environmental stresses. According to the latest statistics from WHO, nearly 300 million of the global population are experiencing some form of depression, and almost half of them have never received treatment. Besides inaccurate diagnosis, the shortage of mental health professionals in many parts of the world, as well as the associated stigma that surrounds mental illnesses, have also prevented people struggling with depression from getting psychiatric treatment. However, these factors can be further distilled down to one fundamental issue, the lack of a valid instrument to assist in the screening and diagnosis of depression.

Improving Doctor-Patient Relations by Removing Common Stereotypes

The current method of screening depression is through clinical observation of signs and symptoms followed by verification of the diagnosis using the criteria listed under the DSM-5. Symptom rating scales in the form of patient questionnaires and structured interviews are often used to assist the DSM-based diagnosis. A major critique of the current method is that the entire process is highly subjective and provides no real data for corroboration. Hence, there are many cases where patients or their attendants doubt the results of the diagnosis and instead dismiss depression simply as an effect of stress or a personality trait. At the same time, quite a lot of people who suffer from symptoms of depression are unaware of their condition. It does not even occur to them that they should seek help from professionals. In sum, these two factors have also reduced the number of patients that are willing to accept treatment to a tiny fraction.

While most people readily attribute depression to psychological causes, Yi-Hung Liu, co-founder of HippoScreen Neurotech Corp. (HNC), explains that it is a physiological disease. More specifically, depression is a biological disorder of the brain. It is a medical condition akin to high blood pressure. Liu believes that patients with symptoms of depression will be more receptive to treatments if they are presented with data-driven evidence for the diagnosis. Thus, HNC has been working on a system for Stress EEG Assessment (SEA) to help investigate the biological basis of depressive orders and facilitate better communication between psychiatrists and their patients. Liu is also a leading researcher at the National Taipei University of Technology, currently serving as both an Associate Professor under the Department of Mechanical Engineering and the Vice Dean of the Research and Development Office.

HNC's System for Rapid Collection of EEG Data Targets Hospitals and Enterprises

HNC's SEA system is a fast and simple method for collecting and analyzing EEG data (or brainwave recordings). The patient that undergoes this procedure first fills out the standard PHQ9 questionnaire and then wears a set of scalp electrodes on their head to record EEG data. The system's AI model then analyzes the data and provides diagnostic information within two minutes. This entire procedure, which includes preparation of the equipment and completion of the PHQ9 questionnaire, only takes 15 to 20 minutes. With this short amount of time, a psychiatrist will be able to obtain test results with an accuracy rate of over 80% and can be used as objective information when making a comprehensive diagnosis of a patient's condition.

The machine-learning algorithm that is central to the AI model of the SEA system currently contains data sets from 90 EEG studies. HNC is also collaborating with psychiatric divisions from the National Taiwan University (NTU) Hospital, the Taipei Veteran General Hospital, and the Chang Gung Memorial Hospital. The company plans to incorporate at least 300 case studies from these three major medical centers into the AI model, thereby further raising the system's overall accuracy.

While similar research on the EEG-based method for diagnosing psychiatric disorders is being undertaken in other countries, no institution or company in Taiwan or abroad has begun the clinical testing and commercialization of a product like the SEA system. Going forward, HNC plans to establish a B2B business model where hospitals and clinics will lease the SEA system. The company's mid-term goal is to set up its own clinics staffed by certified psychiatrists and counselors to provide comprehensive treatment solutions that encompass both medication and cognitive behavioral therapy. As for its long-term vision, HNC wants to take on enterprises as clients, offering them solutions for monitoring and improving the mental health of their employees.

Getting FDA Approval Will Be Taiwan's First Step Toward Precision Psychiatry

Since 2013, Professor Liu has devoted himself to research involving the application of EEG in the diagnosis and treatment of depressive disorders. During the course of his work, Liu published several joint studies with distinguished institutions such as the NTU Hospital and Harvard Medical School. To realize years of research, HNC is constantly seeking opportunities to collaborate with companies from other industries that show genuine interest in investing in the area of smart medicine.

Taiwan Tech Arena (TTA) has contributed enormously to HNC's establishment. Daniel Weng, CTO of HNC, points out that TTA has helped raised around US$ 33,000 for the construction of the SEA system prototype. Besides financial backing, TTA also provides other forms of support such as sponsorship for attending major industry exhibitions, introductions of potential business partners or investors, etc. According to Weng, the industry experts that TTA employs to help startups had given valuable advice that later resulted in further optimization of the SEA system. Following the suggestions, HNC has simplified the UI, made data easier to comprehend, and improved the overall appearance of the hardware. In the process of making these design changes, HNC came in contact with Compal and subsequently entered into ODM cooperation. From the view of HNC, TTA in many respects is responsible for forming the crucial connection that allows their technology to move from the laboratory to the industry.

HNC's SEA system is scheduled for trial operation in the second half of 2020 and then a market entry in the first half of 2021. The company intends to eventually apply its technology to the diagnosis of other mental disorders and even neurodegenerative diseases. For instance, the SEA system may one day assist in the verification of the early onset of Alzheimer's disease in elderly patients who are suffering from mild cognitive impairment. It may also be used to screen for ADHD in children and adolescents. While HNC's research has opened up various potential applications for the EEG-based diagnostic method, the company's immediate objective is to get its entire technology solution including both hardware and software approved by the US Food and Drug Administration (FDA).

Last year, Professor Liu was invited by the Taiwanese Society of Psychiatry to give a presentation on his company's technology at the organization's annual convention. According to Liu, the presentation was very well received by the attendees, and since then he has gotten many follow-up inquiries from mental health professionals working around the island. Some doctors have even described the SEA system as an example of "precision psychiatry." Besides Taiwan's psychiatric community, foreign academics and companies that came across HNC's solution at industry events have also expressed strong interest. Nevertheless, Liu has stated that his company hopes to make Taiwan its home base before expanding its presence globally.

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PURIBLOOD MARCHING INTO GLOBAL MARKET

The company's FDA-approved leukocyte reduction filter hits the US$ 1 billion blood transfusion medical device market

Blood transfusion can be considered a form of organ transplant. It can sustain the life of the recipient, but there are many risks. Most of the adverse reactions to blood transfusion are related to the infusion of allogeneic white blood cells. Therefore, in recent years, the global medical community has begun removing or reducing white blood cells from blood components. This market exceeds US$ 1 billion a year. But due to its high technical threshold, several major European and American companies have long dominated it.

The High Efficiency Anti-coagulation Leukocyte Reduction Filter Developed by PuriBlood

The Taiwanese medical startup PuriBlood Medical has been toiling for years, breaking through technical limitations and developing a series of "anti-coagulation Leukocyte Reduction Filter" products. These products are faster and more precise at removing white blood cells than existing filters on the market. They have also received FDA market approval at the end of

2018 and are about to enter the blood transfusion market.

PuriBlood was founded by Dr. Yung Chang, the director of the CYCU Research and Development Center for Membrane Technology, and has received guidance from the MOST germination program. Its leukocyte filter uses selective cell adhesion that captures white blood cells with polySBMA. In short, it means to "separate the positive and negative charges of SBMA, control its charge bias, and use the specific affinity generated by hydro-electrostatic field to allow adhesion of white blood cells and red blood cells to pass through." Dr. Chang stressed that the key is how to precisely capture white blood cells: "There is around one white blood cell for every thousand red blood cells in our blood. That is why the screening rate must be extremely high." According to clinical trials, PuriBlood's leukocyte filter has a 99.99% reduction effect.

Filtration duration is also a competitive advantage of PuriBlood's products. In the past, the United States was the best at this,

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"PuriBlood's leukocyte reduction filter only requires half the filtration time of existing products and has a 99.99% reduction effect."

taking 15 to 20 minutes to finish filtering one bag of blood. But clinical trials show that PuriBlood's leukocyte reduction filter only takes half the filtration time of existing products on the market. Compared to other companies, PuriBlood's leukocyte reduction filter can process the same amount of blood in a short period of time. The product is also unaffected by temperature and is applicable in any non-glaciated region.

The Importance of Leukocyte Reduction

Approximately 100 million people need a blood transfusion across the globe each year, making safety a great concern. Most of the adverse reactions to a blood transfusion are related to the infusion of allogeneic white blood cells. White blood cells are key immune cells in the human body that attack foreign substances, including allogeneic white blood cells. In general, the number of white blood cells in the recipient is higher than allogeneic white blood cells. Theoretically, no problems should arise if the foreign white blood cells are completely removed from the body, but there will still be side effects. For example, almost every recipient will have a fever due to the febrile nonhemolytic transfusion reaction. For recipients with very weak resistance, like cancer patients undergoing chemotherapy, the infused foreign white blood cells may be higher in number or more aggressive than their own, resulting in alloimmunization. In severe cases, it may even lead to death.

Another problem is that white blood cells carry viruses that can infect the recipient, combined with a very long incubation period. Therefore, reducing white blood cells before blood transfusion can also prevent long-term chronic diseases. Side effects due to allogeneic white blood cells after transfusion include transfusion-related acute lung injury, platelet refractoriness, increased risk of bacterial infection after surgery, and viral infections such as CMV, HIV, and EBV.

Why have many countries implemented leukocyte reduction? The goal is to reduce medical costs after transfusion. Dr. Chang pointed out that this is the main reason why many advanced countries have passed relevant laws and regulations. "Medical costs far exceed complete leukocyte reduction before every blood transfusion in the nation." At present, around 28 countries including the United Kingdom, Germany, France, parts of the United States, the United Arab Emirates, Canada, and Japan have legislated complete leukocyte reduction as a necessary procedure for blood transfusion.

Currently, only specific diseases undergo leukocyte reduction in Taiwan. Around 800 thousand of the 2 million blood transfusions per year undergo pre-transfusion leukocyte reduction. To implement complete leukocyte reduction, it will cost around US$ 10 to 20 million a year. But without leukocyte reduction, the medical costs for subsequent disease management will be around US$ 100 to 200 million. This is a huge burden for both the health care system and the individual. Therefore, the purpose of developing leukocyte reduction products is for preventive medicine, which is also one of the main missions of the Taiwan Blood Services Foundation.

The Blue Ocean Market Conditions and the Next Step of PuriBlood

The global market demand for leukocyte reduction filters is around 5,000 to 6,000 sets per year. There are three major competitors in the global market. The largest company is Germany's Fresenius, which has a turnover of US$ 33 billion a year and ranks among the Fortune 300 companies. The Leukocyte reduction filter is one of the mainstream products, with an annual market share of almost 20 million sets.

The second largest is the U.S. medical giant Haemonetics. In 2012, it purchased a leukocyte reduction technique from Pall, another leader in medical devices, for US$ 5 billion and gained access to the global market. Currently, Haemonetics has a global market share of 10 million sets. The third is a Japanese company, but its technique has not progressed in recent years.

Luke Chen, general manager of PuriBlood, said he hopes that after the new generation of high-performance leukocyte reduction products are launched, they will win over the market with superior user experience, high-quality filtration, and reasonable prices. PuriBlood aims to become the fourth-largest company in the world. Currently, PuriBlood has established a complete blood laboratory and factory that produces filters. The factory has an annual capacity of 1.2 million and 10,000 test orders from one of the major blood banks in the U.S.. In addition to leukocyte reduction filters, PuriBlood is also actively investing in cutting-edge product development to create next generation products that can transform blood preparation based on a comprehensive collection of evidence. 🔲

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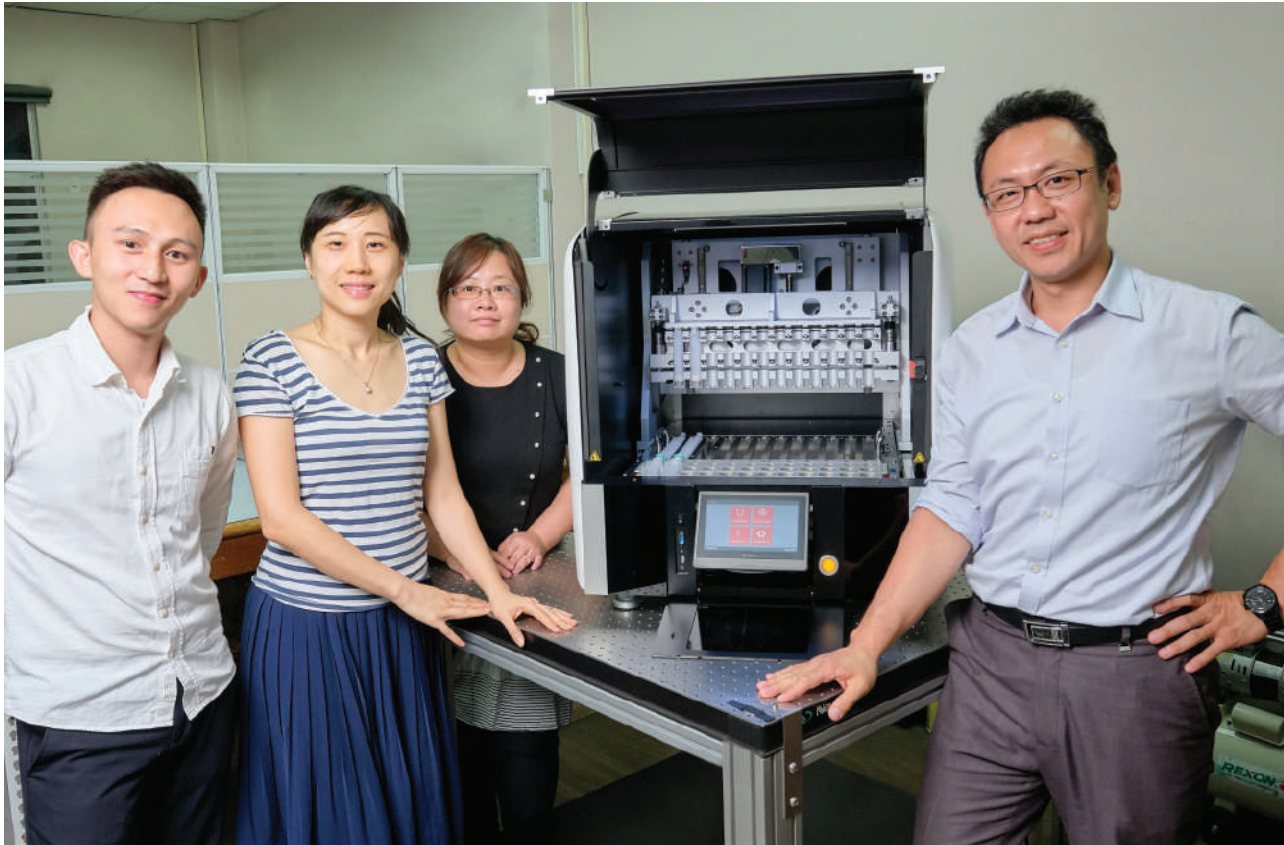
INCREASING TUMOR DNA EXTRACTION YIELD

CatchGene has developed "iCATCHER," which applies a unique approach to extract target DNA accurately

Liquid biopsy, an emerging technology for cancer diagnosis in recent years, features many advantages that traditional surgical biopsy does not have. In order to extract Circulating Tumor DNA (ctDNA), of which the amount remains very small in blood, we need a new and accurate DNA extraction instrument. CatchGene, a startup based in Taiwan, has developed an extraction instruments called "iCATCHER", which applies a unique approach to extract target DNA accurately.

Initiate Innovation by Replacing Tissue Biopsy with Liquid Biopsy

Circulating Cell Free DNA (ccfDNA) refers to DNA outside the cell and without protection from the cell. All cells in the body release ccfDNA into the blood after necrosis and cancer cells are no exception. Necrosis happens in case of the cells' abnormal growth, and DNA is released to the peripheral circulating blood after that, which is called Circulating Tumor DNA (ctDNA). Under normal conditions, these free substances are cleared

by macrophages, but when the cells multiply faster than the clearance rate, tumors cells may have an opportunity to remain free in circulating blood. This is the scenario where a minimally invasive liquid biopsy can be used.

Currently, a biopsy is the most direct way to test for cancer. Doctors find out whether there are cancer cells after taking tissue samples and observing the samples using a microscope. However, tissue biopsy has three major drawbacks: biopsy requires an operation; some organs such as brain, lung, and liver are difficult to access for sample taking; and it is difficult to take samples repeatedly, as the operation involves inherent risks. Therefore, liquid biopsy, one of the non-invasive tumor test methods emerging recently, can assist in early diagnosis and post-operative tracking of cancer based on the above-mentioned characteristics of ctDNA, opening up a new market sector.

Compared with biopsy, liquid biopsy has two major advantages. First, samples are taken from body fluid such as blood and urine,

"iCATCHER can perform liquid biopsy and extraction of circulating free nucleic acid, becoming a new method for precision medicine."

thus making the process less invasive. Second, it is convenient to track the results of drug treatment, and the doctors can find out whether cancer cells have been controlled once blood or urine is collected for testing.

Liquid Biopsy Is Extremely Difficult, so Key Techniques Are Applied to Capture Circulating Free Nucleic Acids

However, capturing circulating free nucleic acids has a major obstacle - the amount of free nucleic acid in the blood is very small. The amount of ccfDNA in 1cc blood is only around 1-20 ng, one ten thousandths of genetic DNA (gDNA); the length of ccfDNA is about 150-200 bp, only one-millionth of that of gDNA. Therefore, we need a new extraction technology to effectively capture these tiny nucleic acids with very small amounts.

There are four major steps in molecular testing: sampling, extraction, detection, and analysis. In the past, most emphasis was placed on cancer molecular detection. However, CatchGene, a startup founded in 2016, targets extraction. What key technologies does the team have to break into this market? Te-Cheng Li, the general manager of CatchGene, said that he suddenly came up with a solution to the key problem one night

and immediately bounced out of bed to make a note. Since then, he has embarked on the road to entrepreneurship.

First of all, most extraction instruments available in the market target gDNA, which has a larger amount in blood, rather than ctDNA. Secondly, the sample size taken by extraction instruments is only about 200 to 400 ml at a time (up to 1000 ml), which is not enough for testing ctDNA. If ctDNA is not found in the 200 ml sample, the worry-free patient returns home possibly missing the earliest opportunity for cancer treatment, because ctDNA is missed out due to the small amount of sample, which leads to a "false negative" test result.

To capture circulating free nucleic acids, the sample should be at least 4 cc (4,000 µl). In other words, new technology must consider both purity and amount of extraction.

The extraction instrument iCATCHER developed by CatchGene differs from traditional extraction techniques at this point. Traditional technology works like "fishing with a rod", using a magnetic bead with a coating for catching double-helical DNA. The bead is put into a liquid sample to catch the target DNA. iCATCHER is like "fishing with a net", considering that the amount of circulation free DNA is very small. Faced with such a small amount, traditional technology may not have valid results, so only using a "net" can increase the chance of catching circulation free DNA.

As liquid biopsy technology becomes more and more precise, it will become easier for organs that are difficult to access or screening methods that people normally tend to avoid (such as stool analysis and colonoscopy for colorectal cancer screening). Only a blood sample can solve the problem.

Te-Cheng pointed out that iCATCHER's target audience is quite clear, including cancer research institutions, private genetic testing companies and next-generation sequencing companies. At present, iCATCHER has obtained EMC and SAFETY certifications. As for global expansion, the company has successfully entered markets in Europe, Germany, the Czech Republic and Poland, and will next target Asia to accumulate enough reputation and credit, hoping to eventually explore the US market that has the highest barrier of entry. 🔝

iCATCHER can perform liquid biopsy and extraction of circulating free nucleic acid. The maximum sample volume is 4,000µl of serum and the minimum elution volume is 30µl. It can obtain circulating free nucleic acid with high concentration and purity, becoming a new method for precision medicine.

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CELL THERAPY TAKES A BIG LEAP FORWARD

The performance of DuoGenic StemCells' high-performance stem cell media is twice as effective as that of other media on the market

Driven by the development of biotechnology, modern healthcare has evolved towards precision medicine, gene therapy, and cell therapy. Among these applications, cell therapy has been recognized as a highly potential therapeutic approach in treating neurodegenerative diseases and cancers, as well as repairing human organs. Stem cell research plays a critical role in the development of cell therapy. However, the difficulty in stem cell culture has brought about many clinical practice challenges.

Aiming at Enhancing Efficiency for Academic Research in the Universities

To facilitate experimentation, Dr. Hong-Lin Su, a professor at the National Chung Hsing University, and his team started to develop new cell culture media. In March 2018, they formed a company named DuoGenic StemCells through technology transfer. Within six months, the two stem cell media they developed grabbed the market's attention. Their cell media are expected to lead cell therapy into a brighter future.

A former student of Dr. Su and the current CEO of DuoGenic StemCells, Chih-Yao Lin says cell therapy is not merely a slogan for people like them, who have been devoted to stem cell research. Cell therapy is aimed to treat diseases that can't be cured with medication such as Parkinson's disease, Alzheimer's disease, and other neurodegenerative diseases, through the application of innovative technology. Cell therapy begins with cell culture to produce a large number of high-quality stem cells for experimental use and clinical applications, high-quality culture media and technology are essential.

The Key Formula in the Stem Cell Culture Media

Located in a quiet alley in Taichung, home to Taiwan's precision machinery industry, the plain-looking building of DuoGenic StemCells' plant accommodates an ISO 14644-1 Class 3 cleanroom that produces more than 1,000 bottles of stem cell culture media per day. The company can produce two kinds of culture media, one is the PLUTO ESC/iPSC cell media and the

"These two culture media support 3D suspension, and the performance is twice as high as that of other media on the market."

other is the AllPhase MSC cell media.

Different kinds of stem cells are generated in different ways and have various features and functions. For example, ESCs (Embryonic stem cell) can differentiate into neural cells, marrow cells, and pancreatic cells which can then be used to replace dying or dysfunctional cells inside patients.

iPSCs (Induced pluripotent stem cell) are a type of pluripotent stem cells (embryonic-like) that can be generated directly from adult cells. iPSCs, which are genetically matched to a particular patient, are used to generate tissue or organs outside the human body. The tissue or organs are then transplanted back into the patient. Theoretically, this method can reduce rejection risk and thus cure diseases caused by damaged cells.

MSCs (Mesenchymal Stem Cell) exist in bone mallow or umbilical cord tissue and can reproduce themselves while differentiating into skeletal cells, neuronal cells, fat, and even liver cells.

Due to the large variety of stem cells and applications, the components of culture media vary by the type of stem cells. It took the team a lot of tests and effort to find the right mixture of proteins. Compared to other media on the market, that requires the use of fetal bovine serum, the xeno-free media developed by the team is more ideal for future clinical practice.

Test results show the performance of these two culture media is twice as high as that of other media on the market. Also, these two culture media support 3D suspension, culture that not only addresses the need for industrializing and automating cell manufacturing, but also makes stem cell production quicker and safer.

Targeting B2B Clinical Practice Market through International Certification

The stem cell market consists of four segments: culture media, medium materials, instruments, and cell lines. Culture media are the largest segment with a market value of US$ 4.6 billion in 2018 and a CAGR of 6.9%. According to Lin, culture media are mainly used for academic research; however, due to fierce market competition and price-sensitive customers, vendors need to put in a lot of marketing effort. Culture media for clinical trials must meet higher standards and have higher requirements for product specifications and certifications. Customers in this

The PLUTO ESC/iPSC culture media and the AllPhase MSC culture media. Both use the mixture of proteins developed in house and contain no fetal bovine serum. The ability of 3D suspension culture makes these two culture media twice as fast as other media.

market segment tend to be more loyal and buy more of the product, thus bringing more profits to the vendors. DuoGenic StemCells' culture media not only has performance and cost advantages, but they can also meet future clinical needs. The company plans to obtain the ISO 13485 Certification Quality Management Systems for Medical Devices this year and will initially target Taiwan's B2B medical market.

The new regulations governing the management of specific medical examination techniques and devices provide a significant boost to cell therapy and stem cell research. Apart from cutting-edge medical technology, many biotech companies have been engaged in cell therapy. Lin believes DuoGenic StemCells' culture media will become a significant driving force for Taiwan's biotech companies. Through the collaboration between DuoGenic StemCells and biotech companies, cell therapy in Taiwan is going to thrive.

DuoGenic StemCells is expected to raise another US$ 1 million by late 2019 and increase the number of employees to 11 people. Besides continuing to develop stem cell culture media for different clinical practice, the company is also seeking to work with large channel players to tap into the Japanese, Chinese, and US markets. To this end, they have submitted a DMF (Drug Master File) to the FDA, in addition to the application for ISO 13485 certification. 🏛

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READING EMOTIONAL STATES THROUGH FACE DETECTION

From the driver's seat to the conference table, FaceHeart can analyze human's emotional states by using image-based physiological signals

FaceHeart can read your heart rate and blood pressure by observing your "complexion." It can further detect your level of fatigue, anxiety and emotional fluctuations while simplifying the signals making facial feature data unnecessary, thereby securing the user's personal information. This technology is not from a well-known multinational tech company, but a Taiwanese startup, FaceHeart. Professor Bing-Fei Wu of NCTU and his research students spent five years developing the "Health Management System Using Image-Based Physiological Signals" technology. The company was founded in 2018 and received investment from MediaTek in less than a year. FaceHeart's business valuation has now reached US$ 16.4 million.

Shine Huang, general manager of FaceHeart, said the key to this technology is detecting changes in the color of facial capillaries. In the past, many companies have studied related technologies but could not make a breakthrough. They could not cope with the noise from facial movements and changes in illumination. Factors like white light, yellow light, sunglasses, and

heavy makeup that can cause misreading must also be avoided. However, within five years, Professor Wu and his research students have overcome the challenges one by one before going on to commercialize the technology.

Currently, in physiological monitoring, FaceHeart's technology can detect the heart rate in just 6 seconds. For movements, it can detect the user drinking water, wearing glasses, wearing a hat, etc. How does this heart rate detection compare with other contact medical devices? Huang said that when the user is at rest, the error of the heartbeat detected every minute is plus or minus three beats. "As for the accuracy of heartbeat and rhythm, I believe that it is acceptable as long as the pattern is correct. You can tell whether the heart rate is speeding up or slowing down by comparing with the normal rate," Huang explained.

It is worth mentioning that this product, both software and hardware, is made in Taiwan. Moreover, after completing the AI matrix computation, the research team simplified the algorithm

so it can be inserted into embedded systems. This means that detection, analysis and data transfer can all be performed by the product. There is no need to upload to the cloud, which reduces the risk of data leakage.

"The hardware is constant, but the software's auto-save function can be turned on or off according to the regulations and personal data protection act in each region. The product fully secures personal data, so even if it is sold to Europe and the United States, the data would not be leaked," said Huang when discussing advantages of the product.

A Wide Range of Applications

The product has a wide range of applications, including smart healthcare, smart transportation, smart finance, smart security, etc. In smart transportation, the product can monitor driver fatigue and instantly alert the driver so as to reduce traffic accidents and ensure safe driving.

In the past, a recurring issue in fleet management is a lack of evidence for a known violation. FaceHeart's product allows fleet to manage drivers and dispatch schedules. "Some Chinese cities stipulate that large trucks must install a driver monitor system (DMS). Europe has also stipulated that in 2020, vehicles must install DMS. This is what I am advocating." Huang is very optimistic about the future of smart transportation applications.

In addition, FaceHeart is diving into the finance industry. For example, when the member of a scam group is going to the ATM, and the camera detects the person's abnormal anxiety

The key to this technology is detecting changes in the color of facial capillaries; it only takes 6 seconds to detect a heart rate.

level, it can alert staff immediately. Banks have a coping mechanism (KYC, know your customer) to block dummy accounts from being opened. With FaceHeart's technology, the entire blocking system can be reinforced.

FaceHeart's product is also useful at the conference table. "For example, many experienced negotiators remain calm and collected during negotiation, and they do not show facial expressions. However, when a certain subject is brought up, their heart rates will change. This is not something that comes with practice. With FaceHeart's technology, I can tell when you are moved by something I said," Huang explained.

A Team of Hidden Talents

As for FaceHeart's initial goal, Huang emphasized that everyone had this conviction: "not to make money, but to achieve two dreams." The first is from the view of the continuously aging society in Taiwan. There is an increasing shortage of medical staff. Artificial intelligence can help reduce the workload of the staff. "Without the help of technology, one nurse can only tend to ten patients. But with it, nurses can quickly determine the patient's illness and one nurse can tend to 100 patients." The medical industry is where FaceHeart most wants to enter.

The second is to build a new startup ecology in Taiwan. Huang lamented that twenty years ago, science parks thrived. But now, people only know about TSMC and MediaTek. Many high-achieving students only go to these two companies after graduating. He believes there should be more industry-academia collaborations to make products using great technologies. Then, when the products generate profit in the market, it will be given back to the school, thus forming a healthy ecosystem.

Huang is a former research student of Prof. Wu. He worked at MediaTek for 18 years before joining FaceHeart. He is a veteran in the industry and also the man behind MediaTek's investment in FaceHeart. After joining, he has invited many others in the industry to join and make up for the team's shortcomings in business and marketing. This group of ambitious, skilled and experienced professionals will not only bring Taiwan's cutting-edge technology to the global platform but also establish a new paradigm of industry-academia collaboration.

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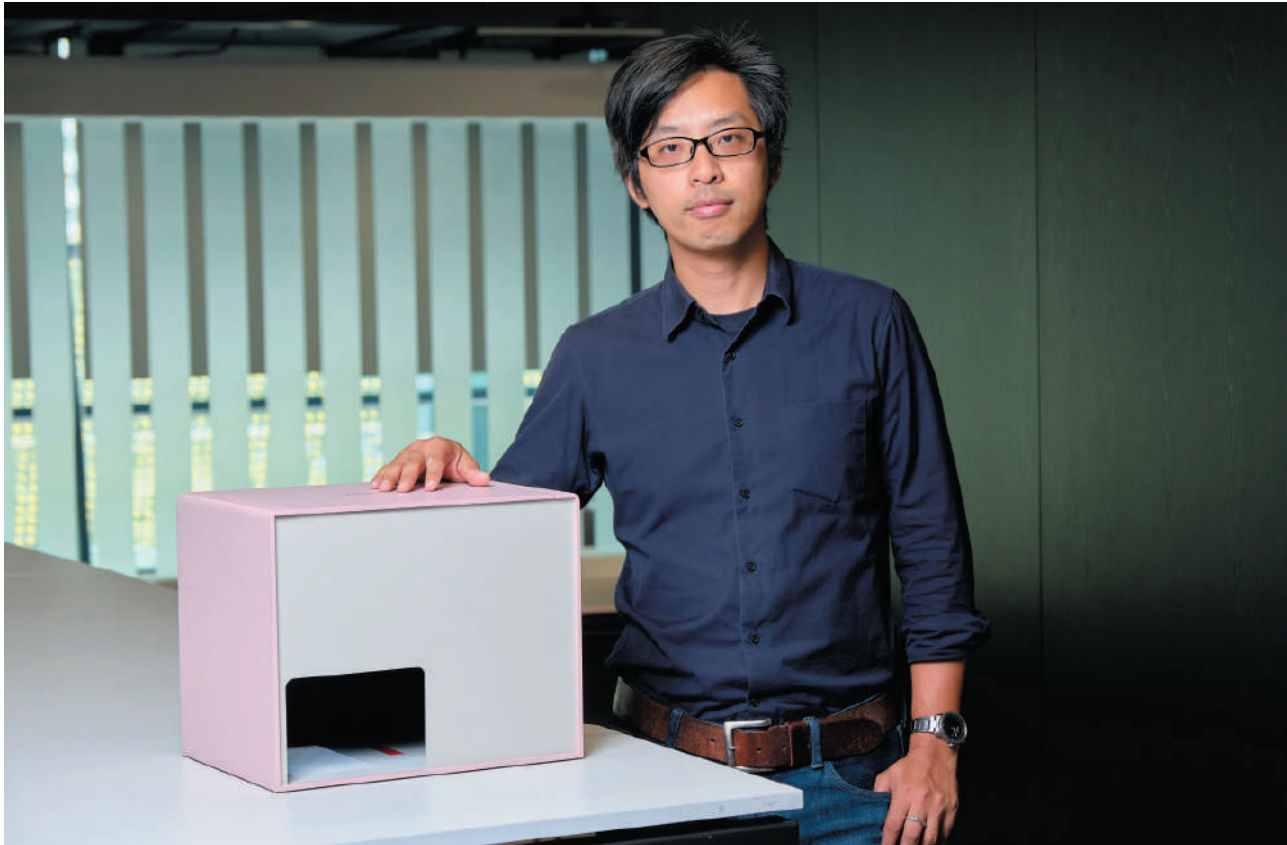
A NEW WAY TO DETECT EARLY STAGE PARKINSON'S DISEASE

Vibrasee uses a non-invasive method along with optical projection, image processing, and AI-driven data analysis to detect PD

Parkinson's Disease (PD), a progressive degenerative disorder of the brain, usually occurs in people aged between 50 and 60. Due to the degeneration and loss of substantia nigra in the brain, which causes a reduction in dopaminergic neurons, patients experience tremors, muscle stiffness, slow movements, and loss of balance. Currently, there is a medical consensus that PD is incurable. However, with the advancement of medical technology, we have gained insights into the causes and evolution of the disease. With early diagnosis and treatment, patients can have more medication choices, thus slowing down the progression of the disease.

Some neurodegenerative diseases also have similar syndromes. Therefore, doctors need to verify the diseases using MRI. As MRI scans are very costly, doctors usually wait until patients have more visible symptoms, thus missing the chance of early diagnosis. This is why the development of inspection equipment for PD has caught everyone's attention. Vibrasee, a micro-vibration detector developed by the

Rongseng Laboratories, uses a non-invasive method along with optical projection, image processing, and AI-driven data analysis technologies to detect PD from the current 80% to more than 90% in the next two years.

With the size of a paper box, Vibrasee contains a special optical camera to detect the micro-vibration on human skin and identify the vibration frequency. Kim Chang, the leader of the project and CEO of Rongseng Laboratories, says the vibration of human bodies is a low-frequency vibration, which has been classified as noise. Now the vibration can be separated from the noise .

Put simply, Vibrasee acts as a vibration amplifier which magnifies the variation of the x, y, and z axes using optical computing, thereby breaking down the low-frequency area into smaller segments to obtain data related to the vibration of the skin and body such as vibration mode, frequency, and shape. The data is analyzed by computers to show vibration at a different frequency that can help doctors in the diagnosis.

more than 10%
Chance of getting PD among 70-year-olds

US$ 30 billion
The neurodegenerative disease market

1 minute
Time required by quick screening testing

From Diagnosis to Medication

Chang has set a three-stage goal for Vibrasee. The ultimate goal is to extend the diagnostic window to 10-20 years from 1-2 years, hence improving the living quality of patients. "Patients with severe tremors mean the functionality of their brain neurons has recessed to 30%-40%. L-dopa is the only effective medicine, but patients will suffer more serious tremors after taking this medicine for five to 10 years. Without other medication choices, patients are left with DBS (Deep Brain Stimulation)," Chang says. If the disease can be detected before the functionality of brain neurons recesses to 40% (known as early diagnosis), patients will have more medication choices, thus slowing down the deterioration of the disease.

The medium-range goal is to help doctors diagnose more accurately with machine learning technology. One of the more unusual symptoms of PD is walking difficulty but without a tremor in the hand. Therefore, it is easy for doctors to misjudge the disease by eyes. The short-term goal is an assessment of patient condition and medication. Vibrasee can help doctors evaluate patients' tremors and adjust medications at any time. This is also the function the research team has achieved.

While Vibrasee can help doctors perform more accurate diagnosis, Chang says this detector targets at elderly care and medical institutions in the long term. There is a slight difference between elderly care and health check institutes. "While the detector currently focuses on PD, we find that we can evaluate the chance of being diagnosed with certain diseases by examining the way people put their hands into the detector, such as the difference between patients with cardiovascular diseases and those with PD." At this moment, the function that can be monetized is medication assessment. New functions have also been developed to provide medication suggestions for patients by scoring the level of their tremors and comparing the results with the medicines they take.

Advantages and Future Outlook

Vibrasee has two major competitors. One of them is GKC (Global Kinetics Corporation) from Australia whose wearable device can identify single-point vibration. "GKC's product requires a large amount of data to identify vibration. The problem is that the data may not come from a critical time point. Our device is free from this issue, as the patient has to put the entire hand into the

Vibrasee, a micro-vibration detector, uses a non-invasive method along with optical projection, image processing, and AI-driven data analysis technologies to detect PD. The accuracy of the detector is expected to increase to more than 90%, from 80%, in the following two years.

detector for optical photography. Even if the sample is the same, there will be a huge difference in the data acquired by both devices. This is Vibrasee's key competitive advantage.

The other major competitor is Medopad, a UK unicorn company that has formed partnerships with Tencent. This company's product examines the way people walk to analyze the chance of getting the disease. However, this method is time-consuming and the device is too bulky to carry around. Vibrasse, on the contrary, is fast and portable. Chang compares the research results of cranial nerve diseases to the Holy Grail for the medical industry. "Research breakthroughs in this field have been relatively few compared to other medical fields. Given the limited number of tools available to neurologists and the high cost of MRI equipment, patients usually have to wait for one to three months. As a result, cranial nerve disease treatment is expected to see significant growth." As the world population is aging more quickly than ever before and neurologic diseases occur in 15% to 20% of the senior population, affecting more and more people, medical equipment, medicines, and inspection equipment for such diseases will become more important.

Besides PD, the team also collects data for other diseases such as essential tremor, chorea, ADHD. "PD is our first goal. We believe our detector will be able to address all of the diseases mentioned above in the future," says Chang. 🖥

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A SHORTCUT TOWARDS THE IOV GOLD RUSH

3drens leads commercial vehicles with years of experience in software and hardware integration and data analysis

There are approximately 400,000 commercial vehicles on the streets of Taiwan every day, including buses, tourist rental vehicles, logistics vehicles, shared vehicles, government vehicles, etc. These vehicles are on the road for an extended amount of time, exceeding private cars. They have different purposes, the routes traveled vary greatly, the quality of drivers varies, and often require training, therefore, making vehicle management difficult for operators.

With years of experience in software and hardware integration and data analysis, the Taiwanese startup 3drens created the "Vehicle Intelligence Platform" that can quickly execute the Internet of Vehicles (IoV) and perform big data analysis through algorithmic models.

Through IoV, commercial vehicle operators can monitor vehicle status in real-time and collect and analyze the data. In addition to smart management, the data is a gold mine that can reduce operating costs and increase revenue.

Vehicle Data Is Valuable but Small and Medium-sized Enterprises Cannot Establish a System on Their Own

In recent years, the wealth contained within vehicle data has received considerable attention. The world's largest online transportation platform Uber and China's largest transportation platform DiDi Chuxing have long been conducting heat map analysis of driver smartphone GPS and user location to find the hottest request time and location for vehicle scheduling and floating rate calculation.

However, not every commercial vehicle operator has the ability to perform data analysis. For small and medium-sized commercial vehicle operators, the cost of developing an IoV system and data analysis algorithm is too high, making it nearly impossible to do. For that reason, the complete hardware, software and data analysis system of 3drens' "Vehicle Intelligence Platform" can be the fastest and most reliable IoV solution for small and medium-sized enterprises.

"The 'Vehicle Intelligence Platform' can execute the IoV, including driving route heat maps and route optimization for logistics vehicles."

Application Analysis of Vehicle Management and Business Optimization

The applications of the "Vehicle Intelligence Platform" in-vehicle management include dynamic management, use of parts management, and predictive maintenance. The applications in business optimization involves route optimization, vehicle dispatch efficiency optimization, driving route heat maps, and driver behavior analysis. For example, the platform can remind the operator which vehicle requires battery replacement, parts replacement, and maintenance according to vehicle mileage.

After receiving a request for goods, with dynamic management, logistics operators can send the nearest vehicle for pick up, and with route optimization, transfer the goods at the relay station to the vehicle closest to the destination.

The driving route heat map shows transport operators the locations requiring the most vehicles, which helps with taxi and YouBike dispatch. Also, using GPS tracking to establish geo-fencing, vehicles can be rented and returned within the geo-fencing range. Along with other data that ensures accurate vehicle status, operators can carry out the 24-hour "semi-unmanned rent and return hotspots" without sending personnel for inspection.

No matter the industry, as long as there is a demand for driver management, the driver's behavior can be analyzed through sudden braking and speed detection, which can then be used for driver improvement recommendations. The vehicle data collected is based on a GPS tracker and on-board diagnostics (OBD), which uses sensors including gyroscopes, temperature, and engine RPM. The data is sent to the cloud in real-time
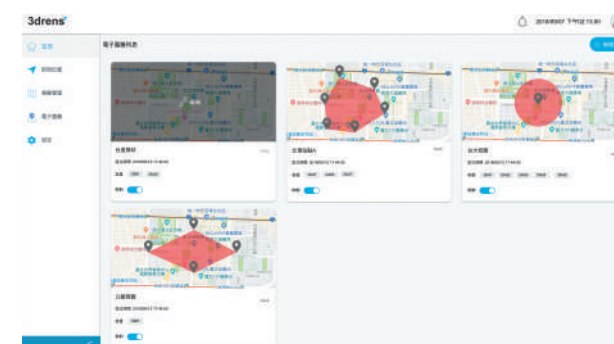
Using GPS tracking to establish geo-fencing allows efficient execution of the 24-hour "semi-unmanned vehicle rental and return system service."

through the LPWAN telecommunication network. It is the first IoV platform that incorporates LPWAN in Taiwan.

High Flexibility — An IoV Solution for All Commercial Vehicle Management

The Vehicle Intelligence Platform can be tailored to customer demands, including collecting additional data, providing different analysis modules, and changing data presentation formats. Besides, the platform is also highly flexible and can be integrated with the customer's existing enterprise resource planning (ERP). The ERP system that the customer already has can be easily upgraded to a smarter vehicle data analysis system.

In addition to the electric vehicle rental industry mentioned above, 3drens' customers include logistics transport operators. The collected data includes additional tire pressure monitoring, which is essential to the safety management of heavy-loaded vehicles. For application, route optimization analysis is also added to improve logistics distribution efficiency. Additionally, the vehicle utilization analysis can quickly check whether there is an imbalance between vehicle dispatch and idle time.

At present, 3drens has already finalized IoV orders for almost 1,500 vehicles. They have also been selected as the leading company for the "Project for Small and Medium Enterprises Expanding the New Southbound Markets" of the Small and Medium Enterprise Administration of the Ministry of Economic Affairs and will expand to the Malaysian market in 2019. 3drens has already signed three memorandums of understanding with Commute Solutions Group Pte Ltd, which provides bus sharing services in Singapore, local system integrators in Singapore, and Malaysian e-commerce logistics company, receiving an order over US$ 200,000. 3drens has also extended an invitation to the huge US vehicle rental industry at CES 2019 to explore the data gold mine together through 3drens' IoV.

Oeo Yu, the Co-founder and CEO of 3drens, said with full confidence, "Our goal is to become a top provider of IoT solutions. By leveraging Taiwan's hardware manufacturing advantages and with 3drens' software and hardware integration, we look forward to exporting to the international market."

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CREATING A GREEN & SMART AGRICULTURAL VALUE CHAIN

AgriTalk integrates biotechnology, IoT, big data analysis, and AI to develop a non-toxic agricultural disease and fertilizer regulation system

Starting from the "TRUST-U Project: Green and Smart Agricultural System," the team went on to found AgriTalk Tech Inc. Throughout the process, they set the bar for "entrepreneurship from academia" and also kick-started the momentum of translating agricultural technology to automated and smart agriculture. More importantly, with the cooperation of the government, industry and academia, the team has already created a non-toxic smart agricultural ecosystem and has solved the most current and fundamental agriculture problems in Taiwan, such as soil acidification, farm labor shortage, and even long-term care.

Dr. Wen-Liang Chen, an associate professor at NCTU College of Biological Science and Technology, together with his students, founded AgriTalk Tech Inc. It integrates biotechnology, IoT, big data analysis, and artificial intelligence to develop a non-toxic agricultural disease and fertilizer regulation system called the "AgriTalk Management Platform." Through big data analysis and AI learning of farmland environment data collected by

various sensors, AgriTalk has created the automated monitoring and management platform that can precisely regulate the six major factors: disease, pest, soil fertility, moisture/humidity, temperature, and light exposure.

Dr. Chen said the company structure is very different from common startups. From the beginning, the company was divided into four departments: operations, IT, biotechnology, and agriculture. The IT department is in charge of the R&D and maintenance of the AgriTalk Management Platform, sensors, IoT devices, and AI systems. The biotechnology department mainly conducts biotech research and farm testing of biological inhibitors, while the agricultural department specifically looks for farm experts. The operations department takes on the role of foreman and senior project manager and integrates all the other departments. Dr. Chen also said that because Taiwan's agriculture industry and the company's demo sites are mainly in the south-central region, the company headquarters will be set in Hsinchu in the future.

"AgriTalk can precisely regulate the six major factors: disease, pest, soil fertility, moisture/humidity, temperature, and light exposure."

Using Technology to Solve Agricultural Problems

AgriTalk's mission is to use technology to solve current agricultural problems in Taiwan. This mission resonates especially well with Dr. Chen, who comes from a family of farmers in Yunlin. When he was a child, he witnessed the horrifying scene where his father almost died from poisoning while spraying pesticide. This is why non-toxic agriculture became his life's pursuit.

Another common problem on farms is soil acidification caused by long-term pesticide and fertilizer abuse. As a result, soil fertility declines and crop yields continue to decrease. Dr. Chen said that long before the establishment of the company, its R&D team separated and developed biological pest inhibitors from 5,000 spider neurotoxins. They can kill specific pests but are harmless to humans and bees.

Furthermore, the most direct result of farm population migration and aging is labor shortage. Dr. Chen believes that encouraging young people to return home is the solution to this predicament. Taking Nanzhuang as an example, he mentioned the township mayor has been eagerly inviting AgriTalk to set up a local demo site. Since young people understand and identify with technology, it will naturally spark their interest in coming home.

In addition, AgriTalk's automated, non-toxic, and precise fertilization can reduce labor demand, maintain soil nutrients, and prevent loss of land productivity, which solves the soil acidification problem step by step. Dr. Chen mentioned that the most important thing is to attract investment from businesses and agricultural marketing channels. This is to build a more secure contractual business model for farmers, thereby opening connections up-stream, mid-stream, and downstream. Therefore, providing long-term profit for the entire village and even the agriculture industry. This will encourage more young people to come home, solving labor shortages and long-term care.

Dr. Yi-Bing Lin, an information-engineering expert and vice-chancellor of University System of Taiwan (UST), and Dr. Chen made the most of the interdisciplinary collaborative research and development during the "Trust-U Project." Dr. Chen quoted Dr. Lin as saying that regarding Taiwan's agricultural technology development, we should not only consider how to increase agricultural efficiency through technology but also examine social issues through the lens of agricultural technology. This includes youth returning home for employment, agricultural

technology education, and even providing solutions for long-term care in rural areas. This will no longer be just an agriculture-specific development. It is an opportunity for society as a whole and the industry to improve.

Presenting a Successful Contractual Business Model at Demo Sites

At present, AgriTalk has set up four demo sites around Taiwan, located at Wufeng (at an altitude of around 1,200 meters), Nanzhuang (at an altitude of around 600 meters), Baoshan and Qionglin area. At the demo sites, AgriTalk displays the benefits of its four key products: sensors, non-toxic agricultural disease regulation system, soil microbial and fertility forecasting system, and biological pest inhibitor. Also, to balance profitability and economic benefits, each demo site focuses on high-value cash crops like rhizome herbs. It is worth mentioning that the red turmeric on AgriTalk's demo sites is only grown for 297 days, but the curcumin can reach 5,000mg/100g, which is 3 to 5 times higher than regular turmeric.

AgriTalk's demo sites collect data from its management platform and sensors to establish a production history that complies with the Good Agriculture and Collection Practice (GACP) and is easy to trace, which ensures consistent safety and quality throughout the entire process from growing environment to raw material further processing.

In addition to its demo sites, AgriTalk develops flexible partnerships to promote its products. In other words, whether it is introducing total solutions, the use of a single product, or even AI-only services (even if using competing products), AgriTalk can do it all.

Dr. Chen said that AgriTalk is actively seeking strategic partnerships to achieve mighty goals and hopes to link all the companies, resources, products, technology, and solutions into a value chain. Moreover, AgriTalk has valuable experience in marketing non-toxic turmeric products to Vietnam, the United States, and Japan, as well as cooperating with the Armenian National Agrarian University. This shows that automated and smart agriculture has no borders and also provides the formula for success for Taiwan's products in the international market.

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SOLVING PAIN POINTS AND BRINGING IN REVENUE

OmniEyes uses AI image recognition to create an all-round traffic management system

Fleet management today faces many challenges. There are large amounts of vehicles on the street at the same time, covering hundreds of kilometers. Management centers must monitor driving information in real-time and take appropriate action for operations management to be truly carried out. The startup founded by professors from National Taiwan Universrity (NTU) has developed "OmniEyes – Next Generation Mobile Video Platform" that can fully collect and analyze live street views. It can increase fleet management efficiency and work with third parties through innovative application services.

As society and mobile technology progresses, fleet arrangement will also diversify, making fleet management improvements vital. Dr. Jun-Ting Chou, the CEO of OmniEyes and a professor at NTU's Department of Electrical Engineering, has studied several fleets since the team was founded a year ago. He observed three pain points in fleet management: "The first is fuel consumption, including idle management and path planning, since many taxi drivers do not shut off the engine. The second is

dangerous driving, which causes vehicle damage and personal injury. The third is fines for traffic violations." These three carry a large expense ratio in fleet management. Therefore, when profit growth is limited, many fleets hope to reduce operating expenses by using traffic management to solve the pain points.

At present, traffic management has become digitized and mostly relies on GPS and OBD2 (On-Board Diagnostics). GPS can record the route and OBD2 is similar to a traffic computer that records driving information, like how hard the driver steps on the gas pedal or brakes, and sends it to the traffic control center. However, Dr. Chou points out that these two tools do not allow the fleet to carry out active and verifiable management. He said, "Heavy braking may be due to the driver's poor driving habit, but also a vehicle dashing out all of a sudden."

OmniCam Makes Fleet Management Easier

How can you help fleets become more active? Dr. Chou

"OmniCam can capture street views in real-time, convert them into information, and send them to the cloud platform."

mentions that image collection and automatic identification technology must be introduced into the current traffic management system. OmniCam, developed by OmniEyes, is an AI image-based traffic management system that combines technologies such as edge computing, AI image recognition, and cloud computing. It captures street views in real-time, convert them into information, and send them to the cloud platform.

OmniCam is a software introduced into an OBU or traffic management system. Through local OBU identification results or images sent to the cloud for real-time analysis, the fleet can determine whether the driver has committed any of the dozen violations such as reverse parking, parking on a crosswalk, or illegal left turn. "For example, we have recently detected drivers who constantly go in the opposite direction and run red lights. When the traffic control center receives a warning and pulls up the footage, the driver cannot make any excuses." OmniCam can also detect the lane position and lane changing during driving and check for other problems through the images.

As for the technical advantages of OmniEyes, Dr. Chou points out that competitors cannot provide real-time recognition on the front-end and handle various real-time requirements. OmniEyes can adjust its computational model to fit different scenarios and can be used in dynamic and complex environments.

Dr. Chou has also shared the case studies of the technical advantages applied in the public sector. Since July of this year, the Taipei City Government has stipulated that passengers swipe their cards both when getting on and off the bus. However, the concern is that this will increase the time it takes to get on and off. So, the government requested OmniEyes to design a system that can calculate the time.

"It took us just two weeks to complete the design," Dr. Chou said proudly of this achievement. The solution proposed was very intuitive. The camera was pointed at the door and the software was trained to detect the door opening and closing. The camera's built-in timer started when the door opened and stopped when the door closed. The conclusion was that the total dwell time of the entire trip was increased by two minutes.

OmniLabel Increases Overall Fleet Revenue

In addition to fleet management, OmniEyes has developed another B2B product called OmniLabel. It can add markers to

the information collected by the fleet and share them with third parties, thereby increasing overall fleet revenue.

"Commercial fleets transport items from point A to B. The more items transported, the higher the revenue. To increase revenue, the fleet must be expanded. If the information collected by the fleet is shared with third parties and a data usage fee is charged, the fleet will experience organic growth," Dr. Chou explained.

OmniEyes has also reached out to these third parties and discovered instances where consultants were requested by customers to find a location with many pet shops, so the customer can open a pet shop nearby. They were also requested to open a dental clinic at a location without dentists within 500 meters. In addition, taxation departments were looking for vehicles that evaded taxes, police departments looking to seize stolen cars, vendors wanting to know the visitor traffic at intersections, and people looking for parking information or the queue status at popular stores. "In the past, yellow pages were used to look up information or a part-time employee was assigned to stand on the street with a stopwatch. But now, OmniLabel can identify the information on signs, the type of business, the number of stores, etc. It can manage all of these in real-time," said Dr. Chou.

Establishing an All-Round Ecosystem

At present, there are about 200 vehicles with OmniCam on the streets of Taipei, including 100 buses on the 6 lines of the Metropolitan Transport Corporation and 40 cabs from Taiwan Taxi. Dr. Chou revealed that OmniEyes would be able to work with a medium-sized fleet at the end of the year. By then, there will be 1,000 more vehicles equipped with OmniEyes.

"Omni-" is the root of the word omnipresent. As its name suggests, OmniEyes means omnipresent eyes and is also Dr. Chou's vision for the entire industry. The company has sold 200 units so far and targets 1,000 units by the end of the year, eyeing the 400,000 dash cam market of the country. Dr. Chou has gradually built an all-round ecosystem from which fleets and third parties can benefit as more application services are created, furthering the realization of a smart city. 🏛

ALLOWING EYES TO CONTROL THE AR/VR WORLD

Ganzin Technology's eye tracking module combines the virtual and real world, replacing the hand-operated user interface

There is an ideal user interface for every technology product. Only when human-computer interaction becomes intuitive and easy to operate can this product be a part of everyday life. "The computer's interface is a mouse. The smartphone's interface is predominantly a touchscreen. We believe the ideal interface for AR/VR products is our eyes," said Dr. Shao-Yi Chien, the founder of Ganzin Technology and professor at the NTU Graduate Institute of Electronics Engineering.

Dr. Chien started out committed to developing eye tracking technology with students from his "Media IC & System Lab." After the first six master's students graduated, they all decided to roll up their sleeves and start a business. Their goal was to create a comprehensive eye tracking solution that cultivates technology that might otherwise exist only in academic papers. Instead of joining a big company to become a million-dollar engineer, they chose to be "entrepreneurs" and start from scratch because they believe that in the future, the eyes will be the ultimate user interface in the integrated virtual and real world.

The Dilemma of Manual AR/VR Applications

Virtual reality (VR) and augmented reality (AR) are considered the next revolutionary products after computers and mobile phones that will completely change our lifestyles. As portrayed in many science fiction films, the user puts on a pair of AR glasses and it will show the desired information. Computer screens are no longer needed in offices; instead, virtual images will appear to float in mid-air. Walking down the street, the social media ratings of the store will pop up before the user's eyes. The user can browse to see the store's menu and promotional items, go to the next page, and even type in words.

Although tech giants such as Microsoft, Facebook, Google, Magic Leap, Sony, and HTC have invested in the development of VR/AR devices, the current user interface is still mainly hand-operated. If it is just an indoor game like chopping vegetables or fighting an enemy, then a remote control will suffice. But for fast and precise movements or outdoor settings, carrying

a remote control to wave around and click in the air is very impractical. This is one of the reasons why VR/AR has not been universalized. Therefore, VR/AR developers are all eagerly seeking new technologies to create non-manual user interfaces.

Eye Tracking Module — Beating Competitors with Its Own IC and Algorithm

To make the eyes the user interface, one must precisely track where the eye is looking, the point of focus, and which subtle actions represent the user's intention to select or click.

Ganzin Technology's first-generation product, the "Aurora" eye tracking module, can precisely track eye movement. More importantly, it has ultra-low power function and consumes only one-sixth of the power of its competitors. Once the battery is fully charged, it can be used for 12 hours, enough for a full day of activities. In addition, the Aurora can be used both indoors and outdoors. It is not affected by a light source, which makes it much more practical. It is also small enough to be placed on the frame of any pair of glasses.

The Aurora eye tracking module consists of two eye cameras, a scene camera, an eye tracking IC (designed and developed by Ganzin Technology), an infrared illuminator, and software development kit (SDK) for the system factory. The key technology lies in Ganzin's IC, which is the cornerstone for power saving, the small size, high-performance computing, and precise tracking by algorithms.

Ganzin Technology's team mentioned that many competitors on the market use multiple infrared illuminators to track eye movements. But since infrared rays are affected by visible light, the product would be ineffective outdoors. Aurora's powerful computer vision algorithm can perform what the competitors cannot. When indoors, it can track the eyes with just one infrared illuminator, which saves more power. When there is sufficient lighting outdoors, Aurora will turn off inactive infrared illuminators and track the eyes with just the camera and algorithm.

Research Always Stays in Academic Papers, but We Will Not Let It Slip by This Time

"Now it seems that we were right about the trend. Tech giants have been acquiring eye tracking companies on the market." Dr. Chien said that after years of teaching at the school, his "Media IC & System Lab" continues to develop outstanding technology. However, in the world of academia, even the best R&D results often remain in the paper after publication. The industry in Taiwan also focuses more on current trending technology and is less interested in forward-looking technology filled with uncertainties.

Dr. Chien feels this is such a pity because things that are similar to many great technologies often appear on the market

Dr. Shao-Yi Chien (fifth from the left), the founder of Ganzin Technology, and his team members.

a few years later. In 2016, when he led students in making the prototype for the eye tracking technology, he believed it could be used for AR/VR. He thought to himself: "I cannot let it slip by."

From Academia to the Industry — The Evolution from IC Design, Algorithm to System Integration

One could say that Ganzin Technology is the culmination of the Founder Dr. Chien's 20 years of specialization in computer vision and IC design. It is also the fruit of his continuous hard work with students who are inspired by him.

In the later stages of product development, Ganzin Technology began full-scale recruitment of talents, including experts in system integration, visual psychology, and business development. The original team was too young and unfamiliar with the development process, so they were often misguided. That is why Dr. Chien decided to introduce people with experience in the industry. He started with his classmates and students, and then headhunted experienced senior business developers and system integration engineers from tech giants like TSMC and NVIDIA.

Moreover, after Ganzin Technology was established, its eye tracking module development project was successfully approved by the Industrial Value Creation Program for Academia and received a 2-year subsidy of NT$ 20 million (around US$ 650,000). Also, because the program requires cooperation with the industry, Ganzin is working with Himax Technologies, an IC design company and has received practical guidance on product development and IC production.

Himax Technologies is equally optimistic about the potential of eye tracking technology. It became the strategic partner and strategic investor of Ganzin Technology after the completion of the program. Throughout the journey, Ganzin Technology's skills and promising eye tracking technology attracted the best players in every field, expanding the company's strength. ⊤

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TAIWAN'S STARTUPS EARN VALUABLE RECOGNITION AT HOME AND ABROAD

TTA pushes Taiwan-based startups to the center of the global stage at this year's InnoVEX and Innovfest.

PASSION AND DRIVE AT INNOVEX 2019

Great innovations and new technology are not only found in private organizations but also from within the government. Taiwan Tech Arena (TTA) as the sponsorship program from the Ministry of Science and Technology (MoST) organized a pavilion joined by 79 startups from many industries.

TTA also sponsored the InnoVEX Pitch Contest Grand Prize Taiwan Tech Award worth US$ 100,000, organized a forum session during the InnoVEX forum on Startup Ecosystems, sponsored the InnoVEX Taiwan Tech Night Party as well as held two Pitch & Match sessions on the InnoVEX Pi Stage.

The passion and drive of nearly 467 startups from 25 countries and regions were on display at this years' InnoVEX event. From the early hours of Wednesday morning on May 29, both local and international tech companies scrambled to arrange booths, prepare speeches, and perfect their pitches. For many entrepreneurs over these three days, InnoVEX was to be a life-changing event.

The Premier of the R.O.C (Taiwan),

Minister of Science and Technology, Deputy Minister of Economic Affairs, and various local government representatives attended the opening of InnoVEX 2019. The international government representatives that attended were the Mayor of Eindhoven, the Deputy of the French Assemblée Nationale and 23 international trade office representatives.

Because so many events occurred simultaneously at InnoVEX both on stage and off, we have captured the best moments from all three days.

The Displays

Aesthetics at this year's InnoVEX event did not disappoint. Taiwan Tech Arena's pavilion was centrally located between the Main and PI stages with displays from all startups dominating the center

floor. Additional pavilions included La French Tech, Startup Terrace, Holland Startup Lounge, and Slingshot Philippines Pavilion, to name a few.

The Speakers

Several incredible minds from around the world were brought together under one roof including Ravi Belani, Co-founder and Managing Director of Alchemist, Amit Pradhan of the Silicon Valley Blockchain Society, and Zvika Popper, VP of Strategy at HYPE Sports Innovation. Taiwan Tech Arena's very own Dr. Lewis Chen and French Tech Taiwan's Laurent Le Guyader also took to the stage to contribute their insights and observations. In total, InnoVEX had more than forty speakers all with incredible backgrounds.

The Panel Discussions

No event on stage at InnoVEX 2019 was more thought-provoking than the panel discussions. It was insightful to witness various perspectives on AI, Biotech, Blockchain, IoT, Smart Machinery, and Sports tech. While all the speakers were dynamic in their own right, the speeches contributed by Ravi Belani, Amit Pradhan, Ravi Belani, Dominik Schiener, and Dr. Min Sun carried a certain weight

that was unmatched. Each speaker had their way of making the information uniquely personal and applicable. Amit Pradhan's speech, for example, was positioned towards AI and Taiwan's unique role in the startup and tech field.

Although each forum branched off as many speakers voiced their impassioned opinions on the subjects, the conversation would always come around full-circle as to how we can make Taiwan more globalized in these industries.

Pitch and Match on the Pi Stage

Over the 3 days of InnoVEX, the Pi Stage hosted pitching, matchmaking, and demo events for exhibiting startups. A dedicated demo session to showcase innovations from around the world was held on the third day of InnoVEX, the Global Demo Day, during which startups from France, Canada, Philippines, and Poland showcased their solutions and products to potential investors or partners in the audience.

Taiwan Tech Arena (TTA) held two pitch and match events together with Asia-Pacific Accelerator Network (AAN) and Taiwan Innovation & Entrepreneurship Center (TIEC). In total there were 240 matchmaking sessions with 45 attending VCs from Belgium, Israel, India, Japan, Korea, Taiwan, and the U.S. The InnoVEX Matchmaking Powered by TTA x TIEC focused on startup-VC matchmaking while InnoVEX Matchmaking Powered by TTA x AAN focused on matching startups with all the accelerators.

Altogether, over 200 matchmaking sessions were initiated during the event with VCs from all parts of the globe engaged in the "speed dating" event.

Pitching Session on Center Stage at InnoVEX 2019

As one of the main industries represented, biotech and its related industries also gained prominence in this year's InnoVEX Pitch Contest. Out of the 143 startups that registered for a total of US$ 420,000 prize pool, 4 out of 10 finalists and 2 of the 7 winners were in the field of biotech.

Judges for the pitch contests included previously mentioned Ravi Belani and Amit Pradhan, as well as Shinzo Nakano, President and CEO of Itoju Technology Ventures, and David Wang, CEO of Taiwania Capital Management Company. Belani, who was the chief judge, commented that the main metrics the judges were looking for were that the startups should be going after something critical, that they are doing something novel or completely new, and that they have a high potential to be a real platform that is bigger than just their current product.

In the span of only a few short minutes, teams must be able to express the benefits and value of their companies to potential investors. While many of them would have been shaken under the great pressure, each startup performed extraordinarily well.

The Taiwan Tech Award worth US$ 100,000 (The grand prize at InnoVEX 2019) was given to MedFluid, a biotech startup that focuses on using their microfluidics technology to improve healthcare quality.

The Taiwania Capital Innovation Award worth US$ 10,000 focused on startups in IoT or biomedical. The award was given to MTAMTech, a biotech startup that aims to resolve issues with the ineffective treatment of cancer patients through personalization of treatment.

Ganzin Technology won the Qualcomm Innovation Award worth US$ 10,000. Ganzin Technology, a Taiwanese startup that created an AR/VR eye-tracking module with a small form factor and minimum power requirements.

Four TTA teams (Lucid, Studio 1 Labs, Weavair, and Singularity & Infinity) took home the prestigious Audi Innovation Award, an award that "seeks to empower startups with innovative solutions that impact our daily lives and shape the future of smart mobility."

TTA is keen to enhance the tech startup global ecosystem in the fields of AI, software and semiconductors and is looking forward to participating at InnoVEX 2020. 🏆

LITTLE TECH GIANTS MEET AT INNOVFEST 2019

For the better part of a decade, startup innovation and technology has been evolving outside the confines of Silicon Valley and is now thriving in hubs across the globe. Notably among these hubs are Taiwan and Singapore, two rising tech superpowers in Asia.

Though separated by the South China Sea and over 3,000 kilometers, Taiwan and Singapore share many similarities, invest heavily in technology and (recently) favor novel ideas over conventional corporate models. This desire to step outside the realm of corporate structure and empower startups is why events like Innovfest in Singapore attract visitors from some 100 countries each year.

Comparatively, Innovfest is the World Series of startup events in Southeast Asia. The two-day event takes place at the Sands Expo and Convention Centre in the world-famous Marina Bay Sands Hotel and hosts many top leaders in tech. The agenda for Innovfest includes speeches, workshops, presentations, and even a sushi bar for networking. Over 300 notable figures such as Sir Martin Sorrell, Ralph Haupter, Lesly Goh, and Taiwan Tech Arena's (TTA)

Managing Director Dr. Lewis Chen contributed on stage during the event.

Dr. Chen spoke on the FutureNow stage alongside Chelsea Sim of BotbotAI, Oliver Tan of Visenze, and Yvonne Chen of Ceres Capital about the topic of Scaling Up Globally With Taiwan's Tech Ecosystem. The topic resonated with many listeners as several startups often encounter issues with scaling globally. Throughout the discussion, an underlining theme was developing around Taiwan being a launchpad for startups in Asia. Startups can take advantage of the country's affordable cost of living, background in hardware, abundance of engineers, and English-friendly environment. It's easy to grow within Taiwan and expand outside of its borders when the time is right.

The Taiwan-Singapore dynamic works exceptionally well when considering

the broader business cycle. Startups needing resources, mentorship, and funding in Asia can look to Taiwan as a test market. After these companies have been primed and are ready to progress to a more competitive market, countries like Singapore would be the next logical step with its diverse workforce and policies that favor businesses.

Singapore also provides an excellent model of what Taiwan can be with fewer barriers to entry, a more progressive financial sector, and more programs for developing startups. Singapore's small but developed tech economy is overtaking Silicon Valley as the number one location for startup talent and is implementing projects to further its effectiveness in industries such as advanced manufacturing, biotech, and health tech.

Upon the conclusion of his speech, Dr. Chen said that there is a lot of potential for collaboration between Taiwan and Singapore, and that he is optimistic about the future development of both countries.

Offstage, the exhibition floor of Innovfest was also filled with energy as TTA introduced their new technologies alongside hundreds of other companies. Investors flocked to the TTA booth throughout the two days and met with teams to discuss potential prospects. Teams from Taiwan secured orders for over US$ 20 million and several awards.

Notable accomplishments included a US$ 1 million order from infrastructure company NADI System Corporation and three orders totaling more than US$ 200,000 from mobility service company 3Drens. Other companies such as Language Hero, an AI-based language app startup, mentioned that they received inquiries from Singapore-based parties throughout the exhibition.

Outside of Innovfest, TTA teams visited several additional co-working spaces, accelerators, and incubators. Workspaces and accelerators are another common interest shared by both Taiwan and Singapore. It is estimated that over 1.4 million square feet of startup space occupies Singapore's urban jungle, while co-working spaces around Taiwan

continue to increase exponentially. The amount of space dedicated to startups is proof that talents and innovations are focal points for these two countries.

A single glance at Singapore's co-working spaces will show how benefits can arise from having a culturally and religiously diverse workplace. Approximately 40% of Singapore's population is foreign, permanent resident, or new citizen with nationalities hailing from Australia, India, Netherlands, France, Japan, Switzerland, and more. This unique mix allows for new insights and a much more universal perspective on variety of ideas.

With more successful events like Innovfest, Taiwan will undoubtedly receive additional interest from

investors and support from the public and private entities. TTA's goal is to become connected with like-minded leaders in technology like Singapore, Hong Kong, and Israel. Very much like Singapore's explosive growth in recent years, it's only a matter of time until Taiwan is recognized as the global hub for technology, innovation, and industry. The world is undergoing a technological revolution, and Taiwan intends to be a leader in science and technology.

Taiwan stands in a unique position full of opportunity and promise. As long as progression and change remain the focal point of the country, it will be propelled into the next era of innovation and become a breeding ground for future unicorns.

TAIWAN TECH ARENA Event Summary

TTA TECH TALK

TTA TECH TALK is an occasional event that updates local startups on the latest technologies, industry trends, and market insights. Notable guest speakers in the previous three editions of TECH TALK included Skywatch Innovation's co-founder Dr. Wei-Chao Chen, KAIST researcher Dr. Chong-Min Kyung, and Indian angel investor Neville Taraporewalla. Dr. Chen, who is an AI specialist, shared his experience working with NVIDIA. Taraporewalla, who serves as the president of Brand Capital, offered his take on market trends in his native India and cultivating startup talents.

MedTech Conference 2019 Saw 12 TTA Startups Win US$ 125 Million in Business Opportunities

A team of 12 biotechnology startups led by MoST's Deputy Director-General Chun-Yi Tu attended the MedTech Conference in Boston. During the event, the team secured a total of 180 appointments with major medical device manufacturers and academic institutions from around the world. It also received orders totaling US$ 120 million through AdvaMed, the organizer of the MedTech Conference.

AdvaMed wields an enormous influence over the biotechnology industry as it has 400 key members worldwide, 80 of which are top-tier manufacturers of medical devices. By connecting with this organization, Taiwan's biotechnology firms have opened up business opportunities across the global market.The 12 startups that attended the MedTech Conference are not only supported by TTA but are also collaborating with the Taiwan Startup Institution under MoST's Biomedical Industrial Innovation Program. Their solutions and ideas received significant attention at the event.

Exhibition highlights include a respiratory monitoring system, a laryngeal implant, an AI-based heart rate tracker, and braided catheter tubing respectively developed by Heroic Faith Medical Science, APrevent Medical, FaceHeart, and Summed Taiwan. The respiratory monitoring system, in particular, has caught the interest of the US military. The successes that the Taiwanese startups achieved at the MedTech Conference demonstrate that TTA has been vital in enhancing Taiwan's visibility in the global technology ecosystem.

TTA Led 16 Startups to an Impressive Showing at TechCrunch Disrupt 2019

TechCruch Disrupt in San Francisco saw 16 Taiwanese startups pitching their solutions to investors. These startups were supported by TTA and specifically chosen by TIEC as the vanguards for breaking into the US market. They together represented six major fields: IoT, network security, AI, healthcare, wearables, and advanced manufacturing. One success story from this event is Roby. This communication technology firm secured business deals with Amazon, Slacker, and Honeywell. In conjunction with the event, TTA also held a reception to publicize Taiwan's role in the global technology sector.

Luxembourg Delegation Made a Visit to TTA and Offered Opportunities for Cooperation

A delegation from Luxembourg led by Mr. Daniel da Cruz, Director General for Foreign Trade and Investment Promotion under the country's Ministry of the Economy, co-hosted an event celebrating innovations and startups with MoST at TTA's headquarters on July 19. Members of the delegation, including ICT experts and business consultants, presented an overview of the entrepreneurial environment and recent technology developments in Luxembourg and the wider Europe. The knowledge that the delegation divulged at the event is invaluable to Taiwanese startups that wish to expand into that region.

Fireside Chats with VCs

"Fireside Chat with VCs" is one of the most popular events offered by TTA. This August, TTA invited Chris Heivly, VP of Innovation at Techstars, to share his journey as a builder of companies and a mentor to startups worldwide. The Fireside Chat provides a platform for entrepreneurs to meet with VCs face to face and obtain expert advice on choosing an accelerator program, attracting investments, and building a healthy mindset for leading a company. The event is also a chance for startups to showcase themselves.

TTA Community Events

TTA has held numerous community events with the goal of building a supportive circle of local startups and fostering camaraderie among its members. Sometimes taking place in conjunction with local and international festivities, these events provide a chance for different startup teams to mingle and network in a more relaxed atmosphere. Some of the fun and cooperative activities that TTA has hosted so far include fitness sessions, rock climbing, beach cleanup, and get-together meals. The aim is to bolster cohesiveness of the startup community besides providing the hardware support.

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