Taiwan Tech Arena in conjunction with the Ministry of Science and Technology support startup program 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.

ISSN 2663-9076
9 772663 907002

TAiWAN TECH ARENA

EMERGING TECHNOLOGY TRENDS FOR 2030

From demand pull to technology push, how do we address the issues arising from technological development that drives market growth?

BUSTLING TTA BLACK CARD COMMUNITY

TTA Black Card Community thrives as more entrepreneurial investors join Taiwan's efforts in becoming a leading international startup ecosystem

TAiWAN TECH ARENA

TTA

JUL. 2021

07

TAIWAN STARTUP ECOSYSTEM MARCHES FORWARD WITH EMERGING TECH TRENDS

As the pandemic continues to impact Taiwan, TTA keeps marching forward through collaboration with entrepreneurial and corporate investors as well as enterprises to support startups to thrive and shine on global stage.

TTA MARCHES FORWARD THROUGH THE PANDEMIC AND KEEPS SUPPORTING STARTUPS TO SHINE

As vaccinated population increases and parts of the world slowly open up, we are all hopeful that 2022 will be the year startup ecosystems around the globe bounce back stronger than ever. In the meantime, TTA continues to support Taiwan and international startups and serves as the platform that connects them to investors, mentors, talents and markets. In June, TTA led a number of Taiwan startups to virtually take part in world-renowned exhibitions namely VivaTech, MWC and deep tech startup competition – Hello Tomorrow Global Challenge. We are also pleased to announce that 11 TTA startups won COMPUTEX d&i awards, a global design and innovation contest, which aims to drive innovation and optimized R&D. Amongst them, two startups – JGB and DoQubiz are awarded with the Gold Awards and Specialty Awards with the support of TTA.

Besides market and media exposure opportunities, TTA continues to work with our corporate partners, VCs and CVCs who not only become more active but also share our confidence that post-pandemic era will be led by advanced technologies. In this issue, we introduce five innovative technology trends expected to reshape our society and life by 2030 including blockchain, energy storage, DNA sequencing, robotics, and artificial intelligence, which are also the core technologies of many startups TTA has actively supported through our accelerator partners and international networks of mentors and investors.

Over the year, Taiwan has been able to attract talents from all across the globe. In order to attract more entrepreneurial investors and foreign professionals to take part in the Taiwan startup ecosystem, TTA launched the TTA Black Card Membership. Not only can members access TTA common area and the VIP Lounge, they could also apply for dedicated desks, be eligible to receive professional consulting service and participate in TTA events. In this issue, we proudly present this vibrant community by introducing two of our Black Card members and their exciting plans for our ecosystem as well as what we can learn for their experience.

In response to changes in the global market in the post-pandemic era, TTA marches forward by establishing a location in Southern Taiwan to further strengthen Taiwan's innovation capabilities and accelerate the development of Taiwan's cybersecurity and smart technology to become the tech center of Asia Pacific. TTA strives to drive Taiwan forward as a vibrant international startup ecosystem and continue to enable Taiwan startups to shine even brighter on world stage.

Andrea Hsu

Director General, Department of Academia-Industry Collaboration and Science Park Affairs

EMERGING TECHNOLOGY TRENDS FOR 2030

The United Nations' Millennium Project's "State of the Future" report identifies the five innovative technology platforms expected to reshape our society and life by 2030: these being blockchain, energy storage, DNA sequencing, robotics, and artificial intelligence.

IEK CONSULTING
Alex Su

I. Demand Pull from Society: In Response to Sustainable Development and Social Reforms

(I) Focus on 2030 Global Sustainable Development Goals

The rapid development of globalization, urbanization and industrialization has caused many shared challenges such as the rampage of the pandemic, replacement of manpower with automation, destruction of the eco-environment, climate change, and a widening gap between rich and poor. At its 70th anniversary on September 25, 2015, the United Nations (UN) held the UN Sustainable Development Summit and published "Transforming Our World: the 2030 Agenda for Sustainable Development" to address the major issues not accomplished by the Millennium Development Goals (MDGs).

This study summarizes the 17 sustainability development goals (SDGs) into three categories, i.e., social, economic, and environmental (Table 1). These goals involve the issues faced by all the countries in the world. To realize equality and human rights, a total of 169 targets are outlined as the guiding principles and the key basis for member states in cross-border cooperation and initiatives to achieve by 2030.

The issues in health & welfare, climate change, environment & ecosystem, green energy, economic development and social equality will be the focal point of global sustainability development, the determinant of national competitiveness, and a driver of technological development going forward. It is hoped that policy initiatives, understanding and making preparations for the innovative technologies of tomorrow will help to resolve relevant issues and accelerate the achievement of the sustainability development goals.

(II) Significant Social Transformations by 2030

1. Greater connectivity

Over the next four to six years, the increasing penetration of networks and mobile phones will connect nearly half of the global population currently not online. This will create a large number of jobs and market opportunities. By 2030, 500 billion devices and 100 trillion sensors will be connecting people and things. Transportation vehicles, machines and urban infrastructure will become smarter in the future.

2. Expanding human capabilities

The combination of artificial intelligence and virtual reality will make just-in-time education popular. Through 5G and other communication technologies, people will be able to freely access the latest information and all the data to meet their needs. Many startups such as Neuralink, Open Water, and Kernel are studying how to connect human brains to the cloud. Super humans are a real possibility going forward.

3. Increased human longevity

The emergence of new technologies such as genome editing, DNA sequencing, and stem-cell therapy is extending the average human life expectancy (to over 90 years). The assistance of artificial intelligence and robots could also enhance human capabilities and help to overcome a variety of intractable diseases. We will eventually live longer and be healthier.

4. Lower living cost

Energy generation cost will decline and the cost of living will be lower in the future. This includes a rapid decline of solar generation cost, gradual enhancement of energy storage capacity and efficiency. Solar generation cost is likely to fall below US$1cents/kWh. If solar becomes a viable alternative energy, seawater desalination will get cheaper, and the traditional use of reservoirs for hydroelectric power generation may no longer be necessary.

Table 1. **UN Sustainability Development Goals: Three Dimensions and Development Goals**

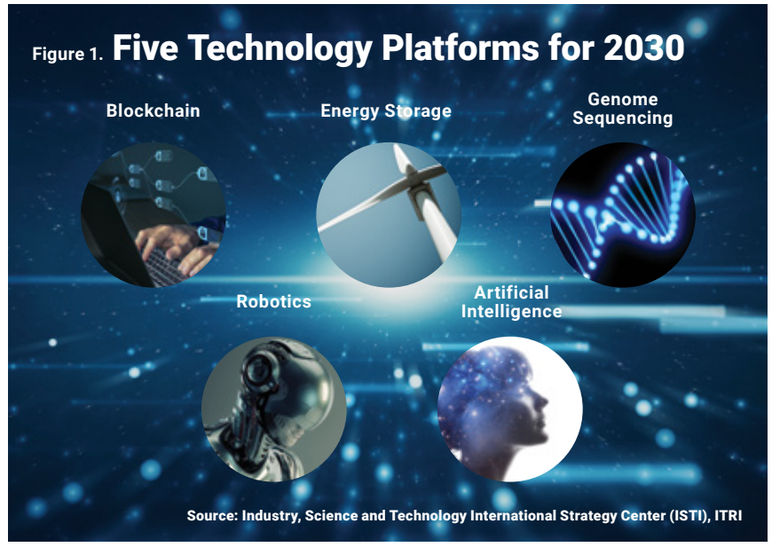
Social	Economic	Environmental
SDG 01. No poverty	SDG 07. Affordable & clean energy	SDG 06. Clean water & sanitation
SDG 02. Zero hunger	SDG 08. Decent work & economic growth	SDG 12. Responsible consumption & production
SDG 03. Good health & wellbeing	SDG 09. Industry, innovation & infrastructure	SDG 13. Climate action
SDG 04. Quality education		SDG 14. Life below water
SDG 05. Gender equality		SDG 15. Life on land
SDG 10. Reduced inequalities		
SDG 11. Sustainable cities & communities		
SDG 16. Peace, justice & strong institutions		
SDG 17. Partnerships for the goals		

Source: UN Sustainability Development Goals (2015)

II. Technology Push: Trends in Five Platform Technologies

To address the abovementioned long-term issues and targets and to analyze the challenges and opportunities involved, the United Nations' Millennium Project applied forecast methods such as the expert method, scenario analysis and Futures Wheel to formulate its "State of the Future" report. This identifies the five innovative technology platforms expected to reshape our society and life by 2030: these being blockchain, energy storage, DNA sequencing, robotics, and artificial intelligence (Figure 1).

Figure 1. **Five Technology Platforms for 2030**



Source: Industry, Science and Technology International Strategy Center (ISTI), ITRI

(I) Blockchain

1. Forward-Looking Technology Trend

Blockchain is a trusted and tamper-proof record, capable of tracking anything of value. Over the past decade, blockchain has developed in a variety of directions and has increasingly become part of our life. Leading companies such as SAP, IBM, Oracle and Microsoft have been investing in blockchain technology R&D and are seeking to offer relevant services to customers. According to a survey by Juniper Research of the top 400 companies in the U.K., 60% of them were either proactively discussing whether they should adopt blockchain technology or are already implementing blockchain.

As the acceptance and adoption of blockchain technology continues to increase in the corporate world, the value added by the application of blockchain technology is forecast to reach US$3.1 trillion by 2030. Other than corporates, some countries are also heavily investing in blockchain technology. The top five countries in blockchain development are Malta, Switzerland, Estonia, China and Singapore. The general overall approach and technological developments in these five countries include the passage of blockchain laws (e.g., virtual financial assets), the creation of cryptocurrency cities, the application of decentralization and data

integrity authentication to administrative procedures (e.g., digital identification cards), the formulation of regulations and alliances for blockchain information service management, and the offering of a good environment and talent pipelines for startups.

Below is a snapshot of global blockchain technological developments:

(1) In 2016, the European Union collaborated with personal data companies, universities and research organizations to create a pan-European blockchain platform for the collection and sharing of patients' medical information among medical institutions.

(2) CareChain AB in Sweden has launched a blockchain platform for medical data. This system allows companies and individuals to store medical data from different locations. Developers can create apps and relevant services, analyze users' data and provide users with advice on health management. It also allows industries to develop related products.

(3) Estonia as a powerhouse in information and communication technology is using blockchain technology to assist the government's overall IT management. Since 2012, it has stored 95% of medical data digitally, and achieved 99% digitalization of applications for medical subsidies and issuance of prescriptions.

(4) To prepare for public health crises, the United States Centers for Disease Control and Prevention is developing a common blockchain platform for pathogen data and disease incidence analysis. In 2017, Pfizer and other pharmaceutical companies and Walmart cooperated in the MediLedger project utilizing Ethereum technology to deploy a blockchain platform for the tracking of counterfeit drugs and the maintenance of the medical supply chain through tracking and verifying the origins of medicines.

Whilst the blockchain technology still under development promises sweeping influence and unlimited potential, the mass adoption of business models requires a better and more complete infrastructure, a more friendly environment and supporting legal frameworks.

2. Future applications

Blockchain technology can be used in a wide range of applications. It goes beyond the tracking of digital and encrypted currencies. Blockchain can be used for electronic transactions of financial assets, digital certificates, food traceability accreditations (e.g., the coffee traceability system based on blockchain and jointly developed by Starbucks and Microsoft), real estate transactions, energy trading systems, protection of art and cultural content, and Internet-of-Things (IoT) device management. It can also be used in medical records management and manufacturing, and in general industries in any fields where credit protection is required.

Take the medical domain for instance, blockchain technology can allow the rapid updating of patients' medical records and prevent tampering and leakage. It serves as a secure mechanism for all medical institutions to manage and share data. The top five medical insurance companies in the U.S. have started to explore the use of blockchain technology in the medicare system by collecting demographic data from health data providers. Humana and UnitedHealth Group have changed their relationship from competition to collaboration. All of these indicate that the method of medical data processing is changing.

(II) Energy storage

1. Forward-Looking Technology Trend

Energy storage is the technology associated with storing electricity via chemical energy, thermal energy, gravitational potential energy and nuclear energy for the purpose of energy provision. Carbon emission reduction is a focal point of the global efforts to tackle climate change. Many heavyweight companies and startups are investing considerable resources on the development of new energy technologies. For example, Bill Gates launched the new energy venture investment fund Breakthrough Energy Ventures (BEV) attracting many big-name companies to invest in a variety of storage and nuclear energy systems. These investees include Form Energy (long-duration battery storage); Ambri (liquid metal battery storage); Aquion Energy (sodium ion battery storage); Malta (electro-thermal battery storage); Terra Power (advanced nuclear reactors) and carbon capture. Below is a summary of the development status of a few high-profile energy startups.

Sulfur-flow battery: Form Energy from the U.S. is a developer of new battery technologies; one of which is sulfur-flow battery technology, which aims to leverage the low cost and high abundance of sulfur to create a cheaper alternative to lithium batteries. The flow battery requires a liquid electrolyte to be injected around the electrodes. As large components such as pumps are required, this technology is not applicable to small electronics devices such as smartphones. However, it will become an alternative for electricity grid storage equipment in the future.

Solid-state battery: Quantum Scape, an energy storage company from the U.S. is planning to commercialize solid-state batteries by 2025. The replacement of liquid electrolytes with solid-state solutions can greatly enhance the energy density and storage capacity of batteries. This helps to resolve the issue of the lower mileage range of electric vehicles compared to conventionally fueled vehicles. The company has received US$100 million in investment from the Volkswagen Automotive Group.

Space-based solar power is expected to generate eight times as much energy than is possible on Earth. It will become a new and inexhaustible energy source.

Geothermal technology: American start-up Fervo Energy is developing state-of-the-art geothermal technology. This technology applies mixed medium stimulation and uses hydraulic fracturing (fracking) technology to build a new system for geothermal energy, to enhance the output of existing geothermal generation plants and construct new geothermal generation capacity. It is envisioned that the application of ultra-high pressure hydraulic power can overcome limitations from porosity and permeability of rock strata. This technology comes from drilling in the oil industry.

Underground hydroelectric energy: Quidnet Energy from the U.S. is developing underground hydroelectric energy storage. Excess electricity from the grid is used to pump water down a disused oil well where it is stored under pressure. When the demand for electricity picks up, the stored water is released back to ponds on the surface via turbines which generate electricity.

Power generation with nuclear fusion: Commonwealth Fusion Systems from the U.S. is a start-up based on technology developed by Massachusetts Institute of Technology. It involves the Tokamak nuclear fusion system with deuterium and tritium as the fuels and utilizes technology that can reduce the volume of nuclear fusion. The goal is to have nuclear fusion power plants up and running within 15 years. The technology places sub-atomic particles into the Tokamak system to generate plasma and controls the heated plasma with superconductive magnetics. The commercialization prospects of this technology will require ongoing verification.

2. Future applications

The emergence of energy storage technologies aims to support clean energy generation without impact on the environment. This will help to reduce greenhouse gas emissions and can be used in a wide range of domains such as power, transportation, manufacturing, construction and agriculture. The research of energy storage technologies requires continuous investment, development, and experimentation, and it will take at least a decade to recover the initial costs. In the long run, the development of renewable energy calls for innovative thinking and a suitable environment.

Space-based solar power(SBSP) currently under development will not cause an environmental footprint and will overcome the problem of the Earth's solar power generating efficiency limit of 20%. Space solar power would collect solar energy at space stations and transmit the power to Earth or other planets. Special rectifier-antenna (Rectenna) systems will need to be installed on the Earth in order to receive the energy and then distribute the energy using the existing methods.

Space-based solar power is expected to generate eight times as much energy than is possible on Earth. It will become a new and inexhaustible energy source. The key considerations for space-based solar energy are the location of equipment installation, satellite structures (eg. GEO/MEO/LEO), and energy collection and transmission. Geostationary Orbit (GEO) satellites are the most promising as they resolve the problem of rectenna sequencing and can transmit electricity non-stop. However, GEO satellites release a large amount of radiation and are prone to the influence of meteorites and solar

winds. The inhibitive cost of launching satellites is another issue to be overcome. According to a study by the U.S. NASA (National Aeronautics and Space Administration), launch costs in the range of US$100-200/kg are required for space solar energy systems to be economically beneficial. Space X, an aerospace company from the U.S., is developing ways to recover and reuse rocket boosters. This will drive the continued reduction of launch costs going forward.

(III) Genome sequencing

1. Forward-Looking Technology Trend

Currently, the analytical and inspection technology for genome sequencing can be largely divided into traditional sequencing, next generation sequencing, and third-generation sequencing. Traditional sequencing is represented by DNA sequencing or sequencing-based typing (SBT) developed by Sanger. Sequencing is achieved through detection of DNA sequences with amplification to increase the number of target sequences. The result is reliable but the output is low and the cost is high. Next generation sequencing (NGS) is to shear DNA fragments into a large number of shorter fragments and then put these fragments back together. This large-volume and fast sequencing of short fragments can effectively enhance the number of comparisons and reduce the error rate in a short time. Third generation sequencing includes single molecule fluorescence sequencing, single molecule real time sequencing (SMRT) and nanopore sequencing. These techniques are fast and do not have the problems of repeated sequences and missing fragments. However, the error rate and the cost are relatively high. CRISPR-Cas9 genome editing has attracted significant attention in the biotech domain. Therapeutics Sangamon in the U.S. uses in-body gene editing to develop a treatment for Hunter syndrome, a rare genetic disorder. The technology is to inject a genome-edited enzyme into the human body to rectify the genetic deficiency that prevents the creation of IDS (iduronate 2-sulfatase) enzyme. This will allow the metabolism of mucopolysaccharides and reduce damage to heart, liver and other organs.

Genome editing is gradually finding its way from the laboratory and into medical therapies. In 2019, University of Pennsylvania published a case study of using the CRISPR technology for the treatment of multiple myeloma and sarcoma. However, the gene injected may damage other important genes. Therefore, it will take time to validate the safety and effectiveness of this method.

Whilst genome editing increases the probability of developing treatments for many diseases resulting from genetic mutations, there are potential ethical issues. One example is the use of genome editing for DNA customization of embryos. A designer baby was born in 2018. Professor He Jiankui of the Southern University of Science and Technology in China claimed to have used genome editing on twins born to be resistant to HIV. The legality and truthfulness of this research sparked many contentions and discussions in the medical world.

2. Future applications

The most mature application of next generation sequencing is non-invasive prenatal testing (NIPT), as the test subjects are straightforward, clinical validations are quick and clinical data is easily accumulated. This is followed by cancer tests. The combination of next generation sequencing and liquid biopsy can meet the continuous and extensive diagnostic and validation requirements for long-term cancer patients. It is primarily used with patients who don't respond to first-line and second-line drugs or suffer from cancer recurrence.

Genome editing will primarily be used in medical care for the treatment of cancers or other terminal diseases. There is a growing number of studies on the enhancement of this technology's accuracy. For instance, the Chinese Academy of Sciences, Sun Yat-sen University, and South China Agricultural University worked with Massachusetts Institute of Technology to establish a research team to investigate the development of a drug treatment for autism with genome editing. CRISPR Therapeutics from Switzerland and Vertex Pharmaceuticals from the U.S. are collaborating on the treatment of hemophilia with genome editing. Editas Medicine from the U.K. sponsored a study on Leber's Congenital Amaurosis, a genetic vision disorder.

The most mature application of next generation sequencing is non-invasive prenatal testing (NIPT), as the test subjects are straightforward, clinical validations are quick and clinical data is easily accumulated.

In addition to the medical domain, genome editing could also be used to boost the economic value of agricultural crops, poultry and livestock in the future. The potential value of genome editing patents is estimated to be in the billions of US dollars. The number of patents obtained each year is also increasing significantly. There will be more and more discussions and solutions to regulatory and ethical issues. Individuals, corporates and society should also think ahead about relevant solutions in order to respond to future societal changes.

(IV) Robotics

1. Forward-Looking Technology Trend

Robotics is a cross-disciplinary technology. It involves the design, production, operation and application of robots, integration with network communication, artificial intelligence algorithms, mechanical operation and sensors. Robots can be divided into service robots, industrial robots and military robots. For instance, Amazon Scout, the six-wheeled fully autonomous driving delivery robot developed by Amazon is currently undergoing operational trials and testing in cities at Snohomish County of Washington State. They are still under the supervision of human minders, known as Amazon Scout Ambassadors. Once the testing and acceptance have been completed, Amazon Scouts will be delivering around city centers on their own. Due to the impact of COVID-19 around the world, the corporate demand for autonomous technology has been increasing. Whilst many companies have deployed a significant amount of artificial intelligence, human supervision or remote control is still required given the complexity of urban environments.

Modular robots that can have customized configurations have the capability to self-repair and replace modules due to their neural network-like control systems. They can be used in industrial and medical settings and as home robots. Modular robots can replace humans in dangerous environments or confined spaces and represent a new development opportunity in the field of emergency rescue. Self-assembling robots, known as M-Blocks, developed by Massachusetts Institute of Technology's Computer Science and Artificial Intelligence Laboratory (CSAIL) can climb up, jump or roll autonomously. They are attracted to each other via rotating round magnets and can configure themselves into a variety of shapes by stacking and combination.

2. Future applications

Once self-assembling robots can be adequately miniaturized, these autonomous robots could be mobilized into troops of mini-robots to deal with a variety of emergency situations and meet onsite requirements. For instance, they could be morphed into a ladder or other protective equipment for special missions such as bridge and building repairs, nuclear power plant patrols, or fire disaster rescue. Robots will be able to continuously self-learn, adapt to environmental changes and even come up with optimal solutions through evolutionary algorithms and technologies such as machine vision. This could lead to close collaboration between humans and robots.

The University of Sheffield in the U.K. has an R&D program on micro-robots for the inspection of structures and pipelines of underground facilities, undertaking repairs with cement adhesives, cleaning and unblocking operations. The inspection robots are approximately one centimeter in length and able to move around autonomously. Operations robots are slightly bigger and must be remotely controlled. The UK government intends to invest US$24 million on this project. It is expected to achieve savings of US$6.4 billion in road excavation costs each year.

Micro robots can also be used for operations in dangerous sites, such as the inspection of waste gases at nuclear power plants, monitoring of oil pipelines, checks on aircraft engine components, repair and assessment of orbiting satellites.

Even smaller nanorobots could be used in medical applications such as for entering the blood vessels and biological tissues to administer drugs and for the treatment of cancers and other diseases. The Chinese University of Hong Kong (CUHK) is using swarms of nanorobots driven by magnetic fields for simple surgical procedures.

(V) Artificial intelligence

1. Forward-Looking Technology Trend

Artificial intelligence has become a priority for R&D initiatives around the world. PwC forecasts that artificial

intelligence will contribute US$15.7 trillion to the global GDP in 2030, and China will account for US$7 trillion of this GDP growth, North America $3.7 trillion. The Chinese government announced in 2017 its ambition to be the leading country in artificial intelligence by 2030. The three Internet giants BAT (Baidu, Alibaba and Tencent) have invested extensively in R&D resources, seeking to spearhead the artificial intelligence sector in China, from copying Silicon Valley to innovations of their own. It is hoped that the industry will gradually extend its footprint outside of China and into the rest of the world. Below is a summary of the measures taken to date:

(1) Baidu: In the 2017 "Baidu World" conference, the company announced its "All in AI" and revealed its ambition to lead large-scale projects such as AI research, autonomous driving, service robots and international open-source platforms. The most representative initiative is its Apollo autonomous driving platform, which has attracted the participation of more than 95 international companies including Nvidia, Ford and Daimler. Baidu worked with the national deep learning research institute in the development of neuromorphic chips and AI robots. The company also worked on speech recognition patents and in 2018, launched Aladdin, which combines smart speakers, smart lamps and projectors. The system was powered by Baidu's AI operating system DuerOS, and aims to compete directly with voice assistants such as Amazon's Alexa and Google's Assistant.

(2) Alibaba: The company is developing City Brain, an AI platform on the cloud. It is also working with local governments in Macau, Hangzhou and the Malaysian government to develop smart cities by using AI algorithms to analyze and manage traffic, sensors, CCTVs, social networks, and government data in order to predict changes in future events. In 2018, Alibaba invested in Nexar, an AI vehicle and traffic sign recognition company.

(3) Tencent: The company has entered the AI medical domain focusing on genetically personalized medicine. Tencent has been working with many companies with the most advanced technologies in the world and numerous startups in different countries. For example, it worked with Babylon Health, an AI medicare company in the U.K. to use AI algorithms for remote diagnostics over their communication app WeChat in order to boost their penetration of medical services. Tencent also invested in many digital health management companies such as WeDoctor (online medical service provider) and iCarbonX (an AI and cloud start-up).

2. Future applications

Artificial intelligence is already deployed in medical diagnostics and therapy (e.g., DeepMind which was acquired by Google), safety protection systems, autonomous robots, smart manufacturing and materials science. In the future, artificial intelligence will be used to lead a revolution in the content and entertainment industries and the development of voice assistants for seniors. The former includes personalized movies, composition and lyrics writing, immersive virtual worlds, AI role playing, dialogue-based storyboard games, and edutainment software. Artificial intelligence can help artists with the creation of artworks and boost human creativity. It can participate in the writing of movie scripts, poems, novels and songs. The latter might resolve the loneliness problem among elderly people with artificial intelligence acting as their best friend, daily caretaker and even emotional companion. This could help solve the digital divide phenomenon for seniors. (A case in point is the collaboration between Amazon and Front Porch, a retirement community in California, U.S.)

With the advancement of voice and data analytics, self-learning robots powered by AI will become intelligent agents for humans by serving as secretaries, protectors, strategic partners and friends. Intelligent agents will be able to assist in daily chores; sense our physical status in order to regulate sleeping habits; adjust ventilation, temperature and lighting; play our favorite music; make recommendations on clothes, shopping lists, recipes and restaurants, and suitable exercise; and provide therapies and reminders for medications. The enhancement of human intelligence with AI will enable the faster processing of events, ushering in an era of augmented intelligence.

III. Industrial Revolutions and Market Growth Driven by Relevant Technologies

The aforesaid technology platforms can be applied to a wide range of domains and scenarios, including ubiquitous sensors and IoT (Internet-of-Things), multi-access edge computing, 5G and B5G/6G, XR (Extended Reality) and immersive media. It will trigger industrial revolutions in biotechnology, energy and health management.

It is estimated that the aforementioned five technology platforms shaping development from 2020 to 2030 (over the next 10-15 years) will create an aggregate commercial value of over US$50 trillion (see Table 2, with the current market size about US$6 trillion). Early investment and R&D efforts now could generate close to 10x returns. Below is a summary of relevant technological trends and applications.

IV. Issues Arising from Future Technological Development will Require Early Response

(I) Ensuing issues

The rapid development of emerging science and technology creates positive benefits to society, but many issues and risks will also ensue. It is imperative to achieve a balance between the potential benefits and possible impacts of emerging technologies.

1. Ethical and privacy problems

Emerging biomedical technologies bring hope to patients suffering from incurable diseases. However, human genetic engineering techniques such as genome sequencing, genome editing, cloning and stem cells come with high risks and scientific uncertainties that are often difficult to control or remedy with traditional methods. Ethical issues arise about the subsequent risks to the ecosystem. Meanwhile, the development of technologies such as artificial intelligence and robotics trigger debates over rights and obligations. This includes whether robots should enjoy the same legal rights as humans, such as the right to participate in politics and access to social benefits; how to distribute the value added and economic benefits created; and who will suffer the impact of massive unemployment.

With regard to privacy protection, there is a growing awareness regarding the use and protection of sensitive personal data such as medical information. Surveys by Dell and Vanson Bourne suggest that 74% of respondents believe that data privacy is the largest social challenge that must be resolved by 2030. Both companies and governments should pay attention to this issue.

2. Algorithm trust and inequality

The development of artificial intelligence systems is rapidly advancing in complexity. For developers and users, the lack of transparency regarding how algorithms work in a black box aggravates the problems of trust and transparency and significantly increases the likelihood of failure.

The popularity of free software and the enhancement of counterfeiting capabilities (such as Deep Fake) makes it impossible for us to fully trust the accuracy of video content. It is expected that by 2030, the proliferation of fake video content will undermine the public's trust in both individuals and institutions. Stanford University, Princeton University and Adobe in the U.S. are collaborating in the development of new algorithms that allow the video editing of talking heads as easily as editing text. The technology could be used to make the speaker play any role simply by changing the script.

Table 2. Five Technology Platforms and Market Size Forecasts

Unit: USD

Platform	Technology	Year introduced	Market size
Blockchain (including cryptocurrencies)	Blockchain	2009	>10 trillion
	(including cryptocurrencies)	2007	<10 trillion
Energy storage (including solar energy and renewable energy)	Autonomous Mobility	2007	c. 10 trillion
	Advanced Battery Systems	2009	<10 trillion
Genome sequencing (including genome editing)	Sequencing Technology	2004	c. 10 trillion
	Genome editing	2012	<10 trillion
Robotics	Adaptive Robots	2005	>10 trillion
	3D printing	1986	c. 1 trillion
	Reusable rockets	2015	c. 1 trillion
Artificial intelligence	Neural networks	2012	>10 trillion
	Mobile connected devices	2007	<10 trillion
	Cloud computing	2007	<10 trillion
	Internet of Things	2011	<10 trillion

Source: ARK Investment Management LLC; State of the Future
Note: Market sizes forecasted based on market capitalization values

Algorithms may also reinforce racial and gender bias. Algorithm developers may intentionally or unconsciously reflect their prejudice in their software code. The fairness and transparency of algorithms have become the focus of future research and risks exposing the trade secrets of competing companies.

According to a study by the research team headed by Joy Buowlmani, a computer scientist at MIT, there is a gender and skin-color bias in three commercial facial recognition systems. The error rate for dark-skinned female faces was as high as 20% to 34%.

3. Data silos

Governments and companies are seeing large amounts of data generated as a result of the digital economy, artificial intelligence and Big Data technology. However, due to a lack of mechanisms for data sharing or exchange and privacy protection, huge amounts of data are scattered across a large number of organizations and systems, forming data silos.

The value of data and the enhancement of efficiency can only be realized when applications and algorithms are interconnected across functions, institutions, public utilities and other organizations. The traditional approach of independent operation lacks interoperability and openness. As a result, the infrastructure can never become truly efficient. Rising costs and unnecessary resource allocation hinder the development of innovative solutions.

(II) Responding Measures

To tackle the issues and challenges arising from the abovementioned technological developments, it is necessary to first plan for the assessment of any legal risks associated with the technology and the establishment of an enhanced open platform to clarify legal disputes concerning the development of emerging technologies, boost the momentum of innovation and mitigate any adverse effects of these technologies.

1. Clarification of ethical issues and legal disputes regarding emerging technologies

In preparation for the plethora of ethical and legal contentions arising from emerging technology platforms mentioned in this report, a thorough examination of possible scenarios for the future is advised. This can facilitate in-depth exploration and clarification of relevant ethics and legal issues, as well as ownership of rights and responsibilities. Through the establishment of comprehensive procedures in data processing, a balance can be achieved between the protection of personal privacy and the development of emerging intelligent technologies.

2. Establishment of a technology legal risk communication and assessment system and relaxation of laws and regulations

As far as regulatory amendments are concerned, it will be necessary to establish a risk assessment, control and analysis mechanism for potential risks and possible benefits of emerging technologies and to work with the governance in the structuring of relevant management and communication procedures. In the meantime, it is necessary to relax the laws and regulations pertinent to biomedicine, green energy, robotics and energy storage technologies and industries. The expansion of the scope and domains of technological applications is advised, in order to accelerate industrial innovation.

3. Data integration platforms to resolve data silos

To resolve the data silos problem, it is necessary to establish data integration platforms and smart logistics centers, in order to integrate data services, stay informed and predict sudden events. The use of blockchain as an authentication technology can establish new types of data models that are secure, private,

authentic and consistent. This can address the pain points in today's technology regulation and data governance and enhance the quality and compliance of data.

Meanwhile, it is necessary to establish a common standard for data publications and interface formats for data from different departments. A single publication platform is required to integrate heterogeneous data and linked data practices and enhance data interoperability in order to resolve the dilemma of cross-functional data silos. In the example of the government's COVID-19 pandemic prevention policy, it is necessary to quickly respond and reach decisions on real-time events. This requires the integration of data from different departments and local city/county governments, the connection with location information of users from telecom operators, and access to traffic camera footage in order to accurately determine the mobility of people and predict the possible spread of the virus, so that the value of data can be maximized.

IEK View

Technological progression and paradigm shifts will in many ways make life more balanced, pleasant and fair. The era of augmented intelligence (in perfect combination with AI) and super humans will arrive. The mass market for smart and mobile devices, driverless vehicles, smart wearables, displays, digital assistants, emotion detectors, environmental imaging, and biomedicine is gradually taking shape. Emerging technologies are developing at an amazing speed. It is worth watching the progress of relevant startups. However, technology is not the only driving force that shapes the future. Seeking the solutions of social problems and critical issues for human should be the starting points for technological advancement. This will make our cities and environments more connected, more sustainable and more livable.

The integration of artificial intelligence (AI) and blockchain can enhance the security of data and algorithms, so that algorithms can process and analyze data in an encrypted state. This mitigates the risk of data theft and leakage. Meanwhile, the decision-making process by AI becomes more transparent, by recording on blockchains the decision-making process based on data points. This does not only boost the credibility of recorded information, but also fosters the public's trust in the transparency and reliability of decisions by AI. It will promote the development of trustworthy AI and enhance the public's trust in the new technology.

The history of technological development shows that progression brings about positive benefits as well as unintended negative effects. Hackers may gain access to driverless cars, drones and robots. Electronic waste continues to pollute water resources. To ensure the emerging technologies can create more benefits to human life, it is necessary to expand the R&D and fundamental research on forward-looking science and technology and design more robust policies and laws, so that new technologies can be harnessed to resolve problems and risks arising from technological innovation.

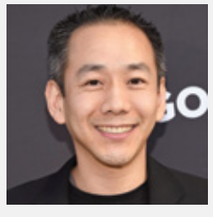
Establishing a data sharing and integration platform with better efficiency and openness is a very critical success factor. By connecting with research organizations and tapping into technology knowledge around the world, it can foster new partnerships among the public, corporates and the government. It is envisioned that technology should be harnessed with creativity, foresight and execution in an environment with robust regulations, risk management and information security, in order to bridge the gap between vision and practices. As the co-competition dynamics continue to evolve in the global technology industry, only by learning from the future and keeping up with mega trends can the industries "stay ahead of the game" and achieve successful transformation.

IEKCONSULTING

https://ieknet-eng.iek.org.tw/
Direct Line: (886) 3-5912340
Fax Line: (886) 3-5820302
Email: iekconsult@itri.org.tw

Focus on Getting Critical Mass is the Only Thing that Matters

Though they make fun calling themselves the COVID refugees, many startup founders from the US have devoted themselves in mentoring startups in Taiwan. Patrick Lee, a serial entrepreneur who created six startups, including Rotten Tomatoes, is one of them. Patrick is now based in Taiwan and is a member of the TTA Black Card Community. He shares his insights on the only thing that matters for startups to survive and be successful in an interview with us.



Patrick Lee

https://www.linkedin.com/in/rottendoubt/

Q: You are now part of the Taiwan startup ecosystem and a TTA mentor, many people would love to know you and what you plan to do in the future. Could you introduce yourself and your background to our readers?

I was born in the States and went to UC Berkeley. From there, I ended up doing six different startups. Rotten Tomatoes was the third one and the most renown one. I also did a startup in China and one in Hong Kong. The one in Hong Kong (Alivenotdead.com) is kind of like MySpace, and one of my co-founders was Daniel Wu (吳彥祖). Afterwards I went back to the States and did a mobile game company called Hobo Labs. For the past few years, I kept myself busy speaking at tech conferences, mentoring a number of different accelerators, and supporting various organizations focusing on Asian Americans, including Gold House and the Asian Pacific Fund.

More recently I came to Taiwan because a lot of friends came here. Since coming here, I've tried to get involved with the Taiwan tech ecosystem and be helpful.

Q: What brought you here in Taiwan? Just because of the friends or because you've spotted other opportunities?

Mainly it's friends. Steve Chen from Youtube came in 2019, told me about Taiwan Employment Gold Card, and asked me to visit. So I came in November of 2019 for a week. I didn't think staying in Taiwan long term at the time. But soon after my visit, Covid hit the States, and a lot of friends started moving to Taiwan to escape from the Covid issues that were happening there.

For me, I didn't come because of that. I came because so many friends within tech and VCs were all here at once, and I felt like I could come and hang out with all of them at the same time and take a closer look at Taiwan.

The longest time I had been here in Taiwan at one point prior to this trip was a month when I was in high school. This time, the plan was to stay for three months and extend from there. I have been here almost half a year now.

Q: What do you enjoy the most in Taiwan?

The best thing was having so many friends here at the same time. I also got to know their friends and met a lot of interesting people. And I would say it's been a really interesting time for everyone to be here all at once. Maybe because Taiwan is so much more dense than the San Francisco Bay Area. The same friends I would see maybe two or three times a year back in the States, I can see two or three times a week or month here in Taiwan. That was quite nice. And I got married last October, and we did wedding photos here in a really nice studio. They don't have things at that level in the States. I also did a full-body health exam here, which was very efficient and at very reasonable price. Again, that kind of service does not exist in the States, or at least not at the level where it's available to most people.

Q: Let us move on to your professional experiences. You co-founded Rotten Tomatoes and five other startups over the past 20 years. What were the most important things you have learned from your entrepreneurial journey?

The one thing I spoke a lot over the past year and a half, is "focus". I noticed that two of the companies that did much better were super focused. They were Rotten Tomatoes and my design firm before that. The three companies we did after Rotten Tomatoes weren't focused, because we were able to raise more money and had more resources. Because of that, we ended up trying to do too much, and that didn't work.

And almost all of the companies that are very successful, they all started off very, very focused. Amazon focused on books. Google was only simple search when it first came out. Facebook was only at Harvard when it first launched. I was sort of looking around and realized that this is true across the world and across every industry. This is the most critical lesson for all start-ups, especially at the early stage. They need to be extremely focused on what they are trying to do, in terms of features, the category they are targeting, and the initial target market.

A big mistake that 99% of entrepreneurs make is trying to do too much too early. It doesn't matter how much money you have. Look at Quibi (which was dissolved within a year of its launch in 2020), it raised almost $2 billion. They went out building almost everything without even testing whether it was something people wanted. I don't even know whether they did surveys or something like that. They could have done that for little to no money with very small tests. Or they could have spent a couple million dollars to run tons of tests to figure out exactly how to do things, but they didn't.

Again, if you try to do too much, it doesn't matter how much money you have. That was the lesson I learned the hard way, and I have shared about it ever since over the last few years to anyone who would listen.

Q: You have given some good examples of extremely focused companies that are successful. I realized that they are also related to interpersonal interactions such as Amazon's book reviews that readers can give book reviews that other people can take as reference for their purchase decisions. For Rotten Tomatoes, that is very similar, too. People want to know other people's opinion about whether it is worthwhile to spend an hour or two on one movie. Do you think that those human factors also increased those companies' chance for success?

I think it's different for Amazon. For Rotten Tomatoes, that was our core feature. The Tomatometer is based on the opinions of hundreds of movie critics who have seen the movie. The problem we were trying to solve was, "I want to see a movie. What should I see?" It is still a huge problem, even today. With so many choices out there, which one would you choose to spend the next hour or two on? We first aggregated critics' reviews, and later on allowed users to also review. That is very important across many sectors, because a lot of times when people need to make decisions they will rely on reviews, especially with purchasing issues.

Q: Do you have any projects here in Taiwan? Or anything that you think is worth working on here?

I have run a group for prominent tech founders for over a decade. It is like a support group. Founders can have other peers to talk to or when they need support in any way. One thing I have been experimenting along with a few other founder friends over the past few months is using it as an investment vehicle to work together and find other deals that are interesting. That is something I would like to do in the future -- moving away from doing startups myself and start investing in and advising/ mentoring startups.

We have a total of 140 people including Steve (Chen) from Youtube, and Kevin (Lin) from Twitch in this group. The majority of those founders are based in the Bay Area, but we also have founders spread around the world. We have been doing it for more than a decade now. One thing we do with the group is to host a dinner every three months or so featuring one member of the group as a host.

Q: As a mentor at TTA, do you have a word of advice for the startups?

I have been emphasizing the importance of focus. When you focus, you have the best chance to get to critical mass. That's what Facebook did with Harvard. It's so important to get to critical mass; and only after should you start to think about scaling up. To me, I'd prefer to get 100% of students at Harvard than to get 1% of every school, even though the latter is a much bigger number. But with that, you can't get a critical mass anywhere. Same thing with a dating app. If I were doing a dating app, I would much rather have 100% of one city, than 1% of every city. With that 100%, you must have done something right there. Then you can expand like what Facebook did. Students were begging them to add their schools. Nothing else really matters except getting to critical mass; and to do that you need extreme focus.

Q: However, some people would say, since Taiwan is not big enough and not international enough, startups should target the global markets from day-one. Do you agree with that statement?

I genuinely don't like anyone going worldwide at the very beginning. Look at Amazon, and Facebook, they were all US-focused when they were founded. Actually none of the successful companies I know started worldwide. I don't think that makes sense. Potentially you can start from Taiwan, but start US-focused in the beginning. But generally, you should focus on one smaller market just to try to get to critical mass. How do you get the critical mass in Taiwan? Start with Taipei. If you can get critical mass in Taipei, then you must be doing something right. If you want to aim for worldwide, I wouldn't do that in the beginning, but you can do it in a way that it is easy to translate into English, or something like that. But whatever you do, make sure you are seeing that's what people want, and a lot of people want. When you succeed in getting to critical mass in one city, then you can expand to a second city. But that is not easy. At the beginning, go for the low hanging fruit. Once you have something that works, then you can look at scaling up

Q: Do you have any suggestions for the TTA as a builder of the startup ecosystem?

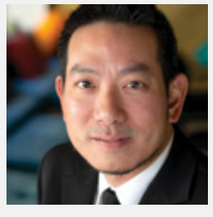
There are two things off the top of my head that they can do. The first is getting mentors to speak at events or office hours. Secondly, I would do curated events by industries. For example, get some enterprise investors together with enterprise startups and do lunch or dinner with no more than 20 people each time. Let the participants go around the room and introduce themselves in 30to 60 seconds so people get to know each other. Or maybe you can have one person to speak to the audience for a bit, and then have everyone mingle and meet each other after. That would be much more valuable than a general mixer for everyone. You can do it within different industries such as biotech, AI, blockchain, etc. By curating an interesting group of people and mixing together startups and investors, there will be more chances to have something come out of that.

Q: Many places are gradually opening up after the vaccines are in place. What would you advise TTA to do in the post-pandemic era so that the startup ecosystem can flourish further?

The analogy I would use for building an ecosystem is to think of a forest. If you think of a startup as a seed, you want to grow it into a very large tree so that it will drop more seeds. When you look at Facebook, Google, Amazon, or Paypal, when they get really big, then suddenly all of the people from those companies would use the money they earned from those companies to invest in or create new startup companies. For example, Tesla's Elon Musk, and the founders of LinkedIn, YouTube, and so many more amazing companies all come from Paypal. And so many semiconductor companies all popped out of Fairchild Semiconductor too. You should let people in the company have equity, so they will accumulate both knowledge and capital when the company exits. You need a tree that is big enough that can start dropping seeds to grow more trees. Silicon Valley has been doing that since the 1950s. Over and over again. You have HP, Yahoo, Google, Facebook, etc. So many trees that Silicon Valley is like a forest. There are so many huge startup unicorns there. Most of the cities only get to have one or two of those companies. For TTA, or Taiwan, the focus should be to put resources to grow the startups into big trees. Instead of just trying to scatter the seeds, you need to focus on how to grow them big enough that they can start dropping more seeds themselves.

It’s Time for Taiwan’s NewSpace Industry to Take off

Eric is a partner of Infinio Capital and a member of TTA Black Card community. He returned to Taiwan for the first time in 2019 after more than 25 years since he left for college in the States in the 1990s. He talks about his aspiration of helping Taiwan to foster a thriving space industry and become a global NewSpace leader in 3-6 years.



Eric Lin

https://www.linkedin.com/in/symbiosiscreative/

Q: What brought you back to Taiwan? Could you share with us your background?

I was born in New Jersey. My mom brought me back to Taiwan when I was three. I went to Tsai Hsing Primary School in Mucha and then attended Taipei American School until I graduated. From there, I went to the United States and haven’t been back for more than 25 years.

I returned to Taiwan due to the encouragement from Dr. Chen Liang-gee, the former minister of Science and Technology. Dr. Chen visited Los Angeles in 2018 and encouraged venture capitalists with Taiwan backgrounds to invest in Taiwan. Unfortunately, not too many people are open to that idea due to the lack of deals in Taiwan. However, since most of my partners have Taiwanese wives, and the wives are very passionate about Taiwan, they encouraged their husbands to invest in Taiwan. And at the same time, I stumbled upon an opportunity to help SpaceX build ground terminals in Taiwan. So I jumped on that opportunity and started the journey of bringing the NewSpace industry to Taiwan. I returned to Taiwan in November 2019 with a SpaceX delegation to meet with government officials and survey production facilities.

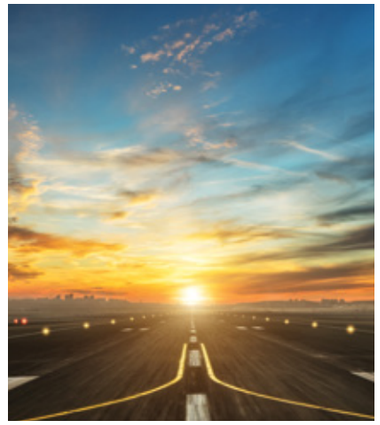
Q: What potential strengths Taiwan has in terms of the space industry?

Taiwan has a strong precision manufacturing capability. To quote Elon Musk, “Sending rockets to space is easy, but cost down on ground terminals is tough.” Musk is sending 42,000 satellites to space to form a low earth orbit satellite constellation called StarLink. Those satellites travel super-fast and are called “the satellite trains”. So, the ground terminal has to track the satellites. The tracking technology is complicated and thus very expensive, and that’s where Taiwan comes in. Taiwan is good at cost-down and dealing with complex mechanical problems. That is the reason why I brought SpaceX to Taiwan to manufacture ground terminals.

Taiwan has accumulated precision manufacturing capabilities over time. The government’s investment in the space sector over the past 20-25 years through the National Space Organization to build their satellites amounts to billions of dollars each year. As far as I know, almost 90% of Formosat 6 and Formosat 7 components were made by Taiwanese companies. That has incubated a lot of capabilities. I believe it is time for the Taiwan government to start commercializing the space technologies they incubated over the years and transform that into a company-led effort.

Q: Do you think Taiwan’s startup ecosystem can support that?

That’s a good question. Taiwan has a very narrow space supply chain. There are about 50-80 space-related enterprises. There are only 3 to 4 startups related to NewSpace sectors here in Taiwan. Having said that, we here at Infinio Capital are trying to bring global NewSpace startups to Taiwan and collaborate with local companies. We need to accelerate Taiwan’s NewSpace capabilities. In that process, we can bring up more Taiwanese



entrepreneurs and startups. But right now, Taiwan does not yet have a sufficient ecosystem to support a NewSpace industry. The good news is, the government has many resources, and corporates are ready to engage. Therefore, we need to bring talents worldwide to Taiwan to cooperate with the government and corporations to accelerate the space industry.

Q: The information-communication technology (ICT) industry is a major sector in Taiwan. Do you think Taiwanese ICT companies can also collaborate and engage with the NewSpace industry?

Definitely, 100%. The NewSpace industry is open for business, and Taiwan has a lot of opportunities. New breeds of satellites are standardized and software-enabled, which means the mission would change according to the software within. Just like you have all kinds of apps on your iphones to perform different functions. Therefore, you can see the new satellites as iphones in the sky. Now we can beam software into the satellites to change

or enhance their functions over time. Taiwan's ICT companies have an excellent opportunity to crack this nut because the satellite is just another piece of ICT device in the sky. This is a new paradigm, just like electric cars, which are ICT products on wheels.

Q: But for products to be able to operate in space, will there be requirements for space-grade certification? How long would that take?

It used to be that way. That is because satellite launches were so expensive, and the certification process was so time-consuming. But not anymore. Elon Musk changed the paradigm. Like Planet Labs, Spire, and Elon Musk's SpaceX, many satellite startups in the Silicon Valley use off-the-shelf components to make satellites. In the past, satellites are complicated, customized, and super durable. They were very expensive and take hundreds of millions of dollars to build, so people want to optimize the satellite's life span. They make satellites to last more than 15 years in the sky. But nowadays, satellites are disposable. I would call it the "Uniqlolization" of the satellite industry. Low earth orbit satellites have life spans of 3-5 years since they will be pulled down by gravity. That made them "disposable" in a way. And by the way, those expensive geostationary satellites that stay in the sky for 10-15 years use old technologies that make them inefficient. With the disposable satellite, you can send the latest technologies into the sky to perform the most advanced functions. Since those new breeds of satellites are smaller and will be disposed of in 3-5 years, you can just use off-the-shelves, vehicle-grade components to do space stuff. Then you probably only need space-grade certifications for environment testing such as extreme temperature, radiation resistance, etc.

Q: To support the future growth of NewSpace startups, any word of advice for the startups, the ecosystem, or TTA?

I think startups here in Taiwan are technically strong and solid in domain knowledge. They work hard and have good work ethics. I used to work with Taiwanese programming talents in software projects, and their quality is way above people from other places. Their front-end capability needs some enhancing, but they are excellent overall. Their weak side is a lack of creativity and go-to-market capability. They need the confidence to create a premium product.

Many of them would come to me, saying, "Hey, I created this me-too product which cost only 1/3 of similar products out there." However, they should create a unique value proposition instead and command higher pricing for that premium product. That is a flaw for Taiwanese entrepreneurs because they lack the confidence to create a premium product. That is, perhaps Taiwan has been an OEM hub, and we are always competing for price. That kind of mentality still sticks with some entrepreneurs, but they don't need to always go for a cheaper solution.

Q: But don't you think that is a dilemma for innovators? This mentality is so strong that the Taiwanese entrepreneurs would do things very cost-effectively, but at the same time, they are caged and unable to be creative and think out of the box? Any suggestions for that? How to overcome the challenge?

That might be true for corporations but should not apply for startups because they should be creating something brand-new, not a me-too product. And even with corporations, many of them are changing their mindsets. That's why Foxconn and Acer are going for high-margin boon market products now. Foxconn's approach to the autonomous vehicle market is one example. Taiwanese entrepreneurs should be innovative and robust technical-wise. They need to have a global view, that is, to have a solid go-to-market strategy from day 1.

The market in Taiwan is too small, so they need to develop products for global audiences.

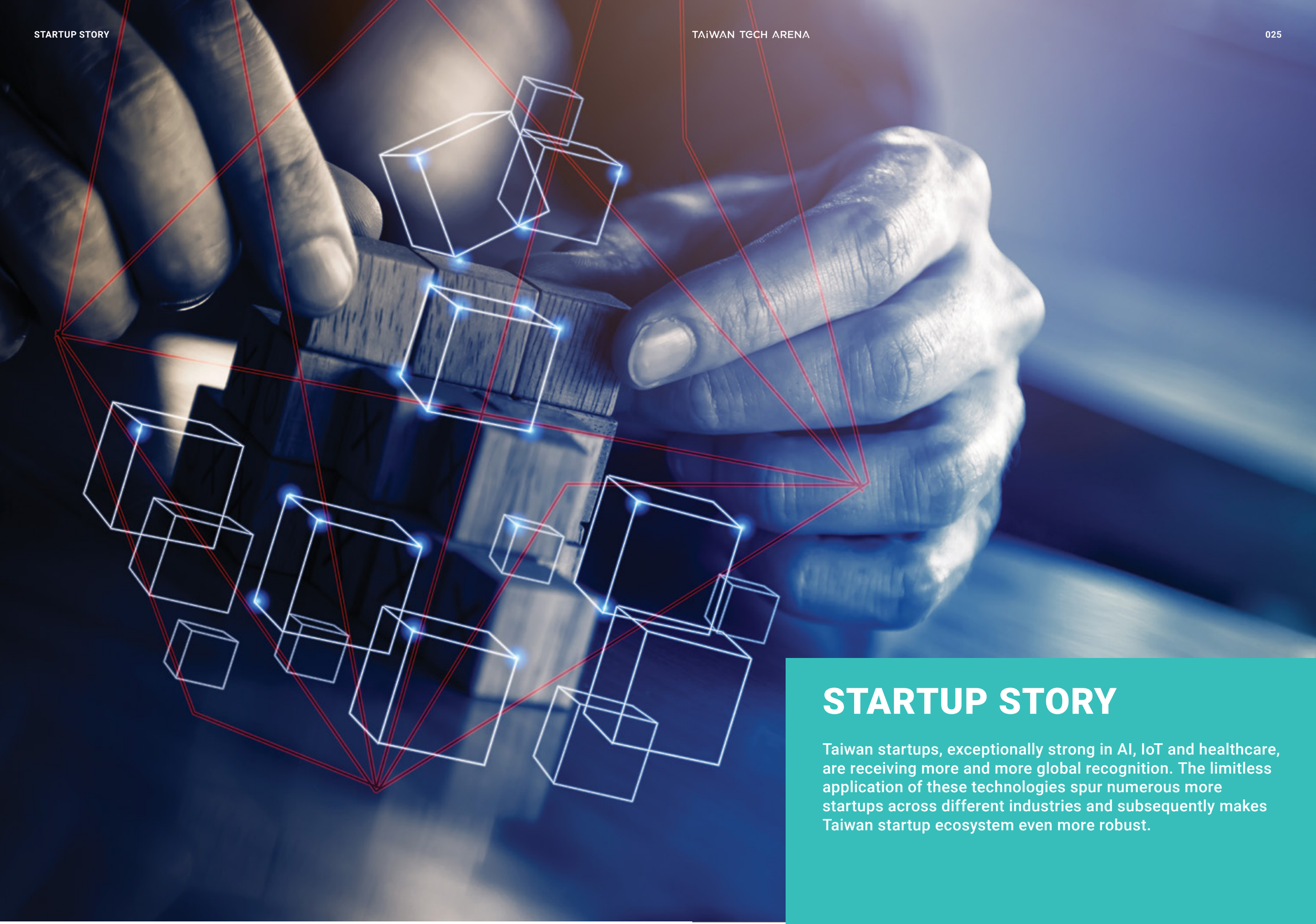
They can create their prototype in Taiwan, but they should travel to their target market fairly early to understand their customers. How can TTA help Taiwan startups better? Well, TTA does a great job giving entrepreneurs a global view. That is excellent. But they need to have more hubs worldwide to bring the Taiwan entrepreneurs to their target markets early on. It is impossible to create products in Taiwan for customers around the world blindly.

TTA has a hub in Silicon Valley and should have more hubs, such as Los Angeles, Boston, New York, or Germany. TTA should also work on the lifestyle ecosystem of entrepreneurs. Helping them to create an ecosystem is critical. Beside building up a local interpersonal networks and getting to know the mentors, local entrepreneurs, investors, and influencers in the community, TTA needs to help the entrepreneurs settle down in a convenient place to live – an all in all lifestyle ecosystem good for their work and mental health. To me, it is vital for Taiwanese entrepreneurs to mingle and integrate into the local startup ecosystem and the market. If TTA does set up a hub near Los Angeles, I will help the entrepreneurs to build up their lifestyle ecosystem there.

Q: Are you planning to stay in Taiwan long-term in the future? What do you see yourself in 5 years?

Right now, I am traveling back and forth between Taiwan and the U.S. every two or three months because my kids are in the US, and they love the school and their friends there. In five years, I would like to see myself establishing a thriving NewSpace industry in Taiwan with global entrepreneurs working side-by-side with local talents. I want to elevate Taiwan to a global NewSpace leader. Perhaps I will live in Taiwan after my kids left for college.

I am confident that Taiwan can capture this market and become a global NewSpace leader. I believe we must make it happen within five years; otherwise, our Asian neighbors will take over the place, and that opportunity is gone forever.



STARTUP STORY

Taiwan startups, exceptionally strong in AI, IoT and healthcare, are receiving more and more global recognition. The limitless application of these technologies spur numerous more startups across different industries and subsequently makes Taiwan startup ecosystem even more robust.

Instant NanoBiosensors

Revolutionizing Biosensing Approaches with Light Sensing, Instant NanoBiosensors' FOPPR Technology Creates a Vision of Mutual Benefit

In times of illness that necessitate physical exams at the hospital, most people have the experience of having to wait long periods of time for computer tomography (CT) and magnetic resonance imaging (MRI) results. Although spinal fluid extraction and biopsy of organic tissue are mature technologies, patients are daunted by the invasive nature of these procedures. The fiberoptic particle plasmon resonance (FOPPR) technology developed by Instant NanoBiosensors not only has sensitivity far exceeding other mainstream instruments on the market, but is able to, using just a small amount of peripheral blood (serum, less than 20μL) and three simple steps-- sample injection, analysis and report generation, produce testing results in just a few minutes. "What's more, the 'light-sensing biomarker analyzer' we have developed drastically reduces device size to desktop dimensions, offering faster and more convenient testing," said Tony Chung, founder and CEO of Instant NanoBiosensors.

"In accordance with our corporate vision of 'Light Saves Lives,' we seek to integrate optics and medicine to provide patients with better healthcare quality." Tony further explained that Instant NanoBiosensors was founded after he, by chance, discovered work on FOPPR being researched by two professors at National Chung Cheng University, Dr. Lai-Kwan Chau and Dr. Shau-Chun Wang, and identified the technology as being of immense commercial value. He therefore invited Dr. Chau and Dr. Wang to jointly found Instant NanoBiosensors in August 2016. Instant NanoBiosensors' goal is to offer clinical physicians testing solutions with higher precision, speed and convenience to serve as the basis for disease surveillance and drug efficacy assessments after patients receive medication for improving patient care and connectivity while closing the gap in healthcare disparities.

High Sensitivity and Specificity FOPPR Technology Yields Results Comparable to Top Large-Sized Devices

FOPPR technology entails placing the blood or urine samples of test subjects on an IN-Chip (pump-free, internally valved microfluidic chip), a new testing chip pioneered by Instant NanoBiosensors, then inserting the chip into the light-sensing biomarker analyzer and detecting biomolecules on the fiber optic surface of the chip using the light source of the device. As Tony pointed out, "this approach has the advantages of being label-free and offers instant detection, high sensitivity as well as high specificity, and is a better option for both patients and medical practitioners from every perspective."

Tony emphasized that one of FOPPR's strongest points is that it is a desktop-sized device capable of yielding analysis and detection results comparable to that of top large-scale equipment utilized in major laboratories. As FOPPR is performed using chips, it does not require robotic arms or complex optics designs, pumps and tubes for processing fluids usually present in enzyme-linked immunosorbent assay (ELISA) automated equipment. As such, device size can be drastically reduced to desktop dimensions.

As an increasing number of antibody-drug conjugates becomes available on the market, companion and ancillary testing equipment for such drugs will become some of the most widely sought products on the market. Quanterix, a publicly traded life sciences company, has for instance been in recently years deeply committed to clinical testing research on high sensitivity biomarkers for brain diseases, cancer and autoimmune diseases in preparation for the upcoming boom of antibody-drug conjugates. The devices that Quanterix has developed however are only suitable for large-scale labs and cannot be applied in digital medicine due to their massive dimensions. Other major international brands such as Abbott and Roche are also actively looking for high performance small-scale testing devices. This signifies vast future business opportunities for Instant NanoBiosensors, a company possessing several state-of-the-art crucial technologies.

Establishing a Presence in the Global Industry Supply Chain to Showcase Taiwan's Startup Power

FOPPR, an approach that completely revolutionizes the existing medical testing industry, has garnered the attention of major international manufacturers. Instant NanoBiosensors was selected from more than 500 startups to join Merck Accelerator Program offered by the Merck Innovation Lab. Strategic collaborations are also currently under way.

In terms of market size, Tony indicated that the global biomarker market value is approximately US$130 billion currently and is expected to rise to US$200 billion in 2025. "Even a 1% market share will mean immense business opportunity." Despite the caution exhibited in this estimate, Instant NanoBiosensors has been extremely active in establishing collaborations with over a dozen medical and academic institutes both in Taiwan and overseas. Apart from the clinical collaboration on kidney disease with Brigham and Women's Hospital of Harvard Medical School in the US, it has also recently completed a clinical study in collaboration with the Department of Neurology at National Taiwan University. At the Digital Health Connected Patient Challenge held by Boston Scientific, Instant NanoBiosensors emerged as a winner from several hundred contestants. This gives the company the opportunity to, in the future, enter into a strategic partnership with Boston Scientific in Boston, a major hub for medical device R&D and clinical research.

With the concerted efforts of the entire team at Instant NanoBiosensors, the company has achieved outstanding results, and Tony believes that Taiwan Tech Arena (TTA) has played an indispensable role in helping the company succeed. As a seasoned entrepreneur, he admits that, in the past, Taiwan's startup environment left much to be desired with businesses relying mostly on their individual experiences and resources. The founding of Instant NanoBiosensors however was a whole new experience owing to the higher level of engagement and the government's efforts in promoting Taiwan startup ecosystem. Instant NanoBiosensors is committed to continue investing in R&D to create a future of mutual benefit for industries, medical institutions and patients.

info@instantnano.com

http://www.instantnano.com/

TEL. +886.2.25700202
ADD. No.2, Sec.4, Nanjing E.Rd Songshan Dist.,
Taipei 105, Taiwan(R.O.C.)

EDITORIAL TEAM
Editor in Chief | **Gloria Hsiao**
Editor Director | **Yo Hwang**
Associate Editor | **Gina Liu**
Art Director | **Alen Yang**
Senior Editor | **Tenniel Liu**
Senior Copy Editor | **Judy Lin**
Copy Editor | **Sandy Du**
Social Media Editor | **Daphne Lien**

DIRECTOR TEAM
Managing Director | **Jason Chang**
Senior Director | **Gloria Hsiao**
Senior Marketing Director | **Betty Hsu**
Operation Director | **Vivian Chen**
Partnership Director | **Dr. Michael Ho**
Event Director | **Elley Yang**
Alumni Director | **Alison Wu**

PROJECT MANAGEMENT TEAM
PM | **Alice Shih, Carol Huang, Nicole Cheng, S.R. Liu**

PARTNERSHIP TEAM
Coordinator | **Benny Yang, Chia-Yu Chang, Danny Lin, Gary Chang, Miao-Ling Hung, Mike Hung, Nicole Hu, Sylvia Chang, Vic Fan**

EVENT & MARKETING & OPERATIONS TEAM
Coordinator | **Celia Liu, Gina Yu, Karei Huang, Dr. Patty Lin Rebecca Cheng, Sara Wang, Savannah Chiu, Tzu-Chieh Shen, Zoe Lee**

EMPOWERING GLOBAL TECH STARTUPS