

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 TECH ARENA

INTERVIEW WITH
QUANTA CTO TED CHANG

Dr. Ted Chang Believes the Startup Spirit Is in Every Successful Taiwanese Tech Company

2019 MOST INNOVATIVE
TECH STARTUPS IN TAIWAN

TTA Presents the Most Aspiring Local Startups that Are Leading Innovations in Various Fields

TAIWAN
TECH
ARENA



JUN. 2019

02

ACHIEVING INNOVATIVE
GROWTH THROUGH
ENTREPRENEURIAL DRIVE

Discover and Learn About
the Most Crucial Advanced
Technologies That Will
Impact Asia by 2030

TAIWAN’S STARTUPS BOLDLY ENTER THE GLOBAL STAGE TO SUCCESS

Soon after making the long journey from an agricultural economy to an industrial economy, Taiwan made another giant leap to become one of the major technological powers on the global stage. This long and miraculous period of economic development was made possible by continuous efforts to expand the talent pool and technological expertise in domestic industries. Like Silicon Valley, Taiwan does not depend on the inheritance of natural resources but instead builds its wealth through recruitment of fresh talents, acquisition of new knowledge, and discovery of new ideas.

Taiwan’s ability to cultivate elite professionals in different technological fields has gained significant recognition from enterprises and governments worldwide. Google’s R&D center in Taiwan is its largest outside the US, being just slightly smaller in scale than Microsoft’s AI research hub in North America. This is one of many examples that illustrate how Taiwan’s technological sector maintains a seamless connection with the rest of the world. As Taiwan takes the final steps to reach the frontier of global technological progress, its industries have to boldly pursue innovation and overseas expansion. Our local scientific and technological talents must move away from their comfort zone and maintain a pioneering spirit.

Our administration focuses on attracting capital and clients when designing policies that encourage the formation of startups, as these two elements are critical to success in innovation and business growth. While domestic startups are already being supported by seed funding, they still require foreign investments in order to expand and become global. As for access to clients and customers, there is a need to shorten the learning curve for startups when it comes to marketing and establishing business relations. Hence, the government’s role is to create an environment where businesses and consumers worldwide are readily familiar with the many great startups in Taiwan and want to establish ties with them. This way, our local startups can ramp up their operations sooner.

To demonstrate Taiwan’s technological prowess, the Ministry of Science and Technology (MoST) since last year has begun the annual selection of the most innovative startups. The government is also assisting these startups to enhance their international visibilities by supporting their marketing efforts. The most innovative startups in 2019 come from a diverse range of fields including AI, biotechnology, agricultural technology, and energy. Each of them was carefully selected from thousands of candidates and has proven to have the capability to expand globally. Altogether, these teams represent the robust innovative and entrepreneurial drives that exist in Taiwan’s society.

The young people of this island have extraordinary talent. While some of them can build their own stages to show off their knowledge and skills, others require a shared platform to do so. Regardless of the type, our administration recognizes that they are the seeds for future transformation of domestic industries. We will do our utmost to foster their entrepreneurial growth and help them achieve their aspirations. 🏢



Dr. Liang-Gee Chen
Minister, Ministry of Science and Technology,
Taiwan

A handwritten signature in black ink that reads "Liang-Gee Chen". The signature is fluid and cursive, written on a light-colored background.

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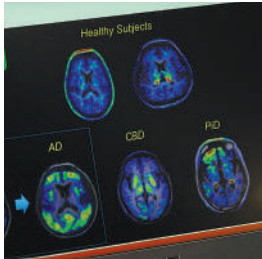


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2030 ADVANCED TECHNOLOGY FROM AN ASIAN PERSPECTIVE

This report aims to assess the 2030 market perspectives and policy plans of major Asian countries and find the 10 most crucial advanced technologies that will affect the Asian region. These technologies are:

- Artificial Intelligence
- 6G Mobile Network
- Autonomous Vehicles
- Industrial Robots
- Service Robots
- Blockchain
- New Energy Vehicles
- Solid-state Batteries
- Nanomaterials
- Renewable and Biodegradable Plastics Materials

The research results have been divided into five key findings.

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

Why 2030?

Many countries have set the year 2030, which is approximately 12 years from now, as time zero for long-term advanced technology research. This period of time is appropriate for governments to invest in R&D and for research institutions to conduct studies and do research. If we invest in the R&D of technology now, we would more likely be able to overcome challenging technologies or changes in large-scale infrastructure in 12 years.

If we look at long-term prospective studies, most only focus on the global perspective or a country’s own domestic and industry development demands. However, this “global perspective” is still more inclined toward the perspectives of developed regions such as Europe and the United States; for the developing countries and markets in other regions, this type of global perspective overgeneralizes them. Therefore, this report looks at a general global perspective and then focuses specifically on Asia. Hopefully, by studying the predictions and outlooks of major Asian

countries, we can precisely foresee the future technology and market demands of that region.

Asian countries play a major role in international advanced technology R&D, including areas such as AI and mobile communication technologies; from a long-term perspective, Asian countries such as China and India have remarkably large market potential. This is why the report aims to understand the differences between Asia and the rest of the international community in terms of long-term technology prospects and market demands.

Methodology, Subjects, and Procedure

This report begins with studies of general global trends. We combined multiple methods, including literature analysis, STEEP (society, technology, economy, environment, and policy) analysis, and word cloud analysis, to scan global 2030 major advanced technologies and trend foresight. We then used technology portfolio planning to select the top 30

advanced technologies around the world to use as the technology items listed in the Asia think tank survey. After analyzing the collected questionnaires, we selected the top 10 key technologies in Asia and carried out scenario analyses to present the 2030 Asia outlook. The 2030 advanced technology research procedure is shown in Figure 1.

To obtain perspectives from various Asian countries, we selected the 10 most significant markets from Asia to carry out survey and data acquisition. During the analysis, the 10 Asian markets were categorized into two separated groups according to the level of development and market characteristics. The first group (G1) comprises of China, Japan, Korea, Singapore, and Taiwan; the second group (G2) includes Malaysia, Thailand, Indonesia, the Philippines, and India.

For the survey, we chose a government-related advanced technology R&D or research facility in each country and gave questionnaires to the experts there. The subjects answered specific questions

related to 30 advanced technologies in terms of impact, investment, penetration rate, etc.

Target Readers

This report focuses on 2030 advanced technology items and has sequenced them according to their importance in Asian countries. The technologies include digital technology, smart machines, green technology and energy, advanced materials, and biotechnology. This wide range encompasses the most important technologies of today. The results can be used as a reference for governments and industries when they are planning long-term technology R&D strategies. For this report, surveys were conducted on various advanced technologies in Asian countries to obtain data regarding the countries’ predictions in terms of domestic market demand, technology R&D demand and requirements, investment intensity, and future penetration rate. These are valuable references for business and governments when they are planning their technology and market deployments.

2030 Global Advanced Technology Scanning

To understand the trend of 2030 global advanced technology developments, this research study reports on long-term technology trends from international organizations and research facilities (For a list of the literature reviewed, please see the “References” section). Studying the projected environmental shifts in 2030 and the needs and demands that may emerge due to the transformations is depicted in the report. The findings are used as the basis to

predict global advanced technology trends in 2030.

Challenges in 2030

This study discusses transformations in 2030 from five aspects: 1) society, 2) technology, 3) economy, 4) environment, and 5) policies.

In an aging society, the employed population will decrease. Sixty percent of the middle class will be in Asia, forming a new consumption pattern. For technological developments, interdisciplinary technological collaborations will be the key to innovation. Digital technology combined with energy and environmental protection technology, smart manufacturing, and advanced medical technologies to enhance physical health will be areas of interest. In terms of the economy, in

2030, bilateral trade flows worldwide will grow to over double their current amount. Asia’s percentage of international exports will rapidly increase by 40%. Regarding the environment, the massive energy consumption market will spur countries to invest in energy technology R&D. Alleviating measures, which focus on conserving energy and reducing carbon emissions, and adaptation measures, which focus on adjusting and adapting energy structures, will be the two major corresponding actions in environmental resource management and energy demand. For policies, emerging countries will play an influential role in the international economic market, creating diverse and complex international relations and making it difficult to predict if the world will be led by a superpower or follow a multilateralism trend. Therefore, this report will not go into detail regarding policies. Nevertheless,

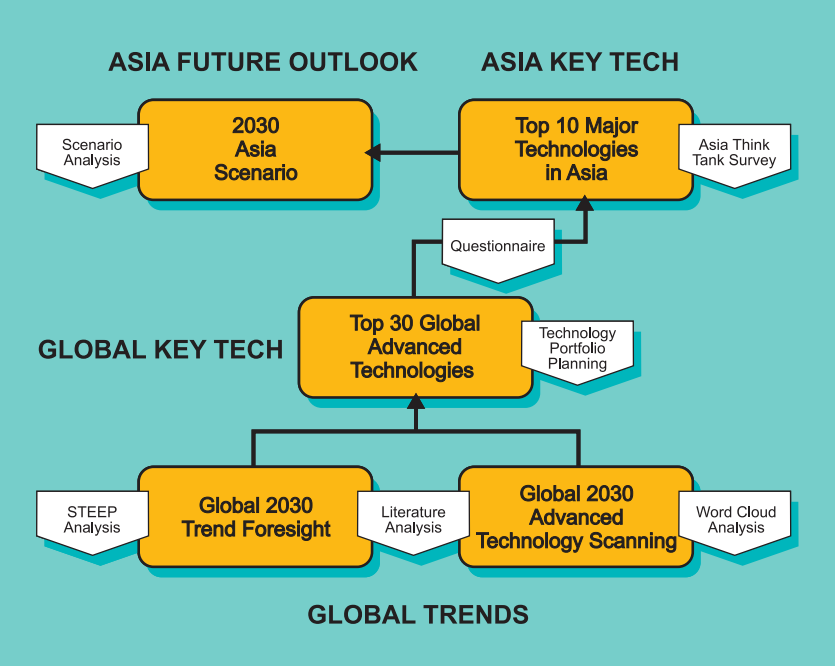


Figure 1. The 2030 advanced technology research procedure.

it can be expected that, under the structures of common markets and production bases, regions will improve their competitiveness in industry development and technology R&D. The level of international competition will shift from an individual country level to a regional level, forming a new technological geopolitical landscape thereby stimulating technology R&D collaborations between regions.

Society: Growing Elderly Population, Megacities, and the Asian Middle Class

According to the United Nation’s estimation, the global population will exceed 8 billion in 2030, and the main population growth will occur in southern Asia and Sub-Saharan Africa. In addition to population growth, the population structure will also change: over half of the world’s elderly population will be in the Asia region. Developing countries, in particular, have to take note that their society is aging at a rate faster than in developed countries. Due to the pressure of aging societies and decreasing working populations, industries will continue to transform into intelligent industries to manage challenges brought forth by a decreased labor supply and population structure transformations.

In 2030, the population in megacities around the world will increase from 3.2 billion to 5 billion. Maintaining a reasonable quality of living in all aspects, reducing urban crime rates, waste disposal, and recycling will become important issues.

The global middle-class population will reach approximately 5 billion, with 3 billion of that population in Asia. This

social class mainly relies on its salary for a living and is generally well educated. Members of this class have professional knowledge, stronger occupational abilities, and a corresponding household consumption expenditure. In emerging regions, the middle class has already become the main force of consumption internationally.

Technology: Interdisciplinary Collaborations to Innovation

According to forecasts, the number of global Internet users will reach 5 billion, which will be 60% of the global population. Therefore, digital applications will become more popular and integrated into other areas of life, such as energy and environmental protection, smart manufacturing, and advanced medical technologies. This will enhance precision sensing, broadband connections, and data-computing capabilities and create innovative and diverse business application opportunities.



In response to climate change, technologies related to renewable energy, solar power, electric cars, and advanced energy storage will be integrated with energy-efficiency solutions. These will play an increasingly important role in energy services.

In response to climate change, technologies related to renewable energy, solar power, electric cars, and advanced energy storage will be integrated with energy-efficiency solutions. These will play an increasingly important role in energy services. Production technologies used in manufacturing industries will mature and be combined with front-end sensors and integrated virtual and physical systems. The trend of emerging technologies entering manufacturing industries will deal with issues raised by flexible manufacturing and labor shortages and stimulate a revolution in industry structure. Life expectancy will be extended due to advanced medical care, and our aging society will see many breakthroughs in medical technology. People will have a better understanding of the human cell atlas, and there will be continual innovations related to genetic control, liquid biopsies, and gene vaccines. The survival capabilities of human beings can be directly enhanced

through biotechnology and advanced medical technologies. However, the application of biotechnology and gene manipulation, technologies that alter organisms, may also bring about controversies in ethics and social values.

Economy: Continuous Bilateral Trade Flows within Increasing Main Economies

The global exports share of Asian countries will grow rapidly and are estimated to reach 39% in 2030. Furthermore, bilateral trade flows between the three major economies of the United States, the European Union, and Asia will more than double by 2030.

During long-term global economic developments, the importance of emerging markets and countries will gradually increase in the world’s developing regions in terms of real gross domestic product, export volume, and spending power. China and India will become the global suppliers of international products and services, and Russia will be the main global supplier of raw materials. India’s actual exports will increase, on average, by 13% annually. In 2030, India and China will take up 6% and 14%, respectively, of global exports. The middle-class population in emerging countries will increase, stimulating the growth of spending power and changing the global consumption map.

Environment: R&D Tends to Combine Alleviating and Adaptation Concepts

According to an estimate by the U.S. Department of Energy, due to the rapid industrialization and population growth, the energy consumption rate will

continue to increase in the next decade. The large energy-consumption market will push countries to invest in related technology. The IEA’s World Energy Investment Outlook pointed out that, in 2035, global energy investment demand will reach US\$ 40.2 trillion, 25 times more than the current US\$ 1.6 trillion.

Alleviation measures, which stress energy saving and carbon reducing, and adaptation measures, which are deployed to adjust and adapt energy structures, will be the two major corresponding actions to energy demand. Environmental resource management will ensure that many ecosystems are protected and maintained. To find a balance between industry development and environmental protection, countries will establish an effective management system to develop a sustainable economic structure that can satisfy basic living needs and not exceed environmental limits.

Opportunities in 2030

This research ran text mining on approximately 20,000 major international prospective literature studies published between 2012 and 2017 and collected 150 advanced technology items. Then 30 advanced technologies were selected according to the challenges the world is expected to face in 2030. The results of the top 30 technologies were discussed and selected by over 25 ISTI senior researchers from different fields and were consulted to provide a balanced view of the global technology trend. The 30 technologies are categorized into five major groups: 1) digital technology, 2) smart machines, 3) green technology and energy, 4) advanced materials, and 5) biotechnology.

From the results, the study found that different issues were reviewed. For example, between 2012 and 2015, there were many discussions concerning electric cars, bioenergy, nanotechnology, renewable energy, quantum computers, cell research, genes and DNA, and various severe contagious diseases (e.g. H5N1). In 2016–2017, most of the discussions were related to electricity supply and renewable energy, 3D printing, biotechnology, carbon emissions, mtDNA, and energy issues, which have always been major topics.

In terms of publication selection, this research included prospective study and advanced technology publications that focused on future prospective issues and technologies. Prospective study publications selected had to include keywords such as “foresight,” “future,” and “forecasting” and cover multidisciplinary perspectives. Selected advanced technology publications were mainly influential interdisciplinary technological periodicals. They were evaluated with reference to the impact factor to confirm the periodical’s significance and influence.

Drivers: Lifetime Expectancy, Lifestyle Improvement, and Environment Protection

This study has found three basic factors, drivers that have long affected human choices. These drivers are not affected by short-term international policies and technology developments and are similar to concepts from physical/safety to self-actualization in Maslow’s hierarchy of needs. The three main drivers are respectively extending life expectancy, improving quality of life, and protecting the environment.

Even though some of these 30 technology items existed in 2018, they will keep evolving. For example, AI will continue to improve self-learning and be able to function with little data. In addition, AI will protect data better and be able to broaden adoption across a range of applications. The evolution of these

technologies will play key roles in lifetime expectancy, lifestyle improvement, and environment protection.

2030 Top 10 Technologies in Asia

To identify the 2030 Top 10 technologies

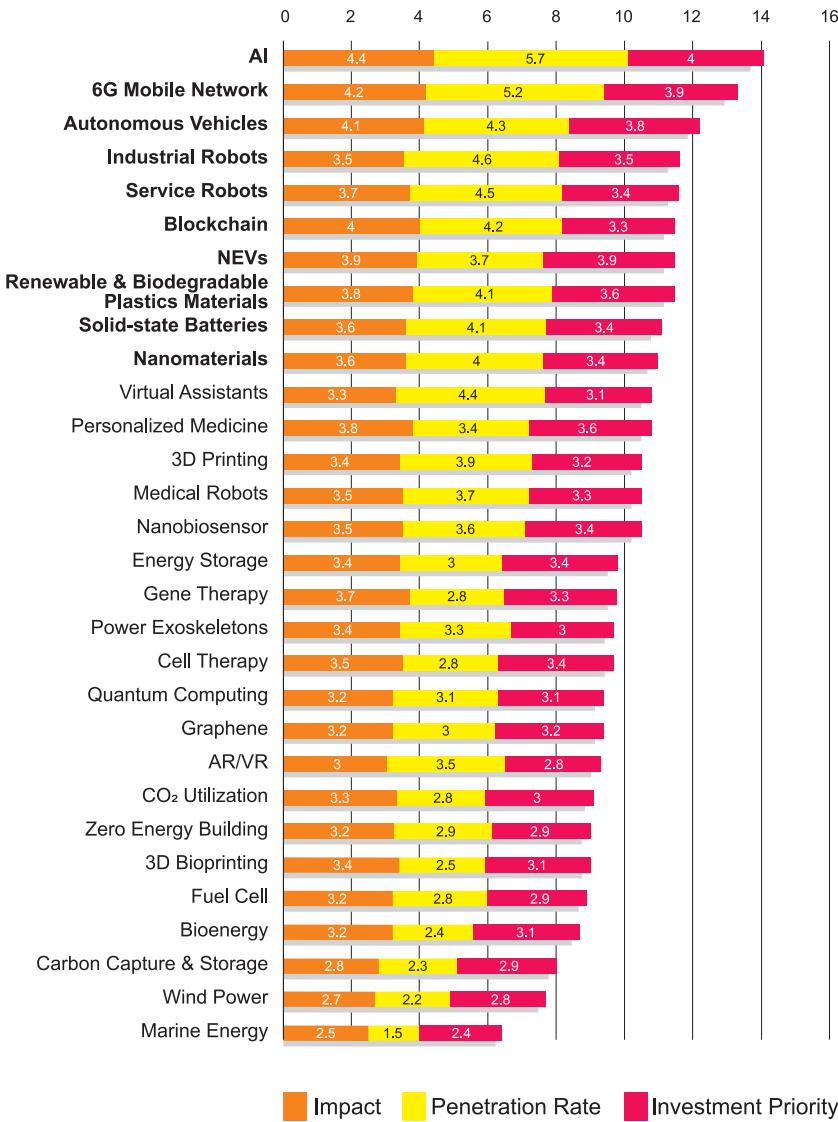


Figure 2. The ranking of the 2030 top-30 technologies in Asia.

in Asia, we conducted a survey that focused on three points: impact, penetration rate, and investment priority. The values of these three points were added up and ranked according to their totals. The reason for these three particular points is as follows: 1) impact encompasses not only the technology a country needs but also the resources invested to facilitate its maturity, 2) penetration rate represents the level of demand for the technology in the country, and 3) investment priority indicates whether the country has put money into R&D or made use of this technology. In our survey, we used different rating scales for the three points: impact (1–5 scale, very low to very high), penetration rate (1–7 scale, <5 to ≥50%), and investment priority (1–5 scale, very low to very high).

After sequencing the values, we see that the top 10 technologies in Asia among the 30 major global technologies are AI (14.1), 6G mobile network (13.3), autonomous vehicles (12.2), industrial robots (11.6), service robots (11.6), blockchain (11.5), NEVs (11.5), renewable and biodegradable plastics materials, solid-state batteries (11.1), and nanomaterials (11).

Worldwide Versus Asia: Breakthrough Versus Living Technology

To understand the differences between worldwide and Asian technology focuses, we reviewed research on many long-term key technologies regarding 2030 and identified the top 30 worldwide technologies. We took 10 that were mentioned more frequently as the worldwide top 10 and then used that as a comparison with the Asian top 10.

Figure 3 shows a comparison between the 2030 Top 10 technologies in Asia and worldwide and the differences between Asian and worldwide key technologies. The first quadrant presents the technologies considered important in both Asia and worldwide: AI and service robots. The fourth quadrant presents technologies focused on in other places but not listed in the top 10 in Asia. Consisting primarily medical technology, with a relatively larger proportion of next-generation advanced technologies such as quantum computing, powered exoskeletons, gene therapy, and personalized medicine.

The second quadrant displays the technology focuses in Asia. These key technologies and developments are those related to application and have a greater impact on people’s everyday routines, such as communication, blockchain, transportation vehicles, environmentally friendly materials, and battery technologies.

As a whole, the worldwide perspective focuses on breakthrough technologies, while, in Asia, the focus is on technologies more related to daily life. There is a distinctive difference between the two.

Ranked by Impact: Economic Development Is the Key Factor

When ranked according to impact, the results of the two groups and overall in Asia are as presented in Figure 4. For technologies that were ranked with a higher score on the impact index, respondents also had to select the reason behind their scoring. The main reasons include the following five areas: society, economic development,

environmental protection, infrastructure, and safety and security.

The results show economic development (8 points) is the most important demand and scored obviously higher than in other categories. It is worth noting that, while people commonly think that industrial

robots can solve labor shortage problems brought forth by aging populations, only 10% of the Asian countries agree with this idea. Societal demands are the main driver for developing service robots, which indicates the market for service robots will be in societal applications for the most part.

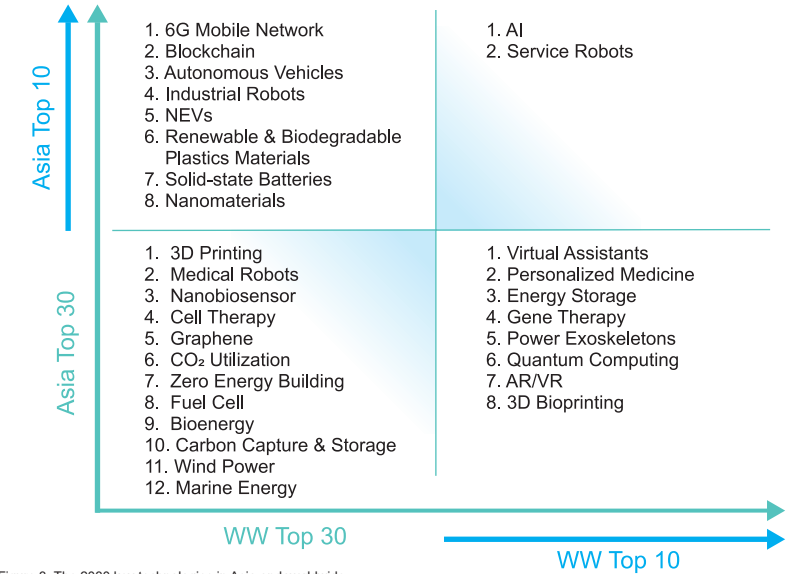


Figure 3. The 2030 key technologies in Asia and worldwide.

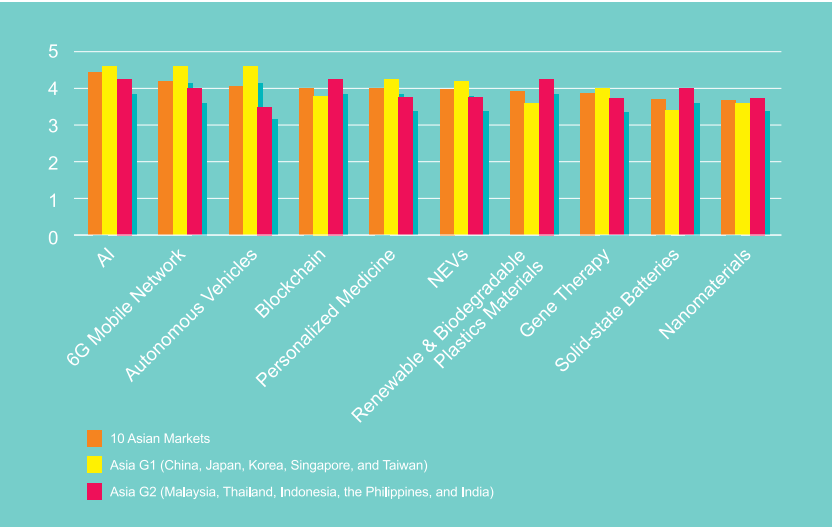


Figure 4. Asian Top 10 technologies ranked by impact.

Ranked by Penetration Rate:
Blockchain, Virtual Assistants
and Advanced Materials Are All
Significant

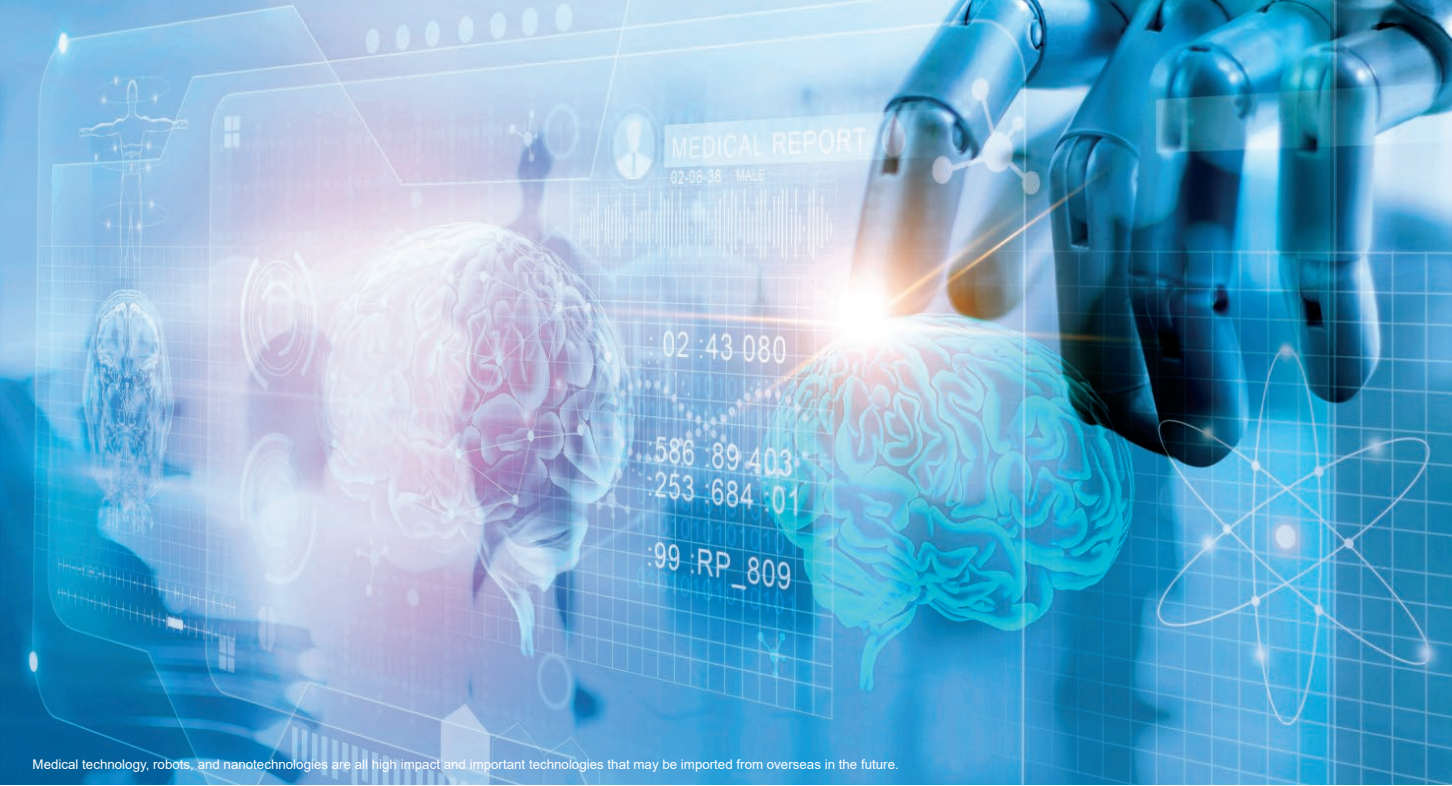
The penetration rate shows how popular the technology might be in each country in 2030. The results show that AI and 6G mobile network are ranked higher

than other technologies, but several technologies such as blockchain, virtual assistants and advanced materials are worth exploring (see Figure 5). Blockchain technology is more popular in G2 than in G1. It may be because developing countries have a higher demand for transaction transparency. Virtual assistant technology was not

listed as one of the top 10 technologies in Asia but ranked fifth in penetration rate. It may be because virtual assistant technology is not what governments will invest much resources in, even though Asian countries think that it will be used ubiquitously. G2 countries have given a higher score in renewable and biodegradable plastic materials than G1 countries because G2 countries have more abundant biomass resources to fulfill the need for the ongoing development of bioplastics.

Ranked by Investment Priority:
AI, 6G, and NEVs Are Significant

In investment priority, the results show that Asian countries agree to invest significantly in AI, 6G mobile network and NEVs technologies. Among the top 10 rankings of investment priorities, except for renewable and biodegradable plastics materials, G1 is higher than G2, representing G1 as the leading countries in advanced technologies (see Figure 7). There are significant gaps between G1 and G2 in the investment priority of several technologies. For example, the G1 countries ranked energy-storage technologies higher than G2. This may be because G1 has a higher renewable-energy penetration rate than G2, and renewable energy requires energy-storage technologies to help solve unstable power supply problems. G1 also invested more in medical technology and developments than G2, mainly because the R&D of advanced medicine requires large amounts of investments and a major foundation to conduct it. G1 ranked autonomous vehicles higher than G2. This shows that G1 countries are more optimistic about the future of autonomous vehicles and invest heavily in their development to seize the market.



Technologies with High-Impact
but Low-Investment Priority:
Depend on Imports

After cross-analyzing the impact and investment priority categories, we discovered that some technologies have a high impact in a country and yet a low investment priority. This indicates that these important technologies may be imported from abroad and not developed locally. Technologies such as blockchain, gene therapy, service robots, nanomaterials, and solid-state batteries all belong to this category, followed by cell therapy, industrial robots, nanobiosensors, and medical robot technologies. In conclusion, medical technology, robots, and nanotechnologies are all high impact and important technologies that may be imported from overseas in the future.

Why Is There Only One Example
of Green Tech in the Top 10
Technologies in Asia?

The global top 30 technologies include eight technologies relevant to green tech and energy; however, only NEVs entered the top 10 technologies in Asia. Here is the following conclusion:

Green technology requires large amounts of investment in R&D, has a long payback period, and carries higher risk; thus, many advanced green

technologies are mostly created in developed countries in Europe and the United States. In Asia, only Japan and China invest in related developments. Nevertheless, there are still some trends that can be observed; for example, energy-storage technology is ranked the second highest in impact and investment priority in Asian countries, mainly because of Japanese investments. Japan is the most aggressive country in Asia in terms of renewable energy development and, thus, has a higher demand for energy-storage technology. In the G2 countries, bioenergy has a high impact score because many Southeast Asian countries have large agricultural industries, which is the main advantage of developing bioenergy.

Why Is Biotech Not One of the
Top 10 Technologies in Asia?

In this survey, the global top 30 technologies include technologies that are relevant to biotechnology; however, none of them entered the top 10 technologies in Asia. The main reasons are as follows:

Advanced medicine technologies require greater investment and longer R&D periods, have higher investment risks and are slower to be commercialized; therefore, in the past, most of the investments and R&D were concentrated in developed countries in Europe and

the United States. The global top 30 technologies include many advanced medicine technologies, yet the top 10 technologies in Asia does not list any biotechnology items. The highest ranking of any biotech item in the Asian list is between 10 and 20, with the highest ranking being personalized medicine. The survey data revealed that, in impact and investment priority, Asian countries gave a relatively high score in personalized medicine and gene therapy. However, the 2030 projected penetration rate all had relatively low scores. This shows that Asian countries do invest in advanced medicine, but the popularity of medicine in 2030 still cannot reach the level of developed countries in Europe and the United States.

2030 Transportation Scenario in
Asia: Industrial and Social Issues

Asian countries will actively develop autonomous vehicles. In 2030, approximately 10–20% of the vehicles on the road will be autonomous. The reasons for Asian countries to develop autonomous vehicles include not only industrial and economic development but also to solve social issues as well; for example, the challenge of elderly drivers in an aging society, professional driver shortage, and traffic congestion in cities. NEVs that run on electricity or bioenergy to reduce air pollution would also reach a 10–20% penetration rate.

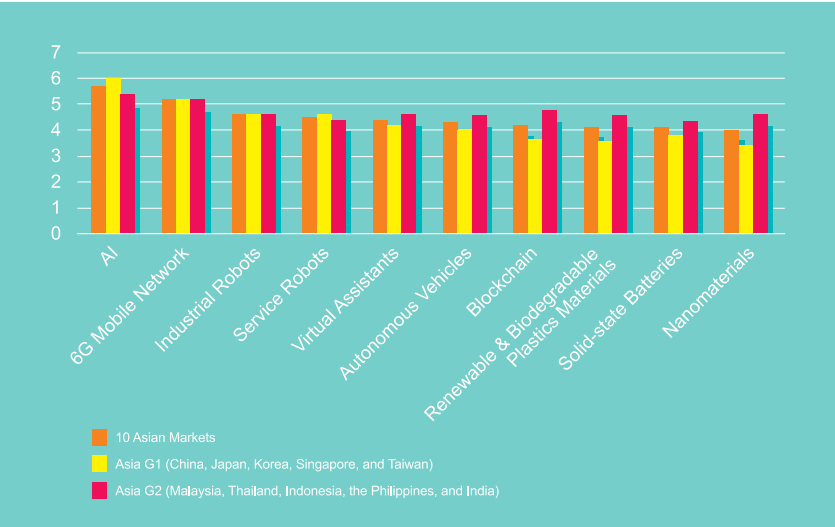


Figure 5. Asian Top-10 technologies ranked by penetration rate.

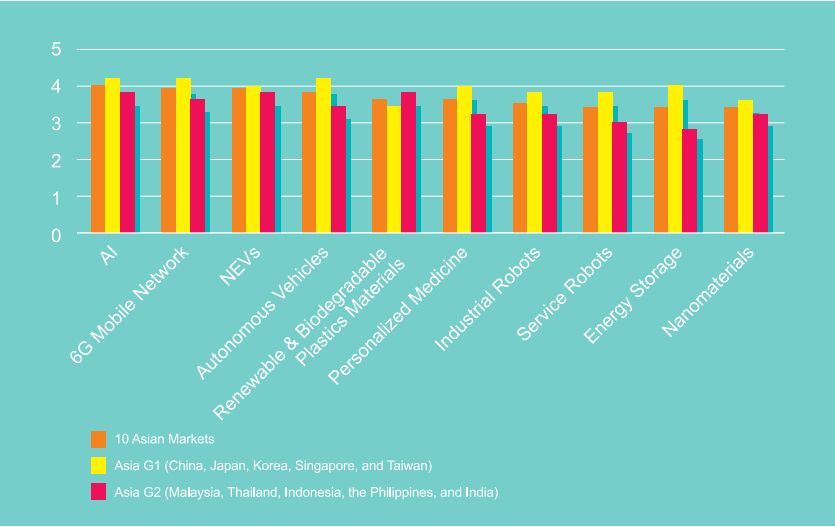


Figure 6. Asian Top-10 technologies ranked by investment priority.

2030 Robot Scenario in Asia: Demand on Assistance

Asian countries have a higher demand for assistance technologies such as robots or autonomous vehicles. Medical and care demand will increase due to aging societies, and low birth rates will lead to labor shortages. These demands will cause Asian countries to invest in related technologies. In 2030 Asia, industrial and service robots will reach a 20–30% penetration rate.

2030 Environment Scenario in Asia: Plastic Products No Longer the Enemy

Many Asian countries are rapidly developing their economies at the moment. Although the average per capita plastic usage is not as high as it is in Europe and the United States, Asian countries lack competent waste management, resulting in massive amounts of plastic waste flow into the oceans. Annually, environmentally friendly plastic manufacturing technology will become a very important key technology for Asian countries. It is estimated that, in 2030, local businesses in nearly every Asian country can commercially mass

produce environmentally friendly plastic materials.Southeast Asian countries have an abundance of agricultural resources, which is an advantage in developing bioenergy industries. Asian countries actively invest in bioenergy development, and this has partially become a major support for NEVs development as well. The countries also actively develop energy-storage technologies. Many renewable-energy power plants already have their own energy-storage systems that significantly solve unstable power generation problems.

Conclusions

In 2030, the world will face new challenges and opportunities in areas such as employment, multidisciplinary technology innovations, energy and the environment, and advanced medicine. These challenges are very different from what we face today. The year 2030 is less than 12 years away, and it is appropriate for enterprises and governments to choose advanced technologies in which to invest. It would be beneficial for Asian countries to prepare in advance and face the business opportunities brought by the changes of large-scale infrastructures

such as transportation, education, and medical care. Through the diversity of countries and cultures around the world, the primary goal of improving technology is to enhance the quality of daily life. We expect that, in 2030, digital technology, smart machines, green technology and energy, advanced materials, and biotechnology will keep playing important roles in improving the lives of people

By 2030, half of the world’s elderly and middle-class will live in Asia. Therefore, this region will be a major consideration when forming new consumption patterns. The 2030 Asia scenario shows a clean and convenient human–machine collaborative society that uses green energy and renewable materials. The scenario also shows the same human–machine collaborative society fulfilling the needs of an aging society. It was found that the 2030 Asian top10 technologies focused little on green technology and biotechnology but has demands regarding a clean environment and changing needs as its society ages. These gaps between advanced technology development and local demands might be excellent business opportunities for global and Asian research institutes and companies. ■

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About the Author



ISTI (Industry, Science and Technology International Strategy Center)

The Industrial, Science and Technology International Strategy Center is devoted to helping businesses in Taiwan meet revolutionary changes in a fast-moving knowledge economy. The Center aims to provide customers with value-added, multi-disciplinary information and services by using its ability to do in-depth research on industrial development. It is also able to forecast new trends in technology. The Center will promptly respond to clients’ needs in an ever-changing environment by coordinating vast R&D capabilities from its parent organization, the Industrial Technology Research Institute, and by connecting international networks that have been persistently cultivated for decades. With its knowledge management and active interactions with the government and industries, the Center is expected to help the nation gain competitive advantages and assist the business community to create value.

INTERVIEW WITH QUANTA CTO TED CHANG

Dr. Ted Chang believes companies should keep the startup spirit alive and adapt with the times in order to survive and drive business transformation.

Eden Lien



Thousands of startups have emerged as technological development continues to pick up speed and product life cycles become shorter and shorter. Being the world's largest notebook PC contract manufacturer, Quanta Computer has established comprehensive R&D capabilities and built a vertically integrated supply chain. What do they think about the relationship between startups and the supply chain and the influence startups have on the entire technology industry? We interviewed Dr. Ted Chang, CTO and VP/GM of Quanta Computer and the head of Quanta Research Institute. Dr. Chang interacts with hundreds of startups every year and has served as a judge for many innovation competitions.

1. Taiwan's startup environment has already seen significant changes. Please share with us your experience and opinions.

Every time I go to a startup event, I always say Quanta is a 31-year-old startup. Even big companies like Quanta need to innovate constantly. Why? They need to evolve and adapt to the changing market. Every time technological evolution takes place, from notebook manufacturing to cloud computing and AI applications, well-established companies have to go through the startup cycle again. To achieve sustainable development, technology companies need to keep innovating. Therefore, Quanta is actually no different from a startup.

To achieve sustainable development, companies have to continue to advance technologically. That means translating ideas into innovations and then creating a viable business model around them. A sustainable business model based on innovations can continuously create new products with complete life cycles. Seen from this perspective, all companies are essentially doing the same as startups.

The influence of the macro environment on startups can be dated back to 2018 when MIT established the Schwarzman College of Computing. This independent and cross-subject college brings together people of various backgrounds to create platforms for the application of data science and AI in different research areas. The aim behind this is to transform the world from the "computer era" to the "computing era." Quanta and its partners were able to meet clients' needs with respect to hardware devices during the computer era. With the development focus shifting to machine learning and data services, however, the value chain that we were familiar with has changed. Companies in the supply chain must adapt to this change. This is also what Taiwanese startups have been doing in recent years.

Taiwan's capital market is changing as well. Investors' interest has transitioned from physical devices to software or data-driven application services provided by startups. Adapting to the changing environment, government and schools are now

proactively in helping people acquire CS, data analyzing, and coding skills so that companies can readily recruit talents in these areas.

2. Taiwan has been known for its complete supply chain. What do you think about the changes in the industrial value chain driven by startups?

Unlike other places in the world, Taiwan has built a complete supply chain. Any innovative ideas, whether from large enterprises or startups, can be transformed into products in Taiwan. When products are realized, the market becomes more active and will start to scale up, leading to a growing demand for new products, higher quality, and affordable pricing. This is another competitive advantage of Taiwan's supply chain: providing affordable and reasonable manufacturing supply chain management for leading brands worldwide. Taiwanese suppliers are able to provide support at every stage of the product life-cycle management process. In some respects, startups are ODM vendors' future customers.

Many startups seeking partnerships with Quanta often ask us what we think about them and why we work with them. My reply is "I think you're Apple in its early days because they also started small." When working with startups, we focus on



"One unicorn company cannot make up an industry, nor can it prop up Taiwan's GDP because GDP must be sustained by a group of companies," said Dr. Ted Chang.



incubating future business opportunities, rather than searching for a one-time business opportunity. If we treat startups as one-time business partners, there is no chance that we will work with them because their orders are small and the risk is high. When we decide to take a risk, we always aim for long-term gains.

Akamai, for example, was founded in 1999 as one of the few providers of network solutions for content delivery. At that time, Taiwanese were unaware of the changes in networking technologies. However, Akamai saw potential opportunities and is now one of the largest players in its market. If you started manufacturing hardware for the company 20 years ago, you might now be in the same profitable business.

Another unique aspect of Taiwan is that all large Taiwanese companies have their eye on the global market. These companies have worked with Google, Apple, Amazon, Facebook, and other international companies in different ways. They know how to create a win-win partnership and respect their partners' copyrights. These are some of the critical factors in creating a new value chain.

3. Many people equate startups with branding. What do you think from the perspective of the supply chain?

First, you need to know that startups could be your customers or suppliers. Quanta's lobby is constantly packed with people from startups. Some of them are our customers who want us to manufacture a complete product for them, while others have value-added solutions that they want to insert into the supply chain. So each startup plays a different role in our partnerships.

We all want to secure a place in the industrial value chain. As long as we are recognized in the value chain, our existence will be meaningful and profitable. In the supply chain, some products have high profit margins while others don't. Also, some

products are more readily realized than others. Not every startup is engaged in branding activities. Some startups might just be a key component supplier, which will grow as their technological competences advance over time.

For example, when speaking of Rolls-Royce, the first thought that comes to mind is cars. Not many people know that aircraft engines manufactured by Rolls-Royce account for a large share of the aircraft engine market. Rolls-Royce is a brand for cars, while its aircraft engines are installed in other brands' aircraft. Is making engines profitable? Very profitable! So startups are not necessarily on the branding side of the supply chain. While brands usually take most of the spotlight, they might not be the biggest profit makers.

In a world where branding is highly encouraged, people tend to ignore the importance of the supply chain. Without backend support, the industry will not be the way it is now. Quanta is the world's largest system provider. Many companies in the supply chain know they can be a part of the global supply chain if their products are accepted and certificated by Quanta. They will then be able to sail around the world with Quanta. Taiwanese startups should expand their vision to encompass the whole value chain instead of focusing on places where the spotlight shines.

4. How do you define the “cool factor” of a startup? What do you think about the “cool factors” of Taiwanese startups?

What makes a startup cool? My answer is being bold, just like what Lester C. Thurow said in his book Fortune Favors the Bold: “be adventurous, willing to learn everything, and daring to venture into the unknown.” To be cool means overturning conventions, a concept similar to disruptive innovations. In contrast, Taiwanese companies generally focus on evolutionary innovations that come about gradually.

Invention and innovation are two cornerstones for tech startups. However, being innovative doesn't mean you are cool. How many people thought the iPod was cool when it was first released? However, it slowly changed the music industry and created new user experience related to the purchasing, downloading, and listening of music. The product gradually won people's hearts and positioned itself as being cool.

User experience is a cool factor because it helps people adapt to new usage scenarios. This phenomenon is more common in other countries. Taiwanese manufacturers, by contrast, are too focus on functionality and sometimes ignore the human element. Therefore, we hardly see products with a special twist. This happens to 80-90% of the teams we have seen.

I think this may also be attributed to the traditional business model in the industry. Taiwanese industries understand their customers well, but customers are not always the end users. For example, I know what Apple wants when selling them computers. However, I know little about the needs of Apple's customers, or the end users of the computers. If we can understand what purpose a product serves to the society, we can design it to meet the end-users' expectations. This is why considering the human element is so important.

5. Do you think we will see unicorn firms in Taiwan in any possible way? If the answer is yes, what kind of companies will they be?

I believe we will see unicorn companies in Taiwan. Don't forget Taiwan's achievements in hardware development. Taiwan has the world's best hardware manufacturing capabilities and that's why Google has increased its investments in Taiwanese talents. While the value of software increases rapidly, the value must be brought out through hardware. Therefore, unicorn companies will be those capable of integrating hardware and software.

The biotechnology industry will probably see major breakthroughs because this sector has the highest concentration of the best local talents next to the computer industry. However, the development of startups in the biotechnology industry may

be different from what we have seen in other sectors. Personally, I place high value on sustainability. Startups must be built on a sturdy foundation. They also must be irreplaceable in the global value chain.

One unicorn company cannot make up an industry, nor can it prop up Taiwan's GDP because GDP must be sustained by a group of companies. Furthermore, a unicorn company must have a long-term vision. Taiwan's industries have low entry barriers that allow local startups to easily enter the list of unicorn companies. However, these startups haven't thought about how to stay in business on their own for as long as possible without outside support. They need to plan for a journey of a thousand miles, if not ten thousand.


Taiwan's young people are very talented and capable of making their ways into the world. The institutions on this island already fostered many successful industry leaders in the past. As for young leaders at newly founded startups, their view on future competition will differ from that of the old guards. We don't need to measure of the success of new startups based on our past experiences and benchmarks.

6. How should Taiwanese startups enhance their engagement and exposure in the global market?


Startups can consider relocating their seed accelerators overseas. They need to constantly interact with other companies so they are not confined to a homogeneous group. Every startup must set its sights on the global market from the onset in order to compete with international companies and succeed. Ultimately, Taiwan's startups should not confine themselves within the island. They ought to recruit from both the local talent pool and the overseas labor markets.

Local startups are now actively attending events such as InnoVEX that is held from late May to early June. This type of events are effective in helping startups move in the right direction and understand their international competitors. I also hope that these events will promote a greater appreciation of Taiwan's values as they become larger and better organized. 🇹🇼


InnoVEX 2019




May 29–31, 2019
Taipei World Trade Center, Exhibition Hall 1




21
Countries




388
Startups



60+
Speakers



17,867
Visitors



696,324
Live Streaming

InnoVEX attracts international startups that showcase AI, AR/VR, Big Data & Cloud, Health & Biotech, IoT, and other innovative applications. In addition to the exhibition, InnoVEX also holds a packed schedule of forum sessions, pitch contest, startup demos, one-on-one business matchmaking, networking party, and more. Many well-known Venture Capitalists along with Accelerators came to join; both as a speaker and a participant of the events. InnoVEX forums and pitches are also broadcasted through live streaming platforms every year to make sure no one will not miss out. In summary, InnoVEX 2018 hosted:



SHOWCASING MOST INNOVATIVE TECH STARTUPS IN TAIWAN

Taiwan Tech Arena (TTA) is proud to present some of the most aspiring local startups that are leading innovations in the fields of AI, biotechnology, agricultural technology, and energy.

Daisy Kuo, Eden Lien, Stan Huang, Irene Chiang, Ryan Hsu, Emma Lin,



MAKING ARTIFICIAL INTELLIGENCE OMNIPRESENT

Kneron creates a complete software and hardware integration solution which enhances IoT device judgment and convenience of living

There are several contenders in the AI and IoT fields. How can startups break through? Kneron successfully carved its way into the market. In 2015, Albert Liu, founder and CEO of Kneron, had seen the increase in hardware computing performance. That is why he incorporated AIoT's intelligent edge computing into products. He began working with big companies to collect the necessary data for training AI, giving his startup a head start in the AI field. Kneron has partnered with Alibaba, Tencent, Baidu, Sogou, Arm Holdings, Qualcomm, TSMC, and Foxconn. They have helped Kneron catch the attention of investors, raising US\$ 33 million since the start of its business. Kneron's investors include Horizons Ventures, Alibaba Entrepreneurs Fund, CDIB, Himax, Qualcomm, ThunderSoft, Sequoia Capital's sub-fund Cloudatlas, and CYZone.

A Complete Solution, Making AI Omnipresent

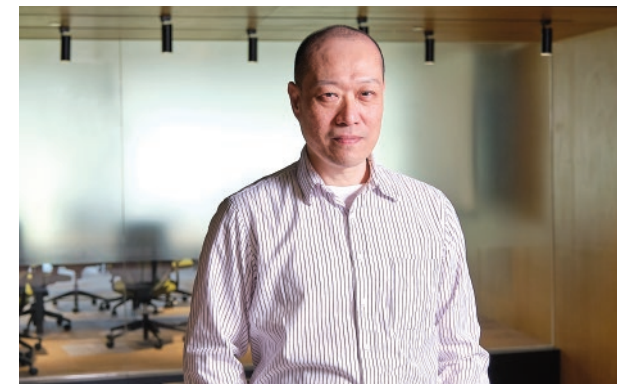
"Kneron's vision is to make artificial intelligence present everywhere! The scenes in science fiction movies have become

a reality. Whether it is images, voice, radio waves, or sound, with artificial intelligence, you can get a meaningful output for all of them," said Roger Liu, the COO of Kneron.

Therefore, from image recognition software, the terminal device-specific AI processor "NPU IP Neural Network Processor" to the AI SoC hardware, Kneron has created a complete software and hardware integration solution. The IoT is made even smarter with the AI solution, so that AI analysis of information like images and sound collected from IoT sensors enhances IoT device judgment and convenience of living.

Kneron provides various SoCs for different applications in the AI ecosystem. Kneron has created solutions not only for high-performance edge computing but lightweight and low-power consumption, providing a much more efficient computing architecture. Roger Liu pointed out, "We can be very efficient for each critical step. With our total solutions, Kneron makes its way into the AI ecosystem cycle."

"NPU IP Neural Network Processor is a terminal unit-specific AI processor with high-performance computing and low-power."



Roger Liu, COO of Kneron, believes the AI applications market is very large, but startups must define the technology, software, IP, and solutions, and lay them out in stages in order to establish products.



Kneron's NPU IP Neural Network Processor Series is a terminal unit-specific AI processor. It is low power and small but has extremely high-performance computing and excellent power usage effectiveness.

Kneron's solutions support three major applications. The first application is a mobile phone that supports AI smart scene detection, 3D modeling, or biometric camera lens for facial recognition or door security.

The second application is a smart home. The camera is used to detect body features; for example, when a child crawls to the kitchen from the living room or is near the furnace, an alert will be sent to the parents. If an elderly person falls, a notification will also be sent. The third application is security and surveillance, like notification of vehicle parking violations.

In terms of Kneron's competitive advantage, Roger Liu mentioned there are currently two types of AI chips. One of them is cloud computing provided by companies like NVIDIA and Intel; the other is Kneron's terminal unit computing, which is edge computing. This is how Roger Liu describes Kneron's AI

terminal computing: "Instead of the cloud, our terminal unit is the cerebrum and the application is the cerebellum. This gives the terminal unit automatic smart judgment."

The Three Stages of Entrepreneurship: Creating the AI chip and Solutions

Great dreams are not realized in one step. Roger Liu pointed out that the market for AI applications is huge. Startups face the challenge of how to define the technology, software, IP, and solutions, which need to be laid out in stages for products to be established. "We are one of the few startups that already have established products and revenue-generating AI solutions."

During the first stage of starting up, Kneron found a way into the market with neural network image recognition software, including facial recognition, body and gesture recognition, and item and scene recognition. Kneron made the company profitable through commercial software.

In the second stage in 2017, Kneron stepped up AI intellectual property core production and launched the "NPU IP Neural Network Processor," a terminal-unit specific AI processor. Albert Liu said that at the time, Kneron was working with investment companies and received recognition from international companies through the IP licensing model. Kneron carried out co-promotion agreements with large intellectual property core companies Synopsys and Cadence to establish their advanced technical products.

In the third stage, Kneron began planning AI SoC after financing was in place. In 2018, Kneron developed a total solution and will launch the first AI SoC product in the second quarter of 2019, focusing on the smart home market. In addition to working on the integration of AI SoC and industrial computers with Aaeon, Kneron will co-develop a terminal AI 3D sensor solution with Etron Technology.

This year, Kneron will expand recruitment and carry out a Series B funding round to find the next pivot for development. Kneron will also actively develop markets in Taiwan, Europe, US, and China, and ultimately, aim for IPO. 🇹🇼

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A VIRTUAL AI ANALYST FOR SECURITY EVALUATION

CyCarrier developed an AI engine with forensic platform to provide security from endpoints to global networks

“Many people are interested in my personal story, but what I want is to get people interested in what CyCarrier is doing,” said Jeremy Chiu, co-founder of CyCarrier Technology. In fact, Chiu has made a name for himself in the cybersecurity industry. Nicknamed Birdman, he was once hailed as a cybersecurity programming genius. With business acumen, he had established several companies before founding CyCarrier. In 2005 and 2011, Chiu set up two cybersecurity companies respectively, providing products and security services for the most challenging IT security problems.

Living out the Hacker Spirit with a Self-developed AI Engine for Security Threat Evaluation

Many people call him an entrepreneur, but Chiu doesn’t like to be defined that way. Just like other hackers, his initial intention was to develop new technology; starting a business was just a natural course. The two companies he established were both acquired, one by the NASDAQ-listed software company Verint

based in Israel, for a hundred times higher than its estimated value. This acquisition was unusual among Taiwanese and cybersecurity startups.

In 2017, Chiu founded CyCarrier with Benson Wu and Peikan Tsung. The three well-known hackers have developed an AI engine and created an automated security threat analysis and forensic platform. By providing protection based on the three elements of awareness, situation, and intelligence, the company has not only strengthened security weak spots but also significantly improved the response time to an attack.

“The first problem that CyCarrier tried to solve after being established was to reduce the IT staff’s time on insignificant work,” said Chiu. In recent years, we have seen an increase in the frequency and complexity of security attacks. Traditionally, IT staff must spend hours checking every computer in order to analyze the attacks and locate the sources, making it extremely inefficient for large companies with thousands or even tens of

“CyCarrier provides security analysis through its virtual AI analyst, leaving hackers nowhere to hide while presenting data visually.”

thousands of computers. “Chances are the companies would have to start over again after checking all the computers for weeks because a new problem occurred,” he added.

Another challenge facing modern IT teams is the difficulty in root cause analysis. After receiving system alerts, IT teams must figure out the relationship between the compromised and the attacking systems to clarify the hacker’s attacking route, in a bid to identify flaws. This process is time and labor consuming which often fails to keep up with the evolution of cyberattacks. Manpower shortages increase the difficulty of analysis.

“I think IT security services should be like remote medical services. When your computer gets sick, you go to the Internet, let an AI engine scan all potential causes, and have an online doctor diagnose the illness,” said Chiu. He likens CyCarrier to a software provider of remote medical services, which helps IT teams diagnose their systems in real time. CyCarrier’s virtual AI analyst can enhance the accuracy of the root cause analysis



CyCarrier provides continuous security analysis through its virtual AI analyst, leaving hackers nowhere to hide while presenting data visually.

and free up IT resources from forensic work to focus on critical management work.

Three IT Security Products Provide Comprehensive Protection for Government and Banking Industry

CyCarrier has developed three IT security products: next-gen MDR endpoint security system Xensor, AI-driven security operations center CyCarrier, and global CTI threat intelligence platform Cybertotal. These three products represent the three points of a security triangle.

Built on an AI remote forensic engine, Xensor uses multi-source auditing and memory scanning to generate endpoint environment logs without transmitting any endpoint files over the network. Auditing, a term originating from taxation and accounting, means to compare, compute, and check data to identify any tax evasion attempts or errors of omission. In the field of IT security, it means to locate the relationship between systems. With the ability to complete scans in ten minutes and transmit less than 1MB of data per day, Xensor has changed people’s impression of IT security systems that have long been perceived as cumbersome. This illustrates the key element of CyCarrier’s technology.

CyCarrier provides continuous security analysis through its virtual AI analyst as well as a team of top-level security experts. IT teams can gain insights into attacks marked in different colors and sizes on a visualized control panel. Cybertotal facilitates joint cyber security exercises and intelligence sharing, allowing customers to get a hold of hacker information through its one-click comparison of global threat intelligence.

Focusing on the government sector and the banking industry, CyCarrier helps its customers perform real-time scanning and monitoring, while automatically and rapidly identifying threats and verifying security alerts. CyCarrier co-founder PeiKan Tsung previously worked in the IT department of the National Policy Agency. His deep understanding of police agencies’ needs has led to close ties between CyCarrier and police stations. In the upcoming year, CyCarrier plans to tap into the Southeast Asian and Japanese markets with the funds obtained from Temasek Holdings, providing the fastest threat intelligence and security products for global IT teams.



THE FUTURE OF MOBILE SURVEILLANCE TECHNOLOGY

BOVIA expands into AI edge computing for mobile devices used by those serving on the frontlines of public safety

Imagine that tens of thousands of people have converged on the city center to celebrate New Year's Eve, resulting in congestion of the local wireless network causing poor mobile signal reception. How will the frontline police officers who are responsible for keeping public order and safety communicate with one another and report back to their respective precincts? Recent technological advances have created wearable cameras that enable today's officers to send live video of their locations back to their command centers. In case of emergency, real-time monitoring of the ground situation makes the effective deployment and command of the police and emergency response personnel possible. Many of the hardware and software behind the latest live streaming body cameras worn by law enforcement officers worldwide are currently supplied by BOVIA Co. Ltd., a Taiwan-based developer of mobile video surveillance systems.

"Our integrated solutions can keep the image quality at its highest even when the streaming videos are transmitted from

an area that is crowded with people and lacks strong mobile signals," said Kevin Yu, the founder of BOVIA.

Traditional law enforcement agencies have been facing enormous challenges as policing and investigative activities enter the high-tech age. CCTV networks and other stationary surveillance equipment have limitations that prevent frontline personnel from taking in the whole situation when carrying out their duties. As for the older generations of portable surveillance technologies such as handheld cameras, they can record what is happening but lack functions that enable law enforcement agencies to assist their frontline personnel in real time. To address the need to maintain seamless visual communication, BOVIA has developed Intelligent Mobile Surveillance Solutions that law enforcement officers can use to record high-resolution videos and send them back to their command centers without delay. Law enforcement agencies that receive videos of unfolding events live streamed by their personnel on the ground will be able to rapidly and fully grasp the developing situations.

In addition to policing and criminal investigation, BOVIA's technologies can be deployed in a wide range of related applications including firefighting, disaster response, factory inspections, etc.

Before founding BOVIA in 2015, Yu had engaged in the R&D of cloud services and technologies pertaining to video compression and streaming for 12 years at Taiwan's Industrial and Technology Research Institute (ITRI). Yu saw that the streaming technologies developed at ITRI were ahead of other existing streaming technologies in the domestic and foreign markets. Toward the end of his time at ITRI, Yu felt that it would be rather disappointing if the technologies from the institute were not commercialized and released to the market. After finding no suitable candidate for the technology transfer, Yu decided to launch his own startup with several business partners.

Building a Brand Name in Intelligent Mobile Video

BOVIA is currently targeting the mobile surveillance market and develops wearable surveillance devices in-house. The company boasts of having the ability to rapidly design customized products for its clients. "We specialize in making a wide variety of equipment, accessories, and even matching uniforms in small quantities," said Yu. "While other providers of mobile surveillance technologies usually take at least half a year to develop a product, we can do it in just two to three months."

Yu also noted that his company's technologies are adopted by over half of Taiwan's law enforcement agencies. Since its founding, BOVIA has supplied products to a total of 30 law enforcement agencies at home and abroad. BOVIA's clients are mainly the principal law enforcement and criminal investigation agencies in Taiwan, including the National Police Agency. Another major client is the Singapore Police Force. Besides working with law enforcement agencies, BOVIA has also provided integrated patrol (guard tour monitoring) systems and inspection systems to clients such as Taiwan High Speed Rail Corp., the Far Eastern Group, and the organizing authority of Taiwan's International Flora Expo. For example, BOVIA is responsible for the integrated patrol system that is deployed in Taipei Far Eastern Telecom Park.

Three Business Models Ensure 90% Customer Retention Rate

BOVIA has adopted three business models during the course of its development. The first model, which was pursued during the foundational period, was to establish the company's brand by providing customized services for major clients in the target market. After moving from the initial phase of development, BOVIA launched its second business model that involved the licensing of whole technology systems. Each technology system, or integrated solution, encompasses hardware equipment and software modules. It may also include AI-based solutions.

According to Yu, sales of integrated solutions currently represent the main source of revenue generation for BOVIA and contribute to the rapid growth of the company's operations. The third and latest model that BOVIA has adopted pertains to cloud services and the leasing of frontend equipment. Yu anticipates that these two ventures will attract many new clients in the near future and provide a steady revenue stream. Furthermore, BOVIA through the latest business model will be able to accelerate its expansion into different market segments and diversify its client base.

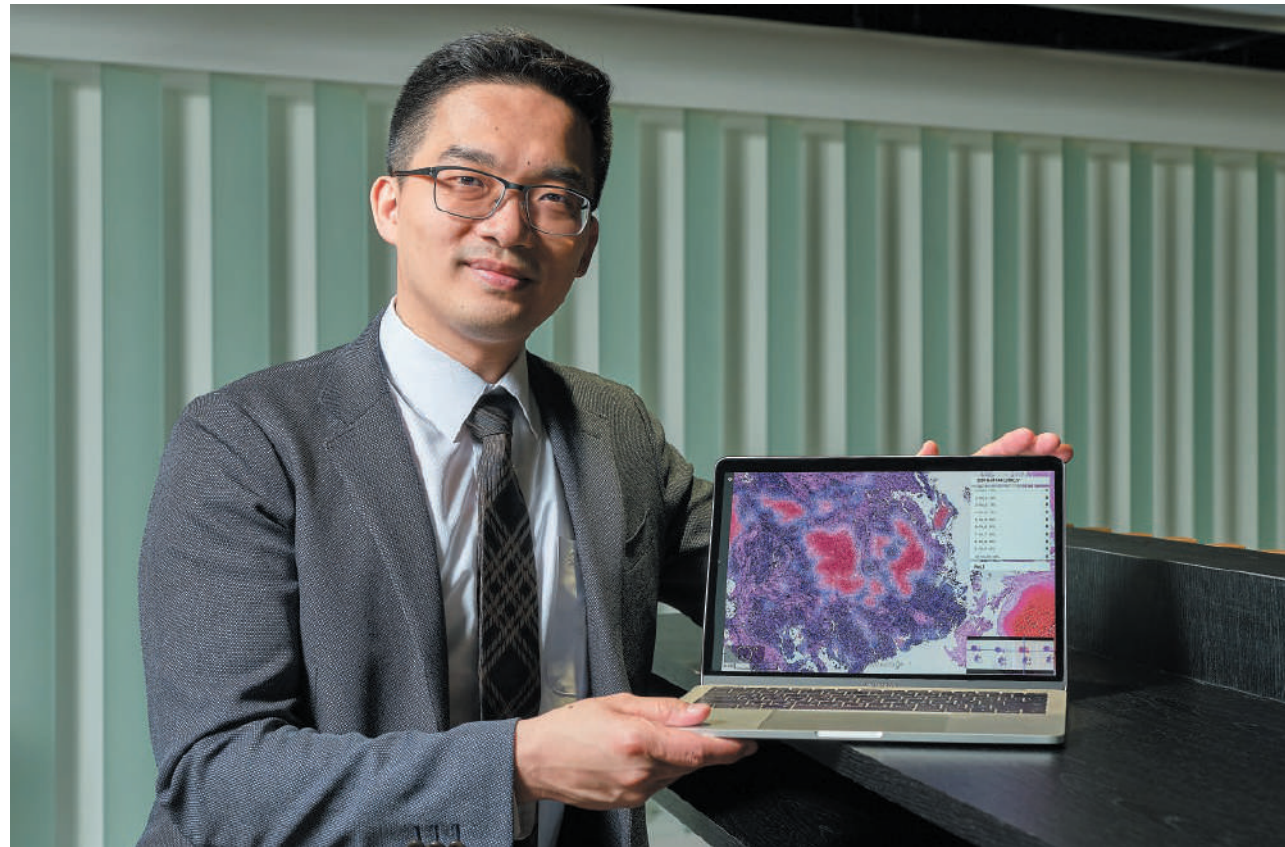
Expanding Market Presence with AI Edge Computing

"An AI-based solution will not be effective or stand out if it does not have an application area to enter and data to analyze," said Yu. With that view in mind, BOVIA has leveraged its core expertise in mobile video technologies to develop AI edge computing for mobile and wearable devices. Yu explained that edge computing can overcome some shortcomings of the current cloud-based AI technologies used by law enforcement agencies. Typically, law enforcement officers who are on duty and responding to incidents record video footage of their respective situations with their portable or body cameras. The footage is then uploaded to cloud computers, where image data are intelligently processed and analyzed by AI systems for tasks such as facial recognition.

However, this back-and-forth transmission of data is too slow to allow agencies to make real-time decisions when directing frontline personnel. BOVIA addresses this particular problem by incorporating AI edge computing directly into its surveillance gear. This allows data analysis to be done at the device level. BOVIA has stated that it is working on AI edge solutions that can support applications such as facial recognition, license plate identification, object classification, sound analysis, etc.

Yu sees his company as a pioneer, creating a whole new market where none previously existed. In addition to the challenging subject of video live streaming, the supply chain for mobile surveillance technologies spans across many fields, including telecommunication, wearable devices, IoT, cloud computing, and AI. BOVIA's products and services not only add to the existing market for surveillance systems, but they also constitute a new market with high growth potential.

Yu said the following when looking at his entrepreneurial experience: "We have managed to establish a beachhead with limited resources. The next step will be enlarging the market and increase its value." BOVIA will be launching a new campaign to expand its international presence in the second half of 2019. The international markets that the company is targeting include Southeast Asia, Europe, and the US. BOVIA also aims to become a listed company within the next three years. 📈



CREATING A WORLD-CLASS AI MEDICAL IMAGING COMPANY

aetherAI digitizes microscope images with identification ability equal to that of a pathologist

“My goal is to create a world-class AI medical imaging company in Taiwan and showcase Taiwan’s technology to the world.” said Dr. Joe Yeh, Co-founder and CEO of aetherAI.

After graduating from the National Taiwan University College of Medicine, Dr. Yeh went to the United States to pursue a Ph.D. in pathology. In 2015, he happened to come across microscopy and program design as well discovering his interest in writing programs. When he was helping others in the lab solve microscope problems by using programs, he found the lab needed to digitize images of tissue slides to put them on a website. Dr. Yeh said, “When I saw the completed digital microscope images, I felt the slides had great potential. I believe that in 5 to 10 years, digital microscopy will be indispensable in the laboratory.” With digital microscopy, doctors and pathologists no longer need to mail the microscope slides back and forth to each other when discussing case reports. They could communicate over long-distance by simply sending a link to the digital microscope images.

The Revolution of Pathology and Digital Microscopy

Digital microscopy will have a massive impact on medicine. That is why Dr. Yeh, a pathologist, decided to learn program design to combine the medical profession with information technology. In 2015, Joe Yeh, Billy Kan and Steve Yeh officially became entrepreneurs when they founded aetherAI. The name of the company was inspired by cloud images.

aetherAI established the “Digital Pathology Imaging Platform” and explored the demand for whole slide image analysis to be put on the cloud. Clients need only provide tissue slides that are then scanned and uploaded to the cloud database.

However, aetherAI realized that digital pathology software and hardware were already in development for a decade. Hospitals and doctors would not be interested in using such an expensive software and hardware for digitizing microscope images. Thus, aetherAI started exploring new segments to find its own place

“The identification rate by the AI model for digital microscope slides of nasopharynx cancer is as high as 97%.”

in the market. With the booming of AI, Dr. Yeh believed that the development of an AI medical imaging company would play an important role in the area of digital pathology.

At first, Dr. Yeh did not understand AI at all. So, he decided to learn AI technology himself and dived into the world of AI medical imaging. This was the crucial turning point for aetherAI.

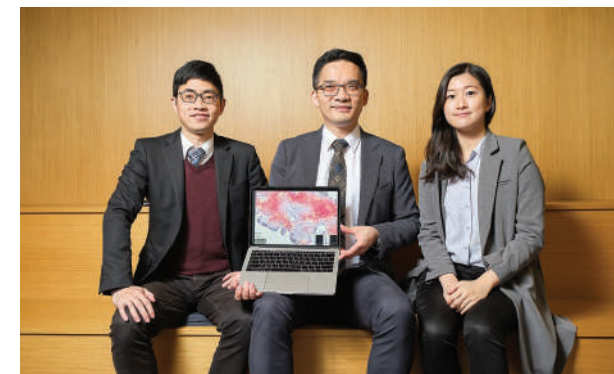
aetherAI is AI Medical Imaging Development Platform with Supervised Learning

In 2018, the company launched the AI medical imaging development platform “aetherAI.” aetherAI worked on digital pathology with the National Taiwan University Hospital and Chang Gung Memorial Hospital, as well as conducted academic research with the Taipei Veterans General Hospital. The hospitals provided valuable information and professional materials, and aetherAI trained the AI model. Currently, there are already 10 different types of data sets.

One of the things that doctors dread is counting. For example, putting 500 cells of a bone marrow sample into 40 categories. With AI, pathologists can save effort, and categorization can be completed very quickly.

In addition, pathologists often need to answer the question of whether the sample indicates there is cancer. Through the medical imaging development platform, AI can scan and check for cancer first, which will significantly shorten the workflow.

aetherAI uses supervised learning where AI can learn the details of numerous microscope slides labeled by pathologists.



aetherAI team members (left to right): Adam Yen (Business Development Director), Joe Yeh (CEO & Co-founder) and Phoebe Liang (Marketing Manager).

aetherAI’s identification ability is now surprisingly equal to that of a pathologist. Using nasopharynx cancer as an example, 300 microscope slides were labeled, and the subsequent identification rate by the AI model for digital microscope slides of nasopharynx cancer is as high as 97%.

AI Deep Learning Shortens the Time for Labeling Microscope Slides

However, a lot of details need to be labeled for one digital microscope slide. Pathologists can only finish one to three slides a night. There are usually hundreds of slides for one case, taking six to nine months to label the details.

It is very time-consuming to train a model, which is why aetherAI tested new models. This year, the deep neural network is being applied to microscope slides. But computing would be too exhausting if a large image is used to train the neural network.

The current method commonly used is for doctors to label the details of the actual location of cancer in a wide region and divide that region into small pieces to ensure each piece has the correct answer, which will also enhance identification. However, labeling will take a lot of time this way. aetherAI has introduced AI training for whole slides, and only clinical diagnosis results are needed for training in the future. Dr. Yeh points out: “Saving time for labeling details means shortening development time by one-quarter.” AI can still quickly and accurately determine whether a microscope slide image indicates cancer.

There are 25 medical centers and approximately 75 regional hospitals that need digitization in Taiwan. Thus, aetherAI predicts the digital pathology market in Taiwan will reach US\$ 65 to 130 million in 5 years.

In 2019, aetherAI received US\$ 1.1 million seed round investment from Cathay Venture. aetherAI plans to expand the business to the US and develop “AI pathology procedures” simultaneously. aetherAI will focus on applying AI to the biotechnology pharmaceutical industry, conducting pathology identification for companies’ samples, and making AI models to label cancer, which will accelerate the biotechnology pharmaceutical development process. 🏢

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TAIWAN MAIN ORTHOPAEDIC BIOTECHNOLOGY

The world's first orthopedic surgical glasses shorten surgery duration time by 30%

The large-scale global minimally invasive medical market has led to the rapid development of imaging equipment. With the continuous innovation of AR, VR, and MR, whoever is first to apply these technologies to current medical procedures and help surgeons see accurate images, especially high-risk surgeries, will be the rising star of the medical industry. The Taiwan Main Orthopaedic Biotechnology Ltd., founded by Dr. Min-Liang Wang of NCUT, has formulated the world's first domestically developed smart surgical glasses solution that not only reduces spinal surgery complexity and errors, but also surgery duration.

In the past, during orthopedic surgery, doctors relied on surgical monitors to position the scalpel. However, this method goes against natural human tendency and is prone to errors. The surgeon would also require a great amount of experience to make accurate determinations, making the cultivation of young surgeons difficult. Another problem, due to the position and angle, the surgeon is the only one with the operating view. Therefore, it is difficult for other doctors or the surgical team

to provide immediate assistance. The smart surgical glasses solution can instantly display X-ray images while worn by doctors. The information includes images and data of patient tissues and bones. Surgeons no longer need to go back and forth between monitors and X-ray data. Through the smart glasses, surgeons can see the correct location of the tissues and bones inside the patient and accurately position the scalpel, effectively shortening surgical duration time by 30%.

The Product Evolution of Smart Glasses for Orthopedic Surgery

At present, Taiwan Main Orthopaedic Biotechnology Ltd. has developed first- and second-generation products. The first-generation product Foresee-X incorporates the operative field into the surgeon's vision with AR technology. Virtual and actual images are superimposed, and patient bone structure and tissues are fully visible through the smart glasses. In addition to improving overall surgical efficiency, smart glasses can reduce

“The glasses can eliminate the need for tens, and even hundreds, of X-rays during a single surgery.”

radiation exposure by more than 60% compared to the mobile C-arm X (C-arm X-ray system) commonly used by surgeons.

The second-generation product Caduceus combines MR with first-generation technology and upgrades images from 2D to 3D. Its QR code and alignment marks help surgeons accurately align the image with the patient's body, just like GPS. With similar navigation functions, surgeons can position the scalpel down to 1.5mm. Thus, the product can be used for spinal surgery that has a higher risk and is more difficult. The post-surgery incision is smaller, the patient recovers faster, and preoperative set-up time is shortened to approximately 8 minutes.

The third-generation product is about to be launched. In addition to first- and second-generation product functions, it also has a smart interactive function. The third-generation product uses preoperative image interpretation and diagnostic information for surgical planning and can immediately inform the surgeon the next step to take during surgery. Its machine intelligence can assist surgeons in making decisions. The team has also improved the entire system, making it lightweight and portable. Doctors do not need to connect it to a computer for calculation through another cable. They can just connect it to a microcircuit board. Furthermore, the third-generation product will be applied more comprehensively. For all surgeries that require the surgeon's attention to stay fixed on the monitors such as endoscopic surgery and microsurgery, smart glasses can help the surgeon position the scalpel accurately.

The Key to Core Technology

“The key to smart glasses is the algorithm.” Dr. Wang pointed out the most challenging technology is superimposing images and focusing the eyes. “Since each person's eyes have a different focal length, and with the addition of camera lens focus, synchronization would require the aid of high-performance computing.” Furthermore, if the surgeon changes position during surgery, the image must be adjusted immediately for the new position. All of this can only be achieved by the development of cutting-edge technologies such as 5G and AR/VR.

In addition to continuously optimizing technology, Taiwan Main Orthopaedic Biotechnology Ltd. has also carried out a global patent strategy. There are currently 12 patents approved or applied for. The first-generation product Foresee-X received CE, FDA, and TFDA approval in 2018, allowing it to be launched



Smart surgical glasses help surgeons see accurate images of bones and tissues, simplifying surgical complexity. Surgeons do not have to go back and forth between monitors and X-ray data.

officially. “The smart glasses market is a monopolized or oligopolistic market. Our competitors are all big manufacturers. But, I really like the challenge because it means the potential of this market is recognized.” Dr. Wang revealed that the company has already signed a contract with a big German manufacturer for future cooperation.

Market Feasibility and Prospects

“Step by step, Taiwan Main Orthopaedic Biotechnology Ltd. has proved its clinical applicability, and willingness to improve our products,” Dr. Wang stated. At present, in addition to working with three hospitals in Taiwan and accumulating 107 clinical cases, Taiwan Main Orthopaedic Biotechnology Ltd. has also expanded abroad to conduct clinical trials with Malaysian hospitals. Currently, 50% of the market lies in the US and the rest in Europe, South America and Southeast Asia. Taiwan Main Orthopaedic Biotechnology Ltd. has established a factory in a Central Taiwan Science Park, which produces 100 sets of equipment each year. “The revenue for 2018 was US\$ 210,000, and our global clientele surpassed 850 companies. We also have 8 exclusive agents around the world.” Dr. Wang said. In order to lead the world-class medical market and define the value of Taiwan, Taiwan Main Orthopaedic Biotechnology Ltd. plans to hold fundraising for the first time. The funds will be used for marketing, working with doctors, and tradeshow. The hope is that an IPO will be obtained in three years. ■

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POPULATION AGING: A GLOBAL PHENOMENON

Aprinoia Therapeutics develops Tau proteins diagnostic reagent to fight against Alzheimer’s disease

Population aging is no longer just a news headline. It is now a stark reality in Taiwan society, as well as many other developed countries all around the world. Neurodegenerative diseases, with Alzheimer’s being the most prevalent, are undoubtedly one of the worst nightmares of an aging society. However, Aprinoia Therapeutics, a startup in Taiwan, has developed relevant diagnostic reagents and drugs that are a glimmer of hope for patients with neurodegenerative diseases.

Alzheimer’s Breakthrough: Tau Proteins

Dr. Ming-Kuei Jang, the founder of Aprinoia Therapeutics, once participated in the cooperative research of Dr. Makoto Higuchi of QST (National Institutes for Quantum and Radiological Science and Technology) in Japan. He wanted to put the QST’s Tau proteins diagnostic reagent technology to use in the market. Not long after Dr. Jang gained experience in pharmaceutical companies and funds management, he founded Aprinoia Therapeutics, in 2015. He then hired Dr. Paul Tempest, a co-

worker at Merck, to lead the medicinal chemistry research team. His first task was to tackle tauopathies.

Among the three recognized diagnostic standards of Alzheimer’s in the world, Aprinoia chose Tau proteins, with a strong correlation to the onset of the disease, as the research object. The pathological changes of Tau proteins affect motor nerves in the brain and are the cause of many neurodegenerative diseases. Aprinoia has already developed a second-generation Tau proteins diagnostic reagent and will conduct a second phase of clinical trials. Aprinoia will go on to develop a third-generation diagnostic reagent that is more convenient to use, as well as diagnostic reagents for Parkinson’s disease.

Dr. Chin-Yin Tai, Aprinoia’s vice president of drug discovery, pointed out that although Alzheimer’s diagnostic reagents are being developed by other pharmaceutical companies, the competitors’ reagents can only detect three variants of Tau proteins. Aprinoia’s diagnostic reagent can detect all six. In

“Aprinoia has already developed a second-generation Tau proteins diagnostic reagent that can detect all six variants of Tau proteins.”

addition to detecting pathological changes of Tau proteins with greater accuracy, the reagent can also detect neurodegenerative diseases other than Alzheimer’s.

Once the diagnostic reagent is developed, it can be licensed to foreign pharmaceutical companies. Dr. Tai said that many pharmaceutical companies are currently conducting clinical trials of tauopathy therapeutic drugs. Aprinoia’s diagnostic reagent can help companies with detection. In the future, a tauopathy drug for Alzheimer’s will still require a diagnostic reagent for further detection, which is why it has great market potential. At present, Aprinoia has already sold usage rights for the first time, generating the company’s initial revenue.

Aprinoia is targeting the European, American, Chinese, and Japanese markets, and has already been stationed in China and Japan to promote diagnostic reagents. Dr. Tai specifically mentioned that Aprinoia’s strategy for Asia has advantages over its competitors. If Aprinoia breaks into the market first, it can establish a competitive advantage.

Working with International Pharmaceutical Companies to Develop Drugs

In addition to diagnostic reagents, Aprinoia is invested in developing drugs for Alzheimer’s. The drugs also provide therapy for pathological Tau proteins and are classified into large molecule and small molecule drugs. The large molecule drug is an antibody that binds to pathological Tau proteins in the brain and promotes the clearance or blocks the spread of the proteins. The small molecule drug is a compound derived from a diagnostic reagent, and the one that is suitable for oral administration with low toxicity is selected for therapy.

Both drugs are in the late stage of development. Aprinoia aims to obtain American FDA approval for clinical trials in 18 months. However, due to the large amount of funds needed for clinical trials, especially for neurodegenerative diseases like Alzheimer’s that require 3 to 5 years of experimentation, the third phase of a clinical trial will cost an astronomical figure—hundreds of millions of US dollars.

Therefore, Aprinoia is seeking cooperation in early discovery with international pharmaceutical companies. In addition to gaining resources and funds from these companies, this will also secure future sales channels for the drugs. The international



“Aprinoia has already developed a second-generation Tau proteins diagnostic reagent that can detect all six variants of Tau proteins.”

pharmaceutical companies can reduce their cost for drug development as well. Moreover, as long as the drug passes the new experimental phase, the international pharmaceutical companies will provide payment, making the drug profitable before it even hits the market.

Rooted in Taiwan, We Aim for the World

The greatest challenge for Aprinoia is neither technology nor funding. Dr. Tempest, the senior vice president of drug discovery, admitted that the most difficult part is adapting to drug regulations, which are different in each country. For example, China and Japan stipulate that drugs must be produced domestically, so Aprinoia must commission manufacturing to local partners to get in the market. Dr. Tempest also mentioned that for Aprinoia to reach the next level, it would need people who are familiar with, and can adequately handle, the regulations in various countries.

In this aging generation, neurodegenerative diseases are not just one of the greatest challenges of Taiwan’s society, but also a serious problem in many developed countries. Dr. Tai emphasized that Aprinoia’s vision is to find a solution to neurodegenerative diseases such as Alzheimer’s. “This is our top priority. Everyone is working diligently towards this goal,” said Dr. Tai, “We would continue to look for Taiwanese investors so the company can stay rooted in Taiwan.” In addition, Aprinoia hopes more foreign investors would support the company in realizing its vision—to transform an aging society. 🇹🇼



THE SURGICAL ACCURACY REVOLUTION

Brain Navi Biotechnology navigation system opens up new opportunities for brain surgery

On November 7, 2018, the NaoTrac autopilot surgical navigation robot, created by Brain Navi Biotechnology, completed the first human brain surgical navigation test in Taiwan. During ventriculostomy, NaoTrac accurately implanted a drain into the designated site according to the surgical path planned by doctors. After more than four years of hard work, Brain Navi Biotechnology can finally enjoy the spotlight.

Creating an Accurate Brain Surgical Navigation System—The Successful Physician Entrepreneur Has a Breakthrough

“Our vision is to develop innovative navigation and robotic techniques for surgeons to improve accuracy, streamline surgical procedures and reduce the learning curve,” said Dr. Jerry Chen, the founder of Brain Navi Biotechnology.

Dr. Chen is a surgeon with a Ph.D. in biomedical engineering. He is also a member of the seventh Stanford-Taiwan Biomedical

Fellowship Program (STB). But this is not his first venture. After returning to Taiwan from the STB program in 2012, Dr. Chen and two other STB members founded iXensor, a company that focuses on mobile medical diagnostic technology. iXensor participated in the CES in 2018 and will soon go public. The reason for starting another company in 2014 and creating Brain Navi Biotechnology that focuses on brain surgery navigation system was to resolve the difficulties of being a surgeon.

“Surgery is a very strange occupation. When you have the physical strength, you do not have the experience. When you have gained the experience, you have lost your strength. Neurosurgery is the most complex surgery of all. That is why I chose brain surgery as the subject of my venture,” Dr. Chen pinpointed the real problems surgeons are confronted with.

Using neurosurgery as an example, the current method to find brain lesions requires the doctor to examine the surgical site before surgery by CT scan, and then slowly look for any lesions

“Compared to the navigation system worldwide, which takes 20 to 30 minutes, NaoTrac’s current positioning time needs only 3 to 5 minutes.”

from the site during surgery based on experience. However, every surgeon’s technique is different, so the damage and severity of damage on the brain will vary. Thus, the outcome of surgery often depends on the experience and skills of the individual surgeon. Unfortunately, experience and physical strength are often unbalanced, increasing the risks associated with surgery.

NaoTrac Can Standardize Surgical Procedures and Reduce Risks of Surgery

If it is just to improve surgical accuracy, then general-purpose robots like the da Vinci Surgical System is a good option. But one of the key aspects of brain surgery is surgical path planning and decision. How to extract from experience, plan the appropriate path and ensure execution according to the path during surgery will be the key to reducing surgical risks. This all depends on the surgical navigation robot.

Therefore, starting with pre-surgical assessment and planning, the NaoTrac autopilot surgical navigation robot can display all kinds of surgical paths in the past as well as the potential loss of function of each path. The visual presentation helps doctors and patients discuss the appropriate path with each other, improving the doctor-patient relationship.

After confirming the surgical path, the robot can then accurately deliver the instrument to the designated site during surgery according to the path planned. This way, doctors can achieve their goals like targeted tissue sampling while minimizing the loss of tissue and also monitor the entire surgery through integrated imaging. When the risk is reduced, the learning curve of young doctors is also significantly reduced, making brain surgery less of a mystery.

High Accuracy with Error Less than 2mm—Brain Navi Masters Key Technologies

However, the greatest difficulties for a brain surgical navigation system are still accuracy and how to perfectly link a patient’s brain image to the actual brain structure with imaging software. In contrast to other navigation systems that use infrared three-dimensional positioning, Brain Navi Biotechnology uses machine vision technology with proprietary software that combines a patient’s CT scan and MRI with machine vision. The high

accuracy rating with an error between 0.2 to 2mm. Dr. Chen said NaoTrac’s current positioning time needs only 3 to 5 minutes. Compared to the navigation system worldwide, which takes 20 to 30 minutes, NaoTrac’s technology obviously has a great competitive advantage with both accuracy and timing.

In addition to getting a head start, the reason why Brain Navi can surpass the performance of other competitors is that the company employs outstanding doctors, researchers and developers in Taiwan to combine technical and clinical application experience, developing products driven by demand. In the future, NaoTrac will conduct brain biopsies, Parkinson’s disease brain implants, and even surgeries that require accurate positioning and quantification like brain cell therapy.

The Market Will Reach US\$ 20 Billion Annually—Bright Future for Surgical Navigation Robots

According to the report “Robotics in Healthcare: Benefits and Opportunities” published by IDC Healthcare Insights, medical institutions in Asia-Pacific (excluding Japan) spent US\$ 3.73 billion on robotics in 2018. It is estimated to reach US\$ 7.03 billion and around US\$ 20 billion worldwide by 2022. Among them, surgical robots will be the most widely used robotics in Asia-Pacific. Additionally, market enthusiasm is evident from the frequent acquisitions made by medical giants in recent years. Dr. Chen revealed that several large international companies are following Brain Navi’s development.

The next step for Brain Navi is to complete certification, apply the navigation system to other surgeries that require accurate positioning and quantification, and expand to overseas markets. Currently, Brain Navi has already obtained 18 patents in Taiwan, USA, Japan, and Korea, and is ready to apply FDA and CE mark this year. Experimental research on applying surgical navigation to other fields is also underway.

In mid-October, Brain Navi will set out for the Congress of Neurological Surgeons Annual Meeting 2019 to present new technology and product. This will be Brain Navi’s first official appearance abroad, and we believe it will successfully pique the interest of many large international companies. ■



BEST BUILDING ENERGY MANAGEMENT SOLUTION

Verdigris’s AI-powered smart meter provides insights into power consumption

Verdigris’s initial intention was to solve soaring electricity bills of uninhabited houses, but ended up developing a solution capable of reducing power consumption by 40% for buildings worldwide. Mark Chung, co-founder of Verdigris, says the main reason that so much electricity is wasted is that users don’t know where energy is being consumed. Focused on finding a solution, he utilized his specialty to create a system capable of monitoring and managing electricity consumption of all appliances.

Smart Meter and Energy Management API Driven by AI Algorithms

Before starting his business to solve energy consumption problems, Chung was engaged in a deep package inspection project at his previous company where he developed algorithms capable of identifying and inspecting specific data packets from different objects or application streams. After spotting unusual electricity usage at his house, he decided to track down the problem. Struck with sudden inspiration, he applied

the algorithms to an electricity meter. He realized that every appliance consumed power in a specific way and devices consuming electricity could be located easily by identifying the features of each loop and waveform.

After the founding of Verdigris, Chung decided to focus on hardware and software development at the same time while targeting building energy management in the business market. The company’s smart meter is incorporated with a high-frequency sensor to detect complete waveforms. Before being converted to digital signals and uploaded to the cloud for AI computing, the current detected from the current transformer must first be computed and compressed at the edge. This has lead Verdigris to be deeply devoted to signal processing techniques to prevent any signal distortion.

Software-wise, its AI-driven energy management API will send power usage alerts, predict the amount of electricity used, and analyze power consumption behaviors of electric appliances in

“Tapping into the market with smart meters and EMS, Verdigris has worked with more than 50 customers from 9 countries”

a loop (weekly, monthly, and hourly) to identify unusual voltage patterns or devices consuming electricity during peak hours. The data is then shown in a visualized format.

The biggest difference between Verdigris’ system and traditional SCARD (Supervisory Control and Data Acquisition) systems for energy management is that SCADA systems usually operate on-premise while Verdigris’ system will transmit electricity consumption data to the cloud. When current monitored by the smart meter changes, the system will be updated synchronously so that AI algorithms can analyze each loop more precisely and provide detailed improvement suggestions.

Verdigris’s Tailor-made Solutions with Ease of Use and Installation

“Most residential users won’t install smart meters and energy management systems just to save a little electricity. However, many enterprises rack their brains to find out the most power-guzzling devices. Therefore, an easy-to-install solution with precise measurement will get their interest,” said Chung. Verdigris’ devices can be easily clamped onto a distribution board so end users can install the device with the help of a licensed technician. Verdigris provides online customer service, software technical support, and hardware warranty services.

After the smart meter on the distribution board collects power consumption data, the data will be sent to the cloud via Wi-Fi, Ethernet, or NB-IoT networks. Observing the energy management needs of large telecoms’ customers, Verdigris has worked with Verizon to upload data via 4G networks, thus creating a comprehensive ecosystem for customers.

“Besides reducing power consumption, many enterprises are more concerned about keeping their equipment running without interruptions and preventing unplanned downtime in order to ensure their production lines operate smoothly,” Chung added. This is why Verdigris helped the biggest online retailer in the US find out why electricity use at one of its warehouses remained consistently high. With Verdigris’ smart meter and energy management system, the retailer realized the root cause was a flaw in its robot charging system, causing the warehouse to pay an extra US\$ 45,000 per month for four consecutive years. The same flaw was found in hundreds of the retailer’s other warehouses across the US. After identifying the cause, the retailer now saves a huge amount of electricity every month. In

addition, they no longer need to delay shipping due to production line downtime in order to check equipment failure.

Collaboration and Market Expansion

The split meter segment of the EMS market is expected to reach US\$ 9.2 billion in 2019 with a CAGR of 20-25%. Tapping into the market with smart meters and energy management systems, Verdigris has worked with more than 50 customers from nine different countries with 90% of its business concentrated in the United States and Korea. NVIDIA, ARM, and Jabil, to name a few, are all Verdigris’ customers.

Regarding the business model, Verdigris provides hardware and software integrated solutions based on customer needs. Verdigris also offers a subscription-based SaaS pricing model for customers that do not want to purchase its hardware devices. Currently, Verdigris’ system can monitor appliances and provide suggestions. In the future, the system will be equipped with automatic control capabilities to provide maximum benefits.

With the launch of its Taiwan branch, GM of Verdigris Asia Santo Ko says manufacturers with the highest energy demand are located in the US and China, while Taiwan has abundant talent and know-how, better IP right protection, and a strong manufacturing supply chain. Therefore, Verdigris has used Taiwan as a bridge by building a local R&D team for its next-generation products. To magnify the results, Verdigris is also in talks with Taiwan’s leading IoT companies to integrate its smart meter and energy management system with their automation platforms. Verdigris’ Chinese market strategy will focus on working with local distributors and strategic partners to expand in this market.

Chung says Verdigris has raised US\$ 21 million in funding. The company’s current goal is to maintain financial stability and create additional value for their customers. The next stage is to beef up product performance and bring down product prices through a more solid development and improvement strategy, while tapping into the mid-range market. The company’s vision is to connect every building and electrical device through AI to achieve the highest energy efficiency. ■



CONVERTING ORGANIC WASTE INTO FERTILIZER IN 3 HOURS

TeTanTi Agri-Biotech develops more than 7,000 functional bacterial strains that can provide the best custom combination of enzymes

Once chemical fertilizers damage the soil nutrient balance, it takes twice as long to restore soil fertility and the land will not produce good crops, doing more harm than good. Concerned with the overuse of chemical fertilizers and pesticides in the global agriculture industry, Dr. Chiu-Chung Young, an academician of Academia Sinica, spent more than ten years developing special enzymes that can quickly convert organic waste into odorless organic fertilizer, encouraging farmers to return to nature and maintain the vitality of the land. The fertilizer factory is currently under construction and expected to be completed and commissioned this year.

24 Years of Experimentation Fuels Dr. Young's Commitment to Educating Farmers

Since the age of 40, Dr. Young has conducted research through remote areas of Taiwan and has given more than 600 lectures. Lecture attendees are all farmers in need of new knowledge. After a lecture, Dr. Young would even leave his home phone

number, welcoming farmers to call him with any questions. He said that the most frequently asked question was: Why are the effects of fertilizer deteriorating?

Dr. Young would reply frankly that it is not the fertilizer that has deteriorated, but the soil. He owns land that is divided into 7 sections at the Taiwan Agricultural Research Institute. He conducted 24 years of experimentation on the land. For 24 years, chemical fertilizer was applied to one of the sections and organic fertilizer on the other. There was another section applied with organic-chemical compound fertilizer. This method was used to compare the degree of soil fertility degradation.

Experimental studies show that the pH level of the chemical fertilized soil dropped from 5 to 4 in just 20 years. At this point, crops are already like “dead ducks.” The soil can still be restored, but will take a very long time. However, if the pH level drops to 3, then the ship has sailed. The soil would no longer be able to produce crops and soil fertility will be difficult to restore.

“The organic fertilizer market sales are 2.5 to 3 million tons per year, which is around US\$ 30 billion.”

Most farmers mistake this for deterioration of fertilizer effects, which is why they add even more fertilizer. As a result, a vicious cycle is formed: soil degradation → poor plant growth → more fertilizer applied → further soil degradation. As soil degradation continues, agriculture management in the next generation will be extremely difficult. That is why Dr. Young traveled around the countryside to promote organic matter as the savior of soil and to remind farmers they should not be overly dependent on chemical fertilizers.

Special Enzymes Convert Organic Waste into Organic Fertilizer in Just 3 Hours

The traditional organic waste composting method is time-consuming, smelly and dirty. On the other hand, it is expensive to just buy organic fertilizers. Dr. Young wanted to change our perception of the unpleasant conversion process of organic fertilizer. He spent 30 years researching and succeeded in replacing microbial fermentation with special enzymes. He developed a quick, clean and odorless piece of equipment that preserves the nutrients of organic fertilizers. It can convert organic waste into organic fertilizer in 3 hours, replacing the traditional 3-month composting method that is smelly and dirty.

Dr. Young and his team founded TeTanTi Agri-Biotech, which is a one-stop agriculture service, which includes upstream, midstream and downstream sectors. First, TeTanTi informs farmers whether their soil is nutritionally balanced and which organic matters are lost. Then, TeTanTi teaches them what kinds of nutrients can help with crop growth. Finally, the fertilizer is customized. TeTanTi is like an agriculture family doctor who custom treats individual soils. From rapid production of organic



The special enzymes can replace microbial fermentation that converts organic waste into organic fertilizer in just 3 hours.

fertilizers to custom formulas and fertilization technology, TeTanTi can do it all.

In addition to a variety of special enzymes that convert various organic matters (e.g. animal feces, kitchen waste, wood chips...), TeTanTi has integrated patented microorganisms and original equipment manufacturers to produce equipment for sale. This equipment is easy to use, just like a rice cooker at home, and the cost of building the factory and purchasing the machines is low. The company plans to directly market the “rapid organic waste conversion technology total solution” to domestic and foreign clients to ensure the production efficiency of the enzyme core technology. Currently, TeTanTi is located in the Taichung Industrial Park and has started construction of its 3,300-square meter factory. It is expected to be completed mid-2019. By then, it can convert 3,000 tons of organic waste, produced by the whole country, in one day.

Expand into Foreign Markets and Develop Condensed Enzymes in the Future

According to statistics, the global fertilizer market reached US\$ 167.3 billion in 2016. The compound annual growth rate from 2016 to 2020 is around 2.9%. It is estimated that the global fertilizer market will surpass US\$ 192.9 billion in 2021. The Asian market has the greatest demand, accounting for about 60% of global consumption, followed by the Americas, which account for 25%. The organic fertilizer market sales are 2.5 to 3 million tons per year, which is around US\$ 30 billion. However, Dr. Young admits that large production is only valuable if there are sales channels. This year’s plan for expansion focuses on three areas: to increase the number of team members, expand into foreign markets and look for large clients. Foreign market expansion will be aimed at Southeast Asia, China and Europe. As for business cooperation, TeTanTi will target large farms, markets, consumer waste, and industrial organic waste.

The long-term goal is to develop “condensed enzymes.” If TeTanTi were to launch in the US, it would face much greater demands due to the vast land. The cost of the containers for exporting the enzymes alone would be extremely high. Thus, Dr. Young is currently studying how to condense the enzymes first and reconstitute them when they arrive at US factories.

SPIN ACCELERATOR TAIWAN

SPIN Accelerator Taiwan is backed by IAPS and HYPE Sports Innovation. SPIN’s goal is to consolidate the resources of Taiwan’s sporting industries and serve startup teams as Taiwan’s first accelerator program oriented towards the sports industry.

SPIN Accelerator Taiwan recently hosted their first demo day showcasing 10 startups focused in the area of sports technology, and we had IAPS Chief Director Hank Huang to share his opinion about the program.

IAPS is Taiwan’s first accelerator backed by academia. NCTU IAPS was founded in 2013 to undertake the startup and accelerator programs of the Ministry of Economic Affairs, Ministry of Science and Technology, and Ministry of Education (iCAN, Innosquare, Fog Computing Alliance, etc.). The accelerator has investment partnerships with Foxconn, Chunghwa Telecom, Lite-On, Shin Kong Financial, amongst others and has helped accelerate sports technology startups such as Golface, GoMore, Chasewind, and FIDODARTS.

HYPE Sports Innovation was founded in 2014 and is the largest global eco-system for sports innovation with more than 40,000 key industry members. Their partners include universities, learning institutes with startup curriculums, and incubators such as Queensland University, Loughborough University, Trento University, and Stockholm University. Since its founding, HYPE has created an ecosystem of more than 9,000 sports startups and 26,000 global industry mentors; this extensive ecosystem allows HYPE to help sports startups pitch to global brands such as Nike, Adidas, and Under Armour as well as form partnerships with sports teams and events.

IAPS and HYPE Sports Innovation forged a partnership to form the sports technology accelerator program SPIN Accelerator

Taiwan. The island was selected by HYPE as its first and only base of operations in Asia for Taiwan's startup energy and mature industry resources.

SPIN Accelerator Taiwan hosts 2 boot camps each year with open registration to sports-oriented startups in the pre-seed, seed, or Series A round (with prototype) stages. Teams selected for the boot camp will attend workshops such as startup preparation, operations, marketing, and experience sharing from industry professionals. Teams will also attend workshops for English pitches, stories and one-on-one counseling from experienced entrepreneurs, as well as strategic guidance from HYPE partners and learning how to build business models that attract investors. In March, SPIN Accelerator Taiwan hosted their first demo day. The 10 startups that made it, out of 50, were Body Breakthrough, Tromin, JMEX, REMA, 17Fit, GoMore, Wusa, JoiUp, Fuelstation and Velodash.

Director General Kao Chin-Hsung of the Sports Administration, Ministry of Education stated: “I’m highly excited for this partnership with HYPE and it brings me joy to see the number of sports technology startups with such high potential. Hopefully working with HYPE will allow Taiwan’s teams to successfully enter global markets...HYPE has seen teams all around the world, so they have a keen understanding of how Taiwanese products are unique and where their potential for future development lies.”

IAPS Chief Director Hank Huang also stated: “IAPS is truly honored to host and establish Asia’s first professional accelerator in sports technology that can assist startups in growing their businesses swiftly and contribute to the sports technology industry from Taiwan to the world.”

As the first cycle of SPIN Accelerator Taiwan concluded successfully, we sat down with Chief Director Hank Huang to gain some insight on the partnership with HYPE, the difficulties faced when starting the program, and plans for the near future.

Q: First I need to ask you, what is the government’s role in this project and what’s the ultimate goal?

Hank: The government’s role here is in the hands of the Sports Administration, who wish to promote our athletes and use sports technology to enable the development of various sports categories, acting as a catalyst for them.

Q: The partnership with HYPE is a major plus for SPIN Accelerator Taiwan. Can you give us some details on what are the biggest benefits offered to these startup teams?

Hank: First, it’s clear that there are a massive number of options. Secondly, we offer international mentors through weekly programs that include boot camp training, investment engagement, and business engagement. What really sets us apart from other accelerators are these 2 things, global opportunities and engaging international mentors.

Q: How does SPIN help Taiwanese teams onto the global stage? Does the partnership with HYPE translate into access to markets in Israel or the Middle East?

Hank: HYPE will allow access to Europe, the U.S., and Australia. Mainly western communities will become our first step. Second, we will engage through the Asia-Pacific Economic Cooperation (APEC) bringing our ecosystem to the global stage in Tokyo, then in Manila 6 months later.

Q: What types of resources does IAPS provide to startups in the program?

Hank: Basically, IAPS brings a few things to the table such as international engagement, business development, and investments. I think that in addition to the standard mentor programs, we also bring engagement to major companies such as GIANT and other French companies like Decathlon.

Q: Speaking of which, Taiwan is a sports nation with two major bicycle manufacturers and many wearable tech

companies, both of which are quite mature. What are your hopes for this accelerator in terms of results?

Hank: Actually, GIANT has representatives here today. I feel like they are operating on traditional thinking. What I really want to do is bring these large power users into the ecosystem so they can look at the types of innovation that are happening. Also, while Taiwan is very strong in these industries, the sporting population is not as widespread when compared to western countries. So, we might be quite good at certain sports, but the overall sporting population is quite low. Part of this program’s goal is to further promote sports and better health. Furthermore, there are many cultural differences when working with HYPE. They feel that athletes and entrepreneurs, in general, have many demands, but Taiwanese entrepreneurs mostly just listen. This is something we’re constantly teaching our teams throughout the process: if you want to go global, you have to ask questions. 🇹🇼



SPARKLABS TAIPEI

SparkLabs Taipei, which targets IoT, AI, VR/AR, Fin-Tech, Cyber Security, and other technology industries, is the global network of accelerator programs and VC funds that is dedicated to offering solutions and guidance for Taiwanese startups go global and international startups land their services in Taiwan.

SparkLabs Taipei recruits 8 startups every batch for an intensive 3 months accelerator program. Here is an interview with SparkLabs Taipei’s batch 1 cohorts.

The world of startup business and entrepreneurship is harsh and brutally competitive. Companies often encounter hurdles right out of the gate such as financing, technical knowledge, marketing, and government regulation. Because of this, it’s no surprise why 90% of startup businesses fail. Luckily, accelerator programs such as SparkLabs Taipei exist to offer solutions to tackle these issues.

SparkLabs Taipei has raised US\$ 4.25 million in an initial close led by CTBC Financial Holding Group. The selected startup can receive a maximum investment of US\$ 40,000 in exchange for up to 6% of equity.

We sat down with four co-founders from the first batch of SparkLabs Taipei’s cohorts, Yadia Colindres and Sonic Wang, co-founders of FOX-TECH, and Melody Hsu and Audi Hsu of ViaSweat, to speak about their experience during the 3 months accelerator program at SparkLabs Taipei.

FOX-TECH

FOX-TECH is a Taiwan-based IoT Startup, which provides IoT solutions for cold chain, smart-farm, and manufacturing business owners so that they can monitor temperature wirelessly and

be able to optimize their business. They have a solid data compression algorithm, which allows them to utilize different types of sensors into their network. FOX-TECH’s flagship product is called Temphawk. It can provide wireless temperature humidity monitoring and requires less than five minutes to deploy. Its power consumption is very low, it only needs to be charged once a year. A few cases include dairy farms in Taiwan, Gardens by the Bay in Singapore, and sake in Japan.

Q: How did you find the SparkLabs Taipei program helpful?

Yadia: For me, I was fortunate to meet so many talented people. Networking with like minds who want to be the very best. A solution is often only a phone call away. Edgar taught us that you don’t wait for the opportunity, “You make the opportunity.” It changes you as an entrepreneur and as a person. I’ve developed a do-or-die attitude.

Sonic: I’ve realized that managing people is important. It’s difficult to recruit talent. SparkLabs has helped us face any problems or issues.

Q: What have you experienced during this program?

Yadia: You gain friends, which is important while you are in an intensive program. They know you for who you are when you had nothing. On the outside, you’re alone. Friends and family don’t understand your situation.

Sonic: There are so many different companies working here. We’re not all in the same industry, but we support each other and have great chemistry.

Q: Since joining IAPS and the SparkLabs Taipei program at TTA, what do you think about Taiwan Tech Arena?

Yadia: Taiwan Tech Arena is a great co-working space. We really utilized the nap room and the 24/hr coffee and tea. The location is great and the space is beautiful. From things as simple tea and coffee, TTA is supporting startups. It’s a very nice area to hang out. It feels personal.

ViaSweat

ViaSweat is a women’s activewear brand in Taiwan. The core tech of their products is the fabrics. “Taiwan is often defined by semiconductors and hardware, but textile innovation is the backbone of Taiwan. In past generations, there was a lot of OEM and ODM work. However, there was a lack of brands, especially in functional wear. I felt that with activewear as a trending category, ViaSweat was something that I really wanted to do.” said Melody Hsu, co-founder of ViaSweat. “Taiwan has excellent functional fabrics, and I wanted to create a brand that represented this.”

Q: How did you find the SparkLabs Taipei program helpful?

Melody: The mentors helped us immensely. We are very fortunate that the mentors we were matched with were very seasoned with what they were doing. They gave really helpful feedback and direction.

Secondly, was the comradery of the other teams. Your friends and family won’t have any idea why you’re staying up so late or what you’re going through. Between demo days and fundraising, it’s hard for them to relate. It’s good to have people that are up late with you as well. It’s also good to be able to vent after meetings... everyone worked well with each other, even though many of us were in different industries.

Q: After this 3 months period, what did you learn?

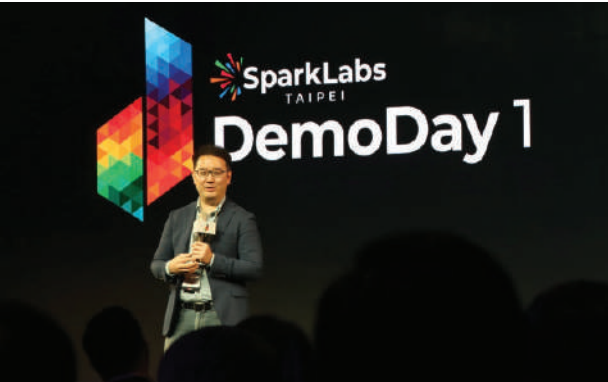
Melody: We learned how to repackage our brand. We were looking for someone to “draw out the unique essence” of the brand and help us focus on our strengths and targets. We accomplished a few milestones over the past three or four years that we didn’t even acknowledge, but they really pointed them out and highlighted them.

Speaking with investors was another skill that we learned. We had been speaking with investors for about a year prior to SparkLabs, but for someone to walk us through and help us move things along was really invaluable, especially when it came to global expansion. Fundraising is a whole other language in and of itself.

Q: Since joining the SparkLabs Taipei program at TTA, what are your thoughts on the workspace and environment?

Audi: The fact that everyone else in this place is also starting up makes it an excellent ecosystem. It’s like the central hub for Taipei. TTA is in an attractive location for this ecosystem. This makes it great when investors meet face to face here. The space gives us a one-up.

Melody: The atmosphere is good. There’s a drive and motivation to it. The government backing gives it more oomph. We also like being in close proximity to the nap room. 🛌



MOX—THE MOBILE ONLY ACCELERATOR

MOX helps the best mobile startups acquire millions of users in Southeast Asia, India, Eastern Europe and South America, which brings free user acquisition to the 167 million users on its smartphone platform and investment in return for revenue share and equity.

MOX focuses on developing mobile-focused companies. After the latest Demo Day featured 6 startups with great potential, Program Director of MOX Jenne Wong provided some insight about their program.

As the first global accelerator in Taiwan, MOX is operated by SOSV—a venture fund with US\$ 500 million assets under management investing through seven accelerators in startups from the internet, hardware, biotech and food sectors.

“MOX helps startups from around the world win in the largest mobile-first markets, like India and Southeast Asia, through our accelerator focused on localization, optimization, monetization and partnerships,” said William Bao Bean, Managing Director of MOX and General Partner of SOSV.

The strategic partnership kicks off with an accelerator program where MOX provides 50-150k users to localize the app and optimize retention and monetization market by market. Each startup has the opportunity to present their technology. Their latest Demo Day was the culmination of three weeks of intensive work, and the event featured 6 startups to come out of the MOX accelerator program.

The demos kicked off with Flickstree, a Series-A video content company that hails from Mumbai, India. Flickstree seeks to provide companies (typically major internet companies, telcos, and phone brands) that do not have video content with high-quality video for distribution.

Up next was Primo. Primo is a platform which allows retailers to cross-promote with other retailers. Using their data-backed approach, Primo helps marketers quickly find and automatically target the most relevant new customers, all while reducing cost per acquisition and increasing customer engagement.

The third presentation was UNL. UNL tells us that 70% of the world still cannot make online purchases simply because they do not have a reliable physical address. UNL solves this by gridding the world in what they call micro-cells. Each cell has a unique name and address, thus allowing mobile users to create their own physical locations, and these users can now use online services such as food delivery and on-demand transportation.

The next one was Advanced Planet. They have created a platform that allows brands to communicate directly with their consumers on a 1:1 level. With a sole and clear focus on B2C personalized messaging, Advanced Planet aims to help brands change the way they communicate and engage with consumers.

Next to demo was Phone Par Loan, which provides zero-interest loans with low fees (determined by the lender) through their app, which leverages all the user's mobile data to determine if they qualify for a loan.

Last to present was Coutloot. Described as the Taobao for India, Coutloot enables small retailers and individuals to start selling online and competing with large e-commerce sites in as little as 30 seconds.

As the demo day concluded successfully, we sat down with Partnership Director Jenne Wong to gain some insight about the program and plans for the near future.

Q: What are the requirements for a startup to be selected for the MOX program?

Jenne: The recruitment for the MOX program comes from a variety of different sources including: word of mouth (from our director William as he is also a key influencer), events, networking, and directly applying through the MOX website. The main requirement to be selected for MOX is the startup's business model and its attractiveness. The solution has to be relevant for the 4 billion users. Currently, we are focused on Southeast Asia and India as we foresee mobile having huge potential especially in India, Indonesia, Thailand and the Philippines. We also have plans to expand the market to Eastern Europe and Latin America.

Q: Can you explain more about the MOX batch program and how it helps the team to grow?

Jenne: The MOX batch program is considered a rolling program. We are constantly looking for applications in order to help the team grow. The MOX program has 4 pillars which are fundraising, growth hacking, localization and partnership.

Fundraising During the month long onboard process at TTA, we prepare each team to pitch their startup to secure outside investment. Then, they'll have the opportunities to do a presentation on demo day for the startup communities, investors and media in Taiwan & Singapore. We consider Singapore's Demo day as the launchpad to Southeast Asia. It's a kickstart for fundraising and partnership.

Growth Hacking This pillar is a two-year growth hacking section at TTA, focusing on helping founders strengthen their product by connecting the team to local and international mentors.

Localization We prepare the startup for local market entry, soft-landing and targeted markets.

Partnership During the 2 years with the MOX program, we will take each team to visit local key market players in Southeast Asia. It's called Geek on a Trip (GOAT). This year, we are planning to go to Indonesia and Thailand.

We believe that Taiwan is the gateway to the Southeast Asia market, and the Taiwan government is very supportive for

Southeast Asia entries. The average Taiwanese person is highly educated, which offers great local talents that can keep pushing the economy forward. We hope more Taiwanese companies will be interested in joining the MOX program to grow their businesses to an international scale.

Q: How are TTA resources helpful for MOX or a Startup? Can you tell us any difficulties or interesting stories that differed from your experiences?

TTA is a great space with the resources and connections to build an international community and startup hub. Most of our teams come from different countries. They have different backgrounds and interesting founder stories. Through team building, the teams in the batch develop the same vision and drive to achieve the end goal. We are grateful to see how the teams' strong bond has created a passion to build this ecosystem.



TAIWAN TECH ARENA

Event Summary

Monthly CXO Breakfast Workshop Hosted by TTA

An informative breakfast can help leaders of startup teams quickly catch up with the latest market trends, expand client resources, and advance their personal careers. Every month, TTA hosts a breakfast workshop for CXOs. The event brings in experts on the trending topics at the moment to share their knowledge. During the recent workshop series, TTA invited guest speakers from Deloitte Taiwan and Yourator to discuss the topics of enterprise communication and startup recruitment strategy.



Taiwan's 10 Coolest Tech Startups of 2019

The Minister of the Ministry of Science and Technology (MoST) Liang-Gee Chen announced the 10 coolest tech startups on March 26 at Taiwan Tech Arena (TTA). Due to committed investments and support from the government, many local startups have risen in the recent period and are ready to introduce their innovations to the market.

The 10 startups selected by MoST this year all have solid technological capabilities and will help demonstrate Taiwan's technological prowess on the global stage. Besides relying on a judging panel comprised of experts in their respective fields, MoST in the selection process has also consulted professional opinions from accelerators, incubators, venture capitalists, and startup communities based in Taiwan and abroad.

The top 10 were selected from more than 2,000 candidates through three rounds of review that considered the quality of the technology, the influence on the industry, the market potential, and the team's potential. To create a startup ecosystem for fostering high-tech entrepreneurship in Taiwan, MoST established and funded TTA—a pioneer program that connects local startups with resources worldwide.

Since its establishment in June 2018, TTA has aimed to connect global resources, and already gathered lots of international and domestic partners, key accelerators (e.g. SparkLabs Taipei, BE Capital, SOSV-MOX, and IAPS), and over a hundred startup teams.

The President Met with TTA's 44 CES Teams



Led by Liang-Gee Chen, the head of MoST, members of TTA's 44 CES startup teams visited President Ing-Wen Tsai at her office on February 26. They reported the following accomplishments made at CES: 5.5 billion TWD in opportunities, four CES Innovation Award Honorees, and recognition from major global enterprises. This year is the second year that MoST has led local startups to attend CES. With support from TTA, Taiwan's innovations gained much greater international media exposure than before.

2019 Startup Fair with International Accelerators

Held on March 5, TTA 2019 Startup Fair hosted five international accelerators that are searching for submissions for major exhibitions across North America, Europe, and Asia. The event featured information sessions for startups that are planning to attend upcoming annual trade shows. Besides the joint invitation of project submissions, there was also a preview of prospective proposals for CES 2020. The Startup Fair offered a platform for exchanges among startups, accelerators, and exhibition organizers.



Demo Day Held by TTA's Partner Accelerators

TTA and several international accelerators have jointly offered programs for tech entrepreneurs whose startups are at various stages of development. Startup Demo Day, which is held periodically, provides opportunities for startup founders to showcase their solutions and present to foreign investors and potential partners. Almost all the startups that have participated in Demo Day reported that they secured funding and resources for launching their ventures in foreign markets soon after presenting their ideas at the event.

Anchor Taiwan x TTA: Female Founder vs. Female Funder

TTA and its partner Anchor Taiwan hosted an invitation-only power lunch for a small group of tech entrepreneurs on March 21. The event included a fire side chat with Elisa Chu, the founder of Anchor Taiwan, and Iella Koblenz, the co-founder of BloomMe. The main topics covered were "women's strengths in entrepreneurship, fundraising, and investing" and "building a successful startup in a foreign country." The lunch meeting also provided an opportunity for attendees to network with investors.





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