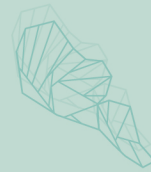


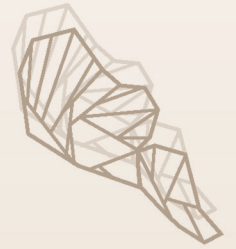


The 5th Presidential Innovation



| Award Report |

The 5th
Presidential
Innovation Award



第五屆總統創新獎





∴ Foreword

During the global pandemic of the past few years, Taiwan has built on our outstanding innovative capabilities to promote digital development, with public-private partnerships demonstrating our formidable resilience and helping us achieve growth amid a global economic contraction.

Taiwanese innovation has won international attention and acclaim, with the IMD World Competitiveness Yearbook for the second consecutive year ranking Taiwan as the world's most competitive economy with a population greater than 20 million. While reviewing candidates for the 5th Presidential Innovation Awards, we found all kinds of innovative potential to integrate and strengthen Taiwan's industry, economy, and society. Long-term projects such as the transformation of our education system, management of our water resources, and cultivation of future industrial talent all require extensive periods of investment and development in order to provide a foundation for our nation's reform and transformation.

After a rigorous and fair review process which began in August 2021, two group winners and three

individual/youth winners of the 5th Presidential Innovation Awards were selected from a total of 277 entries. Covering education, water resources, electrical engineering, semiconductors, and emergency response, the fields represented by this year's awardees are the most diverse yet.

As a winner in the group category, the Junyi Academy Foundation is using technological innovation to promote educational transformation through differentiated instruction, realize educational equality, and give students the ability to learn autonomously throughout their lives, wherever they are located. The other group category winner is the Water Resources Agency of the Ministry of Economic Affairs, which has leveraged technology to fight flooding and drought, develop a diverse range of water resources, ensure domestic and industrial water supply, and improve the resilience of Taiwan's water resources, contributing significantly to public welfare and economic development.

Among the winners in the individual category, Dr. Tsai Mi-Ching, National Cheng Kung University Chair Professor of Mechanical Engineering, has

been a key driver of research, development, and talent cultivation in Taiwan's electric motor industry, providing the sector with an inexhaustible source of technological innovation. His fellow individual award winner, Macronix Chairman Miin Wu, in 1989 led a group of semiconductor experts from the United States back to Taiwan to found Macronix, whose innovative approach to design helped Taiwan move away from the reverse engineering trend in contract manufacturing and made the firm into the second-largest supplier of chips to the global automotive market.

This year's youth category awardee is Sung Ming-Che, a firefighter in the Fire Bureau of Changhua County. He independently designed and developed a body bag that helps first responders work efficiently while respecting the dignity of the deceased and their families. By spurring further private investment in the research and development of rescue equipment, Mr. Sung has improved safety for others in his line of work.

We hope the Presidential Innovation Awards encourage further innovation and value creation, and we look forward to the national economic and social benefits that such accomplishments can bring

to Taiwan's prosperity and to our industries built over generations. Looking ahead, our government will keep working to integrate resources across business, the public sector, academia, and research institutions in order to expand Taiwanese innovation into new fields, thereby making a better Taiwan and contributing even more to the world. I hope these stories can provide inspiration to one and all.

President

A handwritten signature in black ink that reads "Ing-Wen Tsai". The signature is written in a cursive, flowing style with a large, prominent initial 'I'.

December 2022



∴ Foreword by Minister

A myriad of changes has occurred rapidly across the globe. In recent years, the U.S.-China trade conflicts and the COVID-19 pandemic have brought the issue of global supply chain resilience into the spotlight. Supply chain resilience is a source of Taiwan's strength, while the spirit of continuous innovation across government, industry and academia is a key force propelling Taiwan into a leading global role.

It is this spirit of continuous innovation and dedication to solving problems within Taiwan and for people around the world that has led to Taiwan's outsized role in the global supply chain and allowed Taiwan to shine on the world stage. I am delighted to observe that the entries for the biennial Presidential Innovation Awards have become more diverse with each passing year, representing an ever wider range of fields, from technology, services, culture, education and design, to medicine, information security, water conservancy, and beyond. This diversity is testament to Taiwan's active investment in innovation throughout all sectors of society, which has proven to be an endless source of energy driving continual progress.

For this year's 5th Presidential Innovation Awards, there were a total of 277 entries. Because of the greater diversity of entries, the selection

committee's task was even more challenging than in previous years. Based on the selection process, it is clear that committee members carefully considered changes in the current social environment. Over the past two years, the pandemic has raged on, extreme climate change has intensified, and a series of other challenges, such as an urgent demand for industry talent, have appeared one after the other. When selecting winners, committee members not only considered the innovative ideas themselves but also paid special attention to whether these ideas might help solve some of these pressing national issues.

After a rigorous selection process, the two group and three individual winners stood out as particularly exemplary in their ability to promote national and social progress through innovation.

For example, in the face of climate change, the Water Resources Agency (WRA) of the Ministry of Economic Affairs has long used big data and meticulous management to closely monitor the nation's water supply, employing various measures to deal with potential problems in advance. At the start of 2021, as Taiwan was facing its worst drought in a century, the WRA increased water supply by 1.3 billion tons, successfully extending

Taiwan's water supply by 4 months and helping to maintain Taiwan's GDP at NT\$19.8 trillion without any economic interruption. While achieving innovation at a government agency such as the WRA may be more challenging, it has the potential to have a greater impact. This year's other group winner, the Junyi Academy Foundation, is a non-profit organization that has invested in improving education. The foundation has established the largest free online learning platform in Taiwan, moving beyond space constraints to grant millions of students—whether urban or rural—convenient access to online learning while staying safe from the pandemic.

One of the winners in the individual category, Miin Wu, chairman of Macronix International Co. Ltd., brought 28 families, including 40 Taiwanese engineers, back to Taiwan from abroad more than 30 years ago, initiating a trend of skilled technology workers returning to Taiwan for entrepreneurship and development opportunities. He has continued to cultivate high-tech talent in Taiwan, making outstanding contributions to Taiwan's talent pool development. Another of this year's award winners, Mi-Ching Tsai, chair professor at National Cheng Kung University, has long been devoted to motor research, facilitating industry-university cooperation to promote new innovations. He also applied the medical education internship system to graduate and doctoral students, helping to cultivate Taiwanese talent well-versed in both theory and practice. This year's winner of the youth category, firefighter Ming-Che Sung, single-handedly created the world's first

water recovery body bag to protect rescuers while preserving the dignity of the deceased.

From this year's list of honorees, we can see how the perseverance of innovators, whether as part of a government agency, a commercial business, a non-profit organization, or simply as private individuals, can greatly influence society and lead Taiwan to a better tomorrow. This award report records the innovation processes and struggles of these award-winning groups and individuals. Through this report, we hope to pass on the innovative potential of Taiwan, as well as the factors nurturing this potential, so as to spread these ideas throughout society and stimulate even more creative energy.

Lastly, it is our hope that more groups and individuals from all sectors of society will dedicate efforts to innovation and register for the 6th Presidential Innovation Awards, so that we can showcase more wonderful stories of innovation that inspire others to believe in their own potential to create change. Let's support innovation to create a brighter future together.

Minister of Economic Affairs



December 2022


Table of Contents

02	Foreword
04	Foreword by Minister
08	Aim and Orientation of the Award
09	Introduction to the Award
10 – 11	Presidential Innovation Award
	Group Category
12 – 21	▨ Junyi Academy Foundation
22 – 31	▨ Water Resources Agency, MOEA

Presidential Innovation Award

32 – 33 Presidential Innovation Award
Individual Category / Youth Category

Individual Category

34 – 43  Department of Mechanical Engineering, National Cheng Kung University
Mi-Ching Tsai, Chair Professor

44 – 53  Macronix International Co., Ltd.
Miin-Chyou Wu, Macronix Chairman & CEO

Youth Category

54 – 63  Changhua County Fire Department
Ming-Che Sung, Firefighting Inventor

∴ Aim and Orientation of the Award

The Presidential Innovation Award is handed out in recognition of those who have achieved outstanding innovative accomplishments and have made concrete contributions to the country's economic development in terms of their products, technical skills, management, services or cultural performance. With their ideas and enthusiasm about how to move from innovation to starting a business, they can be of help to Taiwan's on-going industrial transformation by serving as models for all sectors, leading them toward the development of an innovative economy for Taiwan and helping establish a comprehensive innovation system for the country and create a competitive edge in economic development.

Individuals or groups in public, private, and academic sectors are encouraged to actively pursue innovation and value creation in products, technical skills, management, organization, marketing, services or cultural performance so that they can help boost the country's overall economic development and strengthen its competitiveness in the world.

∴ Introduction to the Award

The Presidential Innovation Award is held every two years. It is given out to five winners, with two in the group category, two in the individual category and one in the youth category. Registration for competition for the 4th Presidential Innovation Award started in August 2021, ending on Sept. 30 of the same year. A total of 277 individuals and companies registered.

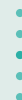
They were evaluated by a selection team divided into four groups : technology R&D, cultural & creative value added, service innovation and talent cultivation. They were responsible for preliminary and secondary reviews. In the final review, they decided on the winners together with members of the Presidential Innovation Award committee. Junyi Academy Foundation and Water Resources Agency, MOEA were the winners in the group category. Department of Mechanical Engineering, National Cheng Kung University Mi-Ching Tsai and Macronix International Co., Ltd. Miin-Chyou Wu were the winner in the individual category. The winner in the youth category was Ming-Che Sung special assistant to the president and chief of research and development at Changhua County Fire Department.

Group Category

...



The wisdom of human beings and the cleverness of technology can help reverse the challenge of unequal distribution of educational resources.





經濟部水利署

“ Our past experiences are not enough to combat climate change. We have to be open-minded to embrace new ideas and create innovative solutions. ”



Group Category

...

Junyi Academy Foundation

Creating a Digital Learning Platform to Help Every Child in Taiwan Grow

The establishment of the Junyi Academy is to continuously provide every child with equal and high-quality educational resources and implement educational equality. The academy utilizes technology to assist teachers and parents in teaching students according to their aptitude and help children develop the habit of self-learning, ultimately becoming lifelong learners who are adaptable to changes. Since its launch at the end of 2012, Junyi has become the largest digital learning platform for compulsory education in Taiwan, with nearly 4 million registered users and more than 30 thousand free educational videos.

With the uncertainty brought by COVID-19, classes used to take place offline in schools might suddenly change to online forms. In the time period where “accidents” frequent happened, nearly 1 million teachers and students visited the platform of Junyi Academy weekly to maintain uninterrupted learning. This echoed the original intention of Junyi Academy when it was founded in 2012 – “Through technology and collaboration, we provide free and high-quality personalized educational resources and environment for all children.”

Every child – this is the key word outlining the mission of Junyi Academy.

The total number of primary and secondary school students in Taiwan are around 2.4 million. While these students are distributed either in urban or rural schools, the educational resources between the underprivileged and the non-underprivileged are vastly different. “Not every child can enjoy the same education quality,” Ray Lu, Chairman and CEO of Junyi Academy Foundation, indicated.



If you ever visit a classroom in Taiwan, you will find that there are always students sleeping in class. Why? It's mostly because the traditional educational system is not able to take into account all students, and teachers can only teach at a unified pace. As a result, students with lower learning speed or comprehension ability are literally abandoned by the system and have no choice but to sleep in class.

Junyi Academy believes that it is possible to be underprivileged not only in remote villages, but in every city, every school, and every classroom. However, Junyi dares to dream big, believing that no child should be left behind. It has realized differentiated instruction via technology, which allows students to learn independently. In addition, the team has



Innovation comes from integrating differences with wisdom. It's about finding new flavors and breaking through the long-standing, difficult-to-solve, but important problems.

Junyi Academy Foundation Chairman and CEO

吳冠緯

visited urban and rural areas to gain a deeper understanding of the situation and address the unequal distribution of educational resources through digital transformation.

Dedication to Public Welfare Gives Rise to the Founding of Junyi Academy

The founding of Junyi Academy stems from its founder Shinjou Fang's concern about the challenges faced by Taiwanese people. After retiring from the high-tech industry, Fang traveled all over Taiwan, only to notice the gap between urban and rural areas and between the rich and the poor. "I really wanted to do my best to make positive impacts." Fang added that he is also the chairman of Cheng Zhi Education Foundation.

What he wanted to do was more than just proposing a solution for a single event or a single problem; his goal was to bring about long-term changes. "Education is the only solution to structural problems." After he realized this truth, Fang decided to start from education.

With a background in the high-tech industry, he had 20 years of experience in the Silicon Valley. In addition, the Khan Academy established in California in 2008 had driven the trend of online learning. Inspired by this, Fang decided to create Junyi Academy with the resources from Cheng Zhi Education Foundation. By producing videos online, he aimed to provide free and high-quality educational resources for the Internet generation. Junyi Academy was officially launched in October 2012. It is the first free and fully open online education platform in Taiwan.



“Showing care for the underprivileged and save the country with science” are the two missions Shinjou Fang set for his public welfare career. “Taiwan has scarce natural resources, and our most precious resource is therefore talent. We must not give up on any student. We not only have to help the underprivileged, but also help gifted ones, just like what Junyi (equality) means.”

The name Junyi is derived from the Junyi School of Innovation in Taitung, which was established by Stanley Yen, Chairman of the Alliance Cultural Foundation. Convinced by the cause to build a free online education platform, Yen agreed to authorize the usage of the name Junyi for free. “Every child, regardless of their backgrounds, enjoys a free, equal, and high-quality educational opportunity.” This is the common philosophy of Stanley Yen and Shinjou Fang.

Handing Over the Mission of Caring for the Underprivileged to the Next Generation

In 2017, Shinjou Fang decided to hand over the baton to the younger generation. After several meetings and discussions with Ray Lu, then CEO of Cheng Zhi Education Foundation, and

board of the foundation, it was decided that Ray Lu and the team at Junyi would set up a new foundation together - Junyi Academy Foundation. After the handover, Fang led the Cheng Zhi Education Foundation to focus on the operation of public school managed by the private sector, continuing to pay attention to the education of the underprivileged and promote character education.

“These young people have done a great job after taking over, and they have done even better!” Fang showed no hesitation in praising the young generation.

While they came from different generations, Shinjou Fang and Ray Lu, the current CEO of Junyi Academy Foundation, can be described as “like-minded.” Both of them have paid attention to the issues of the underprivileged since they were students. Fang founded the UU Club (i.e. Club for Children) when he was at National Chiao Tung University to help underprivileged children. Lu, who was also inspired by Khan’s Academy, spent his spare time recording educational videos on English and math for senior high school students while he was studying in the College of Medicine at National Taiwan University and working as a PGY-1 intern in the hospital. He uploaded the videos to YouTube, hoping that students who were interested in learning could watch and review the videos repeatedly to make up for the gap in educational resources.

Why would a college student take the time to do this? “I worked as a tutor in college and taught in cram schools. I noticed that when students faced challenges during the learning process, as long as someone was there to teach them, they would get over the obstacles and continue to grow. Students who could afford expensive tuition fees enjoyed the resource it took to succeed, while underprivileged students who didn’t have money were often forced



to step back as they were not progressing,” Lu indicated.

The videos that Ray Lu uploaded and shared for free were noticed by Shinjou Fang. In 2013, he invited Lu, who at that time had obtained his medical license, to the foundation as a project teacher.

The Most Meaningful Choice Is to Change People's Lives with Education

Under the current social values in Taiwan, a doctor who chooses to join a non-profit (NPO) educational organization to take a full-time job will be questioned without a doubt, but Ray Lu was determined his decision. “We all said prevention is better than cure. If we can find a solution for the underprivileged children to meet their educational needs at an early stage – a scalable solution, to be specific – we may be

able to address the problem earlier, avoiding the need for more resource-intensive and ineffective remediations later on.” Between medical care and education, Lu chose what was most meaningful to him.

The choice is meaningful because Junyi does change the trajectory of many children's lives. In a primary school in Taichung City, a grade 5 student who originally had to receive remedial education, started learning on the platform of Junyi Academy under the guidance of his teacher. Because he was able to learn at his own pace, the student began to feel the joy of learning, and later even became the top five in the class.

“There were many cases like this. After children fell in love with learning, they started to show interest in acquiring knowledge. Some students even went to the Internet cafe to access Junyi Academy because they didn't have a computer at home.” Every time he heard such a

讓每一位孩子，不論出身，都有機會成為終身學習者。

Every child, from all kinds of backgrounds, can be a lifelong learner.



story, Ray Lu and his teammates would be moved, and their determination to continue to make an impact became even stronger.

Hanwen Cheng, the Principal of Wan-an Elementary School at Taitung County, is the first teacher in Taiwan to introduce Junyi Academy to the classroom. "In remote schools, there are relatively more underprivileged students, but teachers have limited time and cannot take care of every child. Junyi Academy can make up for this shortcoming. After students know how to use Junyi Academy, it is as if they have their own personal teachers." In this teaching model, teachers play a leading role and stimulate students' desire for self-learning.

In addition, Hanwen Cheng also mentioned that teachers at rural schools come and go frequently, and the turnover rate is usually high. Through the use of Junyi Academy, novice teachers can better connect with the teaching progress and can also grow in their profession.

Expanding Influence from the Outside of the Educational System to the Inside

"Do not do things that are not difficult, do not do things that cannot be scaled up, and do not

do things that cannot have a long-term impact." From Cheng Zhi Education Foundation to Junyi Academy Foundation, the team of Junyi has always adhered to the three guiding principles. Along the process, they have created many dazzling results, benefiting countless students and teachers.

Since the platform was launched in 2012, at least 38,000 videos and 86,000 exercises have been uploaded, attracting nearly 4 million registered users, with an average of 110,000 active users weekly. According to the research of Professor Mingjen Lin from the Department of Economics at National Taiwan University, all students who repeatedly used the platform and achieved the mastery in the content effectively improved their academic performance, and this is especially significant for students in the middle or at the bottom of the class rankings.

In addition to using technology to help teachers and students, Junyi has also actively used technology to influence the root of education -- the system. Junyi promotes the digital transformation of education by cooperating with the government and the public in the role of an NGO and serves as the government's policy and executive advisor, gradually influencing the direction of government



policies. It also leverages government resources towards the vision and mission of Junyi Academy. “In order to maintain a neutral role and ensure that we have a say in government cooperation, we do not take government funds,” Lu emphasized.

Junyi actively scales up the training of digital teaching for teachers. They provided systematic assistance to teachers in New Taipei City, Miaoli, and Pingtung on the use Junyi Academy to build new teaching models that take into account underprivileged students. This enabled the transfer of the successful experiences to other remote villages.

Idea Realized and Recognized by the Global Community

Junyi’s dedication has been recognized not only by people in Taiwan, but also those from the global community. In 2019, Junyi Academy received funding from Google.org, with a total of USD 1 million in 2 years. Google.org is the charitable arm of Google. It has been connecting nonprofit innovators around the world since 2005, helping nonprofits achieve their goals by providing funding, volunteering, technology tools, and more.

In 2020, Junyi, Microsoft, a leader in the high-tech industry, and Code.org, the largest NGO for programming education in the United States, became allies in their global efforts to promote teacher training and educational programs. Code.org aims to support students in the United States to learn computer science and provides free programming courses to assist the development of computer science courses at school. Junyi and Microsoft have teamed up with Code.org to expand the efforts. In particular, Junyi is the only educational NPO in Taiwan listed as a partner of Code.org.

Ray Lu mentioned in particular that, “The reason Junyi was recognized and favored by well-known international institutions has a lot to do with the soundness and transparency of its financial status.” It is necessary to provide



detailed financial statements audited by accountants every year. In addition, the board of directors of the foundation includes Limei He, the senior deputy general manager of TSMC’s Eurasian business and its former chief financial officer. “Director He’s professional supervision is indeed a big plus for us to obtain capital injections.”

As a non-profit organization, Junyi needs long-term financial support from the industry. However, Junyi has a three-noes policy when collaborating with large organizations: Don’t take the money if you are not sure about the source of the funding; don’t take the money that will foster a sole proprietorship; and don’t take money for things that Junyi doesn’t plan to do.

“We hope to raise half of the funds from large organizations and the other half from the public.” Lu believes that every donation represents the donor’s support and trust in the NPO. “Every donation not only injects capital to our business, but also encourages us to keep going.”

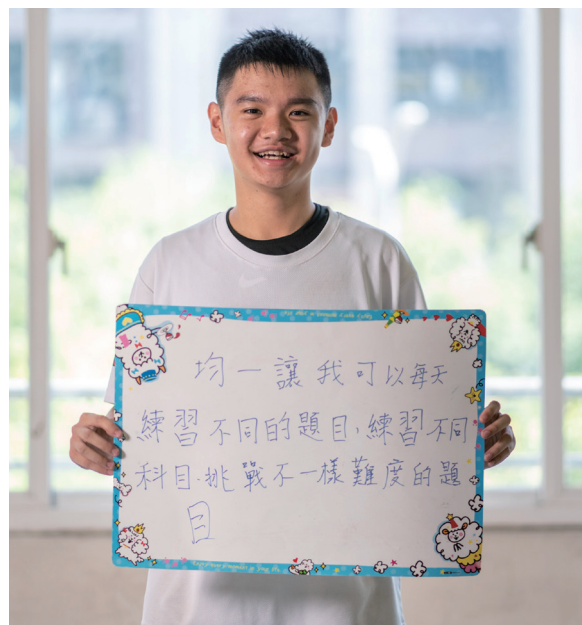
While NPOs need to raise funds to maintain their operations, many NPOs in Taiwan are not good at seeking external aids. “2018 was the first year for the Junyi Academy Foundation to operate independently. We gave out all our efforts to raise funds, but failed to reach half of the lower

end of the target. I was quite frustrated at the time, but the desperation led to determination.” Ray Lu searched for assistance from his network and tried to share his ideas with others. “We found that many people were paying attention to Junyi, but they just didn't know that we were faced with the challenge. Once they realized we needed help, they were all willing to support us. My classmates from the college of medicine were such an example.”

As a result, the fundraiser ended up 50% above of the higher end of the target set by Junyi. While the expected fixed monthly donation obtained from the fundraiser had been NTD 600,000, the actual amount raised was NTD 1 million. After several years of adjustment, the financial structure of the foundation has changed from the original 94.1% of directors' funding, 1.1% of organizational support, and 4.8% of public donations, to 3.6% of directors' funding, 55.5% of organizational support, and 40.1% of public donations in 2020. “For an NPO, such a revenue composition is quite healthy and stable. It ensures the sustainable operation of the NPO,” Lu added.

Calling for Outstanding Talents to Change Society Together

Along the way, Junyi has made numerous achievements. They started from the outside of the educational system and gradually stepped into the system to drive further changes. Looking back at the fruitful results, Lu gave all credit to the exceptional team at Junyi. “These outstanding talents gathered here because they all wanted to change the social status quo, and my task is to ignite and summon the enthusiasm of these outstanding talents.” There are about 32 full-



time and part-time partners in Junyi, with a very diverse team composition, covering fields such as medicine, programming, education, the public sector, and media marketing.

Eva, a software engineer at Junyi, came to the organization from MediaTek. “I was looking forward to a meaningful job that would allow me to exercise my talents and truly appreciate the meaning and value of life. I found it here at Junyi.”

Under the leadership of Ray Lu, this exceptional team continues to move forward. Their next step is to improve the educational content for elementary school students and teachers and ultimately create a complete online course program covering from elementary school to high school. In terms of teacher training, the team plans to transform the current tool-oriented training model to a situation-oriented one. Through lecturer instruction and a matching system, the new model will help teachers on a larger scale to overcome obstacles in traditional teaching scenarios and make it to take care of every single student.

“Actions Speak Louder than Words.” Many people complain about education, but the team at Junyi rolled up their sleeves to address the problems. If you agree with Junyi's philosophy, you may wish to donate to support them and make an impact to society together.

“

Mantra for Success

Junyi built up the largest free online education platform in Taiwan and continues to focus on its three main features, including: Free for use, effectively improving the capabilities of students from all backgrounds, and assisting more children in need with the joint effort of the public and the private sectors. In addition, Junyi conducted scaled training for teachers using digital technologies and guided the teachers to transform their original teaching methods into differentiated teaching using technology, which allowed students to learn independently. The team visited urban and remote areas frequently to address the unequal distribution of educational resources through digital transformation.

In terms of organizational management, Junyi has broken the stereotype of a non-profit organization (NPO) and is one of the few NPOs that has its own engineering team. Therefore, Junyi boasts solid technical strength and high-quality products that are continuously optimized. Junyi is committed to creating a friendly workplace of gender equality to attract and nurture more outstanding talents work together with them to make positive impacts to Taiwan.

Junyi's innovative model has received a USD 1 million funding from Google.org, as well as the support from code.org, the largest NGO for urban education promotion in the United States, and Microsoft, a leader in the high-tech industry. It is evident that Junyi's concept of cultivating lifelong learners with technological innovations has won wide recognition.

”



Junyi Academy Foundation

2012

Integrating all resources, Cheng Zhi Education Foundation launched the online platform of Junyi Academy.

2016

Performance report of Junyi Academy was released, indicating that the assistance was more obviously noted on students in the middle or at the bottom of the class rankings.

2017

Handing over the baton to the younger generation, Cheng Zhi established Junyi Academy Foundation.

2019

Junyi hosted the first Education For Sustainable Development Forum with partners from the industry, the government, and the academia participating.

2020

- ◆ Junyi joined Education CoLab to build up an educational ecosystem.
- ◆ Junyi collaborated with guidance groups for the first time on the Taipei CooC-Cloud Project.

2021

Maintaining learning progress even when schools were suspended, Junyi provided the most needed assistance to teachers and students.

President's Name | Ray Lu

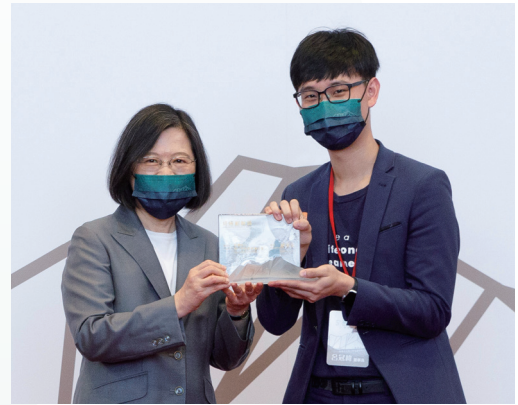
Awardee's Address | No. 25, Baoqing Rd., Zhongzheng Dist.,
Taipei City 100005, Taiwan (R.O.C.)

Years of Establishment | 2017.11

Telephone No. | 02-2393-1231

Website | <https://official.junyiacademy.org/>

No. of Employees | 27



Scope of Operation | 1. Multi-party digital content integration :

Junyi assists all children in Taiwan by developing key strategies for the integration of digital content policies from multiple parties, resulting in better learning contents for all.

2. Publisher content integration :

Junyi signed an MOU with the three major publishers in Taiwan (NAN I, Hanlin, and Kang Hsuan). The three publishers have given free authorization for all videos and exercises, allowing children in Taiwan to access the resources on Junyi for free.

3. Scale-up of teacher training on digital teaching :

The assistance from Junyi goes not only to the underprivileged students in remote regions. It provided systematic assistance to teachers in New Taipei City in building new teaching models that take into account underprivileged students. This enabled the transfer of the successful experiences to other remote villages.

4. Acting as the digital learning and executive advisor for the education bureaus :

Junyi maintains its neutral role and gradually influence the direction of government policies through collaboration from the public and private sectors. It also leverages government resources towards the vision and mission of Junyi Academy.

5. Providing the most needed assistance for teachers and students even when schools were suspended due to the pandemic :

Junyi has been always with all teachers and students in Taiwan even when classes were suspended. The dedicated epidemic prevention page is updated on a daily basis.

6. Junyi collaborated with the public and private sectors to reverse the unequal distribution of educational resources and create a scaled personalized learning model for underprivileged children.

7. Junyi has been promoting digital learning with businesses, while responding to SDGs and ESG goals at the same time.

Group Category

...

Water Resources Agency, MOEA

Laying the Foundation of Water Management for the People, the Land, and Generations to Come Through Innovative Solutions

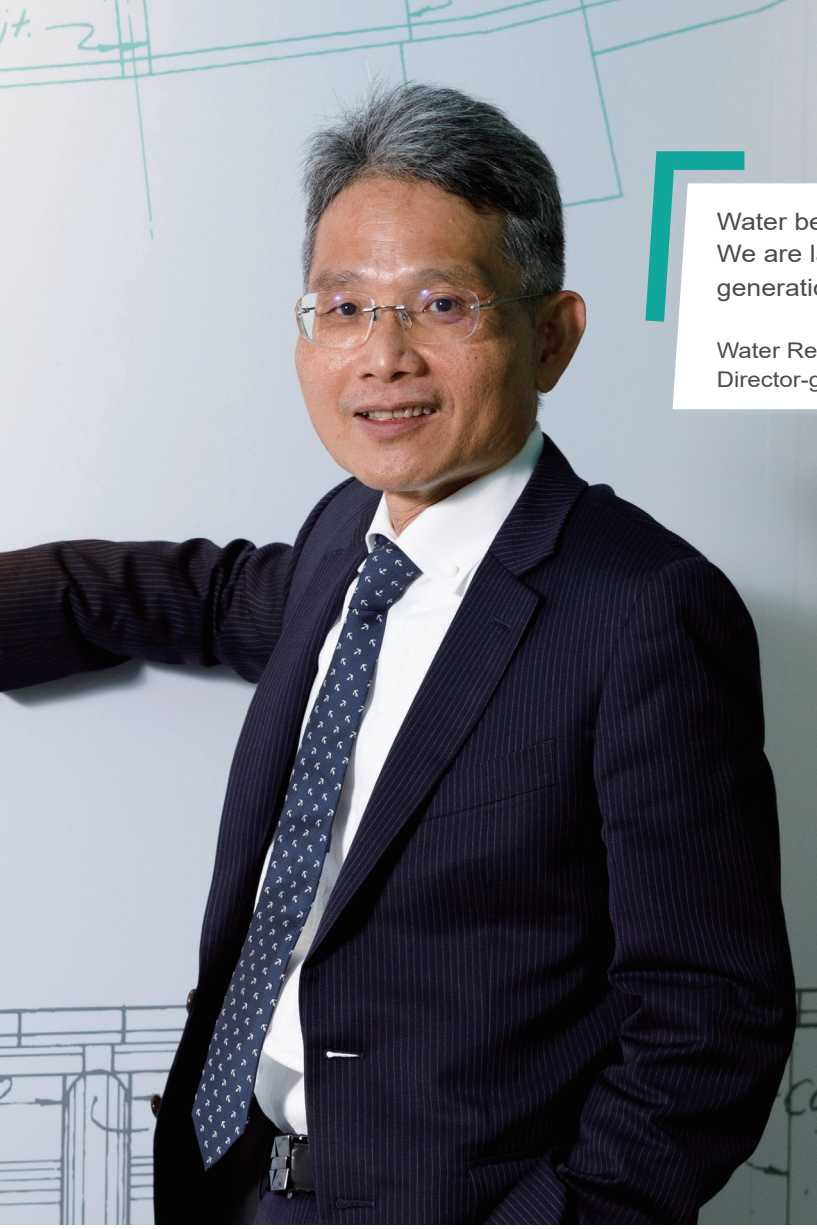
Under the increasing threat of extreme weather and climate change, droughts, floods, and many other natural disasters have been frequently recorded. The current trends are completely different from past experiences, and so the Water Resources Agency under the Ministry of Economic Affairs (MOEA) must shuffle off the burden of the past and embrace innovation. Last year (2021), we experienced the worst drought in the past 100 years; this great challenge proved that the new mindset and practices adopted by the Water Resources Agency played a critical role in helping Taiwanese people and businesses overcome water shortages. The diverse short-, medium- and long-term water resource management methods introduced by the Water Resources Agency have built up Taiwan's resilience to better cope with future climate change events.

The management of water resources in Taiwan has never been an easy task. In Taiwan, precipitation is concentrated during the rainy season. Due to the country's steep terrain, it is often difficult to store and utilize water resources. Furthermore, in recent years, Taiwan has suffered the effects of climate change, which have affected the amount and period of rainfall, making them completely different from past rules of thumb. The data and analysis accumulated over the past one hundred years may not be applicable to the situations today.

Faced with a host of challenges, how is the Water Resources Agency, MOEA, which is in charge of Taiwan's water supply and management, tackling these issues? How is the Agency preparing for the future? "Innovation is the answer." Chien-Hsin Lai,

Director-general of the Water Resources Agency, joined the public service system in 1992. With more than 30 years of experience, he deeply understands that, "Many problems that are happening now have subverted traditional hydrology, and past knowledge and wisdom of our ancestors alone are not enough anymore. Our current problems cannot be solved by simply following established solutions. Only when we are open-minded enough to embrace new mindsets and come up with innovative solutions can we solve these new problems."

Fortunately, the team of the Water Resources Agency is constantly seeking groundbreaking solutions with innovative thinking and acquiring new knowledge in the fields of hydrology, science and technology. Therefore, when the worst drought



Water benefits the people and the land.
We are laying the foundation of water management for
generations to come through innovative services.

Water Resources Agency, MOEA
Director-general

Chien-Hsin Lai

Working as a Team to Find Water Sources and Overcome Challenges

From June 2020 to May 2021, a large-scale drought occurred in the western part of Taiwan. The cumulative annual precipitation only reached 880 mm, which is one third of the average rainfall over the years. It was the most severe drought since 1911, which is why it was referred to as the “once-in-a-century drought.” This drought ended by the end of June 2021.

During the month-long water shortage period, the Water Resources Agency faced the requests for more water from the public and the private sector every day, and the entire team was under great pressure. They tried everything to look for water, transfer water, and save water.

The first thing the team did was ask nature for more rainfall, but of course in modern society, it is not possible to just “lay back and wait for the rain.” Rather, by utilizing technology, the team found ways to modify the weather to bring down rainfall as soon as possible. During the drought, whenever the team found that a cloud system was about to pass, as long as the weather and environmental conditions allowed it, the precipitation enhancement team at the Water Resources Agency would immediately start the cloud seeding operations, using ground generators, high-altitude flares, drones, and air force planes to increase precipitation in the catchment area.

The quest for water was the one and only goal of the Water Resources Agency. It explored every avenue and even turned to construction sites for new solutions. During basement excavation operations, the groundwater level needs to be lowered below

in 100 years hit Taiwan, even though they were under great pressure and exhausted, they never panicked because deep down they knew they would come up with a solution eventually. “Pressure is what drives new practices and new ideas,” Mr. Lai commented.

Chien-Hsin Lai, who is courageous and always willing to embrace new mindsets, led his team at the Water Resources Agency through the once-in-a-century drought. “Our Director-general requires all data and content to be accurate, and all handling methods to be as rigorous and meticulous as possible. He is willing to embrace new ideas and is always driving change.” Ya-Ju Lee, Section Chief of the Water Resources Agency, described Mr. Lai as a civil servant who regards his profession as his life mission, and often tells his team, “What should be done, must be done!”



the base of the excavation. The groundwater pumped out in the past was left to be discharged to the drainage system without being used. However, in times of limited water availability, our precious water resources must not be wasted. Therefore, the Water Resources Agency collaborated with the Taiwan Water Corporation, Taichung City Government, construction companies, the Ministry of the Interior, and the Environmental Protection Administration to collect water from construction sites. The collected water was filtered to meet tap water standards before it was channeled into the tap water system. At that time, daily supply from the collected water reached more than 98,000 tons, which could satisfy the daily water consumption of 400,000 people.

Domestic sewage and industrial wastewater were also essential sources of water. After the sewage treatment process, the water was transmitted to a water recycling plant for further purification. The purified water could be then used for non-domestic purposes, helping prevent the manufacturing industry from using water that should otherwise be allocated to domestic and agricultural purposes. Together with the construction of emergency seawater desalination plants and digging wells, the team of the Water Resources

Agency left no roads untaken in its fight against the drought.

“During those days, we were all used to working overtime and being yelled at!” As Director-general Lai mentioned the dedication of his team, he turned rather emotional. “However, we knew that we had to solve the problem, otherwise people and enterprises would all suffer.” As the team sought to solve the challenge, there was a scene that he would never forget. “One of our colleagues used a drone to inspect water sources. When he discovered that there was still water in a pond, our team was so excited that you could hear thunderous cheers. It was as if we had won the world championship of a sports competition.”

During those stressful days, the trust of Mei-Hua Wang, Minister of Economic Affairs, relieved a lot of the pressure of Lai’s team. “The Minister trusted our expertise, and during meetings, she always supported the solutions that we proposed based on scientific facts and logical judgments. After confirming the facts with us, she would turn around, face the outside world and explain everything.” It was during the drought relief process that Director-general Lai realized how brave Minister Wang was and how she dared to take on

responsibilities. “Because of the Minister’s support, we were able to overcome the difficulties with a cool-headed attitude.”



Forward-looking Infrastructure: Laying the Foundation for Drought Resilience

In the face of the once-in-a-century drought, the Water Resources Agency took numerous contingency measures. However, Director-general Lai emphasized that, “The water conservancy constructions and meticulous management models that we have promoted over the years set a solid foundation for the battle against the drought.”

Water resources are the foundation of a country's survival and development. In order to cope with climate change and the growing demand for water, the Executive Yuan formulated four strategies for stabilizing water supply in 2017, namely, the development of new resources, water conservation, water allocation, and emergency backup systems. In addition, the Forward-looking Infrastructure Development Program also included a range of projects to construct water resource recovery facilities, strengthen water supply capacity, and enhance facility resilience. The efforts were expected to increase water supply by 1.75 million tons per day, equivalent to 16% of Taiwan's water consumption. This played a key role in the fight to relieve the once-in-a-century drought in 2020-2021.

Following this drought crisis, looking into the future, the Water Resources Agency has made early preparations and continually implemented drought relief and water resource development plans such as enhancing water recycling, constructing new desalination plants, strengthening regional water distribution, reducing tap water leakage, building artificial lakes, collecting water from underground streams, and removing sediments from reservoirs. In 2025, an extra supply of 860,000 tons of water will be increased per day (equivalent to 8% of the

national water consumption). At the same time, the Water Resources Agency, in collaboration with the Construction and Planning Agency, and local governments, plans to build 11 water recycling plants by 2031, which will supply another 289,000 tons of water per day.

Moreover, after the completion of the emergency desalination facilities in Hsinchu and Taichung during the drought relief period, in addition to the current 100,000-ton desalination plant in Mailiao, central Yunlin, which will be completed next year (2023), the 100,000-ton plant in Hsinchu and 200,000-ton plant in Tainan are now receiving an Environmental Impact Assessment (EIA), which will be completed in 2026 at the earliest. The team is also planning on building desalination plants in Taoyuan, Chiayi, Kaohsiung, and Pingtung to reduce the dependence on rainfall and increase stable water sources during dry seasons.

Successful Tackling of the 100-year Drought Reaches the Global Stage

Furthermore, the Water Resources Agency's success in tackling the 100-year drought attracted international attention. "Since the outbreak of COVID-19, the whole world has been paying attention to the wafer production capacity of Taiwan's semiconductor industry. Many were worried that the lack of water would worsen the production capacity problem. In the end, we successfully prevented the production lines from shutting down due to water shortages," Chien-Hsin Lai said proudly.

The drought relief miracle created by the Water Resources Agency has been featured



in many international media, including Japan's Sankei Shimbun, NHK, Singapore Television, Channel News Asia, the UK's BBC, the Guardian and Reuters, Deutsche Welle, Radio France Internationale, and the Wall Street Journal of the US.

In addition, international organizations such as the Asian Development Bank (ADB) and the Japanese Ministry of Economy, Trade and Industry have also invited the Water Resources Agency to participate in seminars and exchange events on drought management. "We are happy to further deepen international diplomacy for Taiwan based on our experience in combating the drought." said Director-general Chien-Hsin Lai.

Setting up the Base to Develop New Technologies for Water Conservancy

Water resource management is an industry that has existed for thousands of years. While it has a long-established history, this doesn't mean ancient wisdom cannot be challenged. On the contrary, in the face of climate challenges, new technologies have become a powerful tool for water conservancy experts.

For example, considering the impact of extreme climate and the fact that future rainfall will be more difficult to predict, the Water Resources Agency has promptly started to work with the National Chung-Shan Institute of Science & Technology to develop the "extended-range rain-enhancing flare." The enhanced flare can reach an altitude of over 300 meters, as opposed to previous versions that could only reach a height of 150-200m. As a result, it can get closer to cloud systems and produce more rainfall. The testing for the extended-range rain-enhancing flare has been completed, soaring more than 300 meters high. The new generation high-altitude flares are expected to come in handy for future droughts.

It is worth mentioning that the first "R&D, Testing, and Demonstration Base for Innovative Technologies on Water Resource Management" established by the Water Resources Agency in 2020 has played a key role in promoting the R&D and application of water resource management technologies.

The Water Resources Agency revitalized the existing seawater desalination module plant located in the Nanliao area of Hsinchu City and established



the "R&D, Testing, and Demonstration Base for Innovative Technologies on Water Resource Management." The base focuses on smart sensors, water treatment, and hydroelectric power, and serves as an R&D and demonstration platform for domestic manufacturers that are willing to test, verify, and objectively evaluate their equipment performance.

At present, a number of excellent Taiwanese businesses have been selected and obtained entry qualifications. They have started relevant R&D and testing plans in the base, including the observation of groundwater subsidy based on moisture content and temperature, the development of low-energy-consuming seawater desalination equipment, and development of wind and hydropower equipment. In addition, the Water Resources Agency and the Industrial Technology Research Institute have also developed an innovative backpacking water purification equipment to meet both domestic and international needs, such as disaster relief in the Philippines.

Adopting Smart Technology to Overturn Century-old Irrigation Practices

By adopting smart technology, the Water Resources Agency has even changed the century-old irrigation methods of the Chianan Irrigation System, refining the management of irrigation water, saving more water, and improving the work safety of irrigation workers.



The irrigation water of the Chianan Irrigation System originates from the Wusanto Reservoir, the water travels through the 18,000-kilometer-long irrigation channel, all the way from the water guiding channel, main channel, minor channel, branch channel to different areas, and then through the middle and small water supply channels to farmlands.

To ensure that all farmland has access to water for irrigation, irrigation gate controllers need to ride around on motorcycles because when water is in shortage, farmers rush to fight for water; when there is too much water, it can lead to overflow. In response to different situations, irrigation gate controllers sometimes have to set up water barriers to guide the direction of the water flow; sometimes they have to close the gates to avoid wasting water.

“This job is both physically and mentally draining, and most of the irrigation gate controllers are senior farmers, with an average age of 60 to 70,” Yan-Hsing Chen, the head of the Longtian Working Station, Chianan Management Office, mentioned as he talked about the hard work of the controllers. “Sometimes they have to patrol the farmlands on scooters either in complete darkness or during a storm. We are highly concerned about the safety of these elderly people, and we worry about them falling over, among other potential accidents.”

The risks of working as an irrigation gate controller increase with age, this is where

technology comes into play. The Water Resources Agency signed the "Smart Water Management - Advanced Irrigation Plan" with both TSMC and the Chianan Management Office, Irrigation Agency in 2018. Thanks to ICT and smart sensing technologies, it is now possible to open water gates remotely to divert water and monitor the water level in the farm, soil moisture content, and real-time precipitation through sensors. Irrigation gate controllers can check water channels on a smart phone, and then only go out to deal with problems when necessary.

“Frankly speaking, the controllers did not like this new working mode at first,” Yan-Hsing Chen explained. He had to explain this new method from the perspective of safety and painstakingly communicate with them. “After persuading them to try it out, they learned the benefits of smart technology, and they realized that technology could help make their work easier and safer. This also allows them to continue to work as irrigation gate controllers even as they age.”

Through the implementation of the Advanced Irrigation Plan, the precision of water distribution for irrigation can be improved, achieving maximum irrigation efficiency with the least amount of water. The experience of the Longtian Working Station in the Chianan Irrigation Region indicated that thanks to the efforts of irrigation gate controllers, it is possible to save another 3% for the first crop rice (currently saving 25%-30% of water) and another



6% for the second crop rice. Thanks to this success, this model will be applied to other irrigation areas in the future.

Adopting New Water Management Mindsets to Tackle Extreme Climate

“Climate change is intensifying, and the frequency of droughts and floods will increase. It is unclear when they will happen; therefore, we have to race against time. We must move our brains as fast as possible and be prepared as much as we can.” Chien-Hsin Lai emphasized. He added that the new chapter on “Runoff Allocation and Outflow Control” in the Water Act is a change inspired by the new water management mindset in the face of extreme precipitation.

In the past, when floods occurred, the traditional solution was to simply use waterways to allocate parts of the flood. However, in recent years, it has been found that this method is not enough to cope with rapid and fierce precipitation. Therefore, the Water Resources Agency proposed numerous strategies to increase regional limit of flood-bearing capabilities through runoff suppression, runoff diversion, runoff detention, and retention basins where a pool of water is kept permanently.

One of the methods is to evaluate the existing non-water management facilities of the public sector, such as parking lots, parks, and school playgrounds. These facilities are then given the function of flood retention to assist in regulating

floods, delaying the arrival of flood peaks, increasing infiltration, and reducing the occurrence of floods, ultimately solving the flooding predicament. In addition, innovative practices such as on-site flood detention and waterfront improvement are all new measures that the Water Resources Agency has been promoting in recent years.

Climate change has brought quite a few challenges for the team of the Water Resources Agency, and a lot of these challenges are new to many. The team has to keep acquiring new knowledge before they can come up with solutions. “We organized study clubs to study and discuss together. We also encouraged colleagues to go abroad for learning exchanges, with the hope that they will bring back new ideas.” Chien-Hsin Lai emphasized again that the future of water management will be based in groundbreaking strategies. “We will continue to implement innovative services to lay the foundation for the people, the land, and the generations to come.”





Mantra for Success

In the face of the once-in-a-century drought, we introduced innovative water management approaches, carefully controlled every drop of water, combined with multiple innovative water sources, maintained social stability and uninterrupted economic development, and overcame the challenge together.

During those difficult times, we used technology equipment to monitor the water supply every day and held drought contingency meetings at all levels. By implementing a three-pronged strategy of saving more water, transferring more water, and looking for more water resources, we strived to find every drop of water available, and collaborated with all sectors to successfully relieve the drought.

International media were also interested in how Taiwan resolved the industrial water supply crisis in the face of its worst drought in a century, ensuring the production capacity of the semiconductor industry. Many countries have also contacted us to discuss collaboration opportunities in terms of water resources management. Taiwan's efforts have been recognized by the international community, and the success has also pushed Taiwan onto the global stage.

Faced with the worsening effects of climate change, the Water Resources Agency has promoted the Forward-looking Infrastructure Development Program - Water Environments Construction Plan, based on innovative ideas. In addition to expedite the construction of infrastructure for water resources, the plan aims to strengthen water resources management by enhancing water use efficiency as well as backup and transfer capabilities to improve the stability of Taiwan's water supply and build up a resilient water environment.





Water Resources Agency, MOEA

1947

The Water Conservancy Bureau was established under the Department of Reconstruction, Taiwan Provincial Government (TPG). In 1997, the Department of Water Conservation was established combining numerous water conservancy agencies. In 1999, the Agency was reorganized under the Ministry of Economic Affairs by the TPG, and was later merged into the Water Resources Agency (WRA) in 2002.

2016

The “Three Laws on Water Conservancy” were enacted to build a thorough water conservancy culture and management system. The three laws include the Reclaimed Water Resources Development Act, Amendment to the Water Supply Act, and Amendment to the Water Act.

2017

Faced with the impact of climate change, the WRA promoted the Forward-looking Infrastructure Development Program - Water Environments Construction Plan to build up the water environments in Taiwan, based on innovative ideas. It also launched the Action Plan for Stable Industrial Water Supply. This plan not only implements strategies to develop new resources and conserve water, it also further enhances local water allocation and emergency backup systems. Projects including the main water channel in Taoyuan and Hsinchu, backup wells, water recycling facilities, and collecting the runoff in the Kaoping River were completed ahead of schedule, ensuring stable and resilient supply of industrial water and playing a key role in tackling recent droughts.

2017

The WRA launched the Digital Water in Taiwan program to provide diverse water services, including the Internet of Things (IoT) for Water Resources platform; furthermore, this platform combines AR and VR technologies to provide real-time data, simulate disasters, and implement smart precision irrigation through cross-sector collaboration.

2017

In line with the core concept of nature-based solutions, the WRA implemented the Local Flood Detention Plan to increase Taiwan’s resilience against flooding hand in hand with nature. The plan aims to maintain the landscape of farmlands and their food production functions, while reducing flooding risks without additional land acquisition costs.

2018

The new chapter on “Runoff Allocation and Outflow Control” in the Water Act was added to increase Taiwan’s resilience against flooding, changing its core principle from “no floods” to “no fear of floods.”

2019

The concept of waterfront improvement was introduced. The WRA integrated the land, the river, and the community to build a waterfront improvement plan that would integrate water and safety, water and the environment, and water and culture.

2020

During the once-in-a-century drought, which took place from 2020 to 2021, the WRA made arrangements ahead of schedule, finetuned its control mechanisms, and integrated several innovative water resources, overcoming the most severe drought in the past 100 years. In light of climate change, the WRA revised the water resources management plan to implement the comprehensive operation and management of drainage basins, construct the West Corridor Water Supply Network, and produce water with technology to ensure stable water supplies.

President's Name | Chien-Hsin Lai Director-General

Awardee's Address | No.501, Sec. 2, Liming Rd., Nantun Dist.,
Taichung City 408281, Taiwan (R.O.C.)

Years of Establishment | 1974

Telephone No. | 04-2250-1250

Website | <https://www.wra.gov.tw/>

No. of Employees | More than 2,090 people

Scope of Operation | The Water Resources Agency (WRA) is the central supervising agency for water management. It is the highest-level government agency that monitors water management policies and businesses around the country. The WRA is dedicated to introducing innovative solutions to one of the most ancient industries in the past thousands of years, in order to lay the foundation for the people, the land, and the generations to come. The WRA responsibilities include :

1. Drafting and implementing water management/water policies and regulations.
2. Inspecting, planning, supervising, and handling water management/water-related matters.
3. Planning and developing strategies for water management, including the development of new resources, water conservation, water allocation, and emergency backup systems.
4. Maintaining key water management facilities and the sustainable operation of reservoirs (dredging).
5. Registering, managing, and supervising water rights.
6. Planning and promoting water resources for military readiness.
7. Drafting, implementing, and reviewing the changes, maintenance operations, and management plans of water channels.
8. Runoff allocation, outflow control, local flood detention, and waterfront improvement.
9. Smart water management, the Internet of things for water resources, water management technology development, and international collaborations.
10. Central drought and flooding relief efforts.
11. Other administrative tasks related to water management.

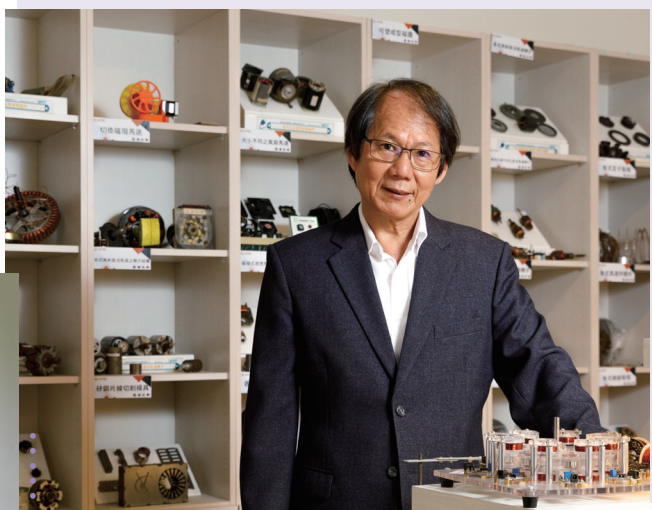
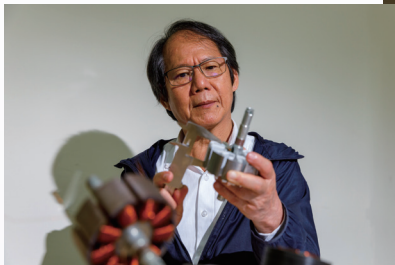


Individual Category

...

Department of Mechanical Engineering,
National Cheng Kung University

Mi-Ching Tsai, Chair Professor



“ The EMTRC is an experiment in branding. The school lent me its name and allowed me to lead a team in independent operations. It seems to have been a success. ”

Macronix International Co., Ltd.

Miin-Chyou Wu, Macronix Chairman & CEO



“ I pioneered a big-data information system that combines statistics and semiconductors. It has been adopted by the industry, cementing Taiwan's status as a global semiconductor production hub. ”

Youth Category

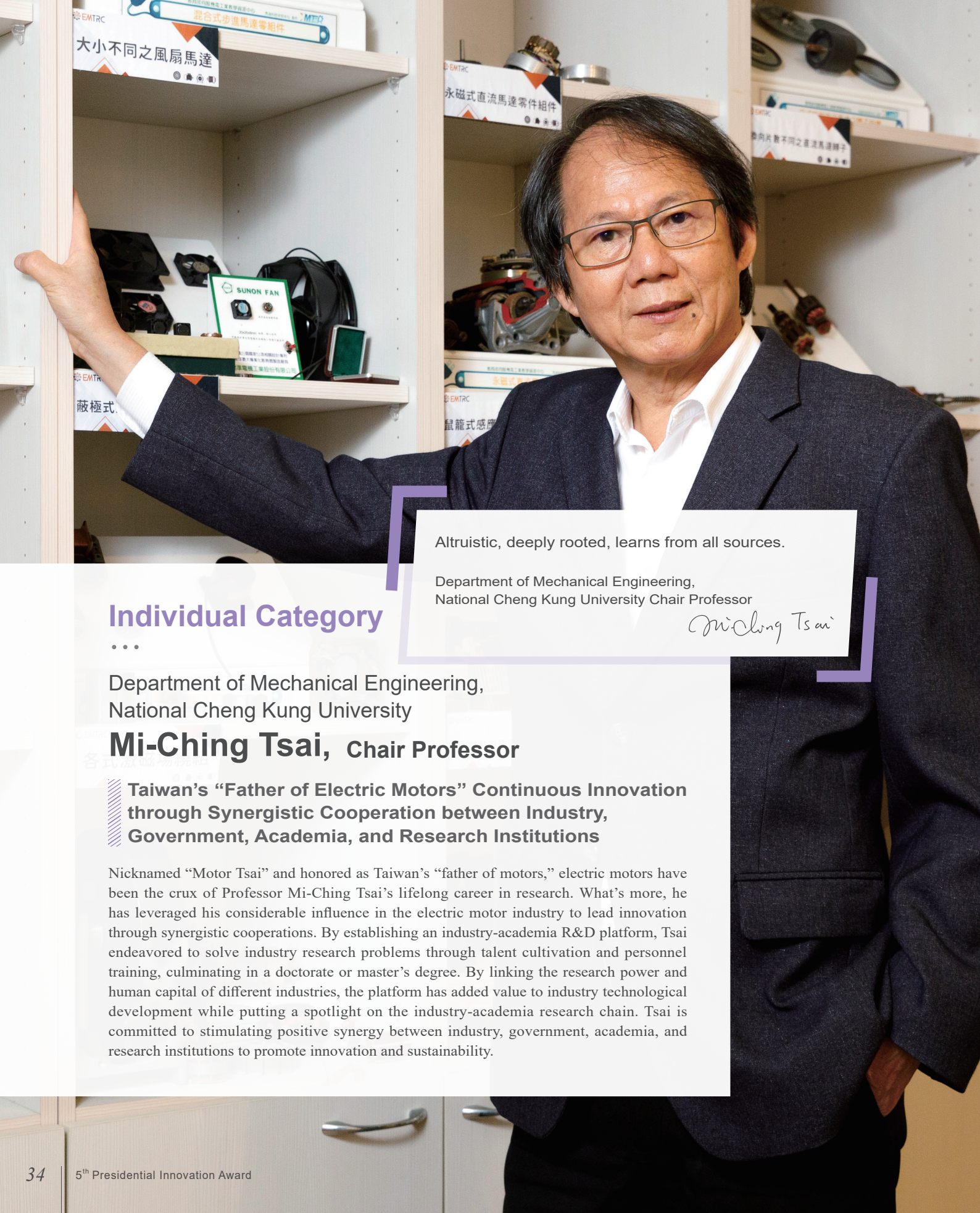


Changhua County Fire Department
Ming-Che Sung, Firefighting Inventor



Invention is just the beginning. I hope that through our influence, the world can see the power of Taiwan's firefighters.





Individual Category

...

Department of Mechanical Engineering,
National Cheng Kung University

Mi-Ching Tsai, Chair Professor

Taiwan’s “Father of Electric Motors” Continuous Innovation through Synergistic Cooperation between Industry, Government, Academia, and Research Institutions

Nicknamed “Motor Tsai” and honored as Taiwan’s “father of motors,” electric motors have been the crux of Professor Mi-Ching Tsai’s lifelong career in research. What’s more, he has leveraged his considerable influence in the electric motor industry to lead innovation through synergistic cooperations. By establishing an industry-academia R&D platform, Tsai endeavored to solve industry research problems through talent cultivation and personnel training, culminating in a doctorate or master’s degree. By linking the research power and human capital of different industries, the platform has added value to industry technological development while putting a spotlight on the industry-academia research chain. Tsai is committed to stimulating positive synergy between industry, government, academia, and research institutions to promote innovation and sustainability.

Altruistic, deeply rooted, learns from all sources.

Department of Mechanical Engineering,
National Cheng Kung University Chair Professor

Mi-Ching Tsai

In the field of electric motors in Taiwan, the name “Motor Tsai” is synonymous with professional authority and strategic influence, and is well-known throughout the industry, government and academia. Such a reputation is undoubtedly a result of Tsai’s accomplishments as the founder of the National Cheng Kung University Electric Motor Technology Research Center (EMTRC).

Twenty-three years ago, the Digital Learning Program hosted by the Ministry of Education in Lukang inspired Tsai to establish the EMTRC. After nearly a quarter of a century focusing on motor design and drive technology, he has successfully built up a self-sustaining industry-academia research center at the National Cheng Kung University and established a training system that uses practical methods to help industry talents hone their skills. Furthermore, he championed the establishment of the Electric Motor Intellectual Property Alliance by espousing teamwork and resource sharing, as well as joint research platforms comprised of academia, equipment suppliers, and industry talents.

While in leadership positions at the National Cheng Kung University’s Research and Services Headquarters, Metal Industries Research and Development Centre (MIRDC), and the Ministry of Science and Technology, Tsai advocated the idea of “reinvigorating the system for sustainable growth” to disrupt rigid limitations. A number of innovative industry-academia research partnerships were pushed with considerable success, making a long-term impact on Taiwan’s motor and other related industries.

Tsai has keen insight into motor application trends and evolution, time and time again showing that he is ahead of the curve. Products he helped develop range from electric vehicles, automation equipment, unmanned vehicles, and green energy systems such as wind turbines. He has cultivated a team of post-graduates at the EMTRC, more than 200 of which have thus far become deeply involved in related industries, working at companies like the China Steel Corporation, Delta Electronics, Giant, and Gogoro.

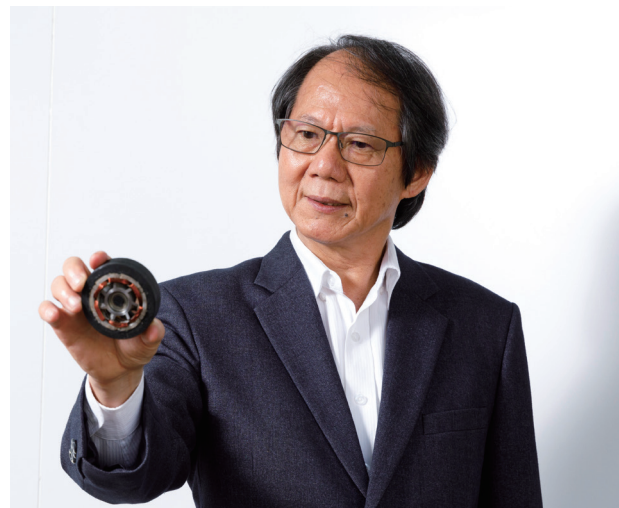
Tsai’s outstanding achievements in research and development as well as talent cultivation

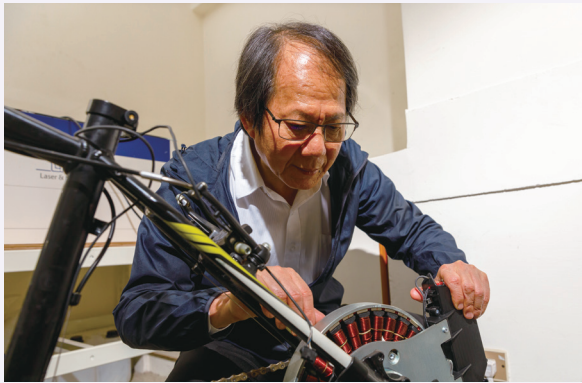
have been recognized by the Executive Yuan, Ministry of Economic Affairs, Ministry of Science and Technology, and Ministry of Education, among others. Among the many honors that he has received thus far, the Presidential Innovation Award is one of the crowning jewels of Professor Tsai’s distinguished research career.

Doctorate of Engineering in Motor Research from Oxford University

Mi-Ching Tsai was born to a farming family in Guiren, Tainan. After graduating from the Electrical Engineering department at the National Kaohsiung University of Science and Technology, he worked in telecommunications for a year before pursuing further technical and vocational education. He obtained a master’s degree from the National Taiwan University of Science and Technology and later served as a lecturer at the National Cheng Kung University’s department of Mechanical Engineering.

In 1986, Tsai received public funding to study in the UK, going on to obtain a doctorate in engineering science from Oxford University four years later. After ten years as a faculty member at NCKU, he went to Cambridge University in 2003 as a visiting professor for a year. Benefiting greatly from an environment where he could concentrate solely on his work, he completed the book *Robust and Optimal Control: A Two-port Framework Approach*, which was published in the UK in 2014 and has been downloaded nearly 30,000 times to date.





During these further studies in the UK, Tsai originally wanted to assimilate and bring back the UK higher education research system to Taiwan, but after observing the differences between the teaching faculty structures of both countries, he found that it would be difficult to implement in Taiwan. Most UK universities had a pyramid-shaped faculty structure, where only a few professors sat at the top while the rest of the pyramid was made up of senior lecturers, regular lecturers, and others, and research was led by only a small number of professors.

Taiwan's university faculty structure on the other hand, was an inverted pyramid. Almost every professor had their own research lab and took on government projects, while much of the research work fell to master's students who would be replaced upon graduation every two years. Tsai favored a team-based organization for research, where several professors would lead full-time doctorate and Master-level researchers to focus on technical problems in industry.

Knowing that entrenched systems are difficult to change, Tsai decided to try a different approach, utilizing a "research center" structure with the intention of inviting like-minded professors to jointly invest in motor research. In 1999, he proposed to the university the establishment of the EMTRC, which would go on to become a renowned research center throughout industry and academia.

Founding NCKU's EMTRC to Solve Industry Problems

As luck would have it, NCKU had just set up a special center for industry-academia research called the Research and Services Headquarters in 1998.

At the time, it was a pioneering institution among universities in Taiwan, encouraging professors on campus to actively develop industry-academia cooperation. Tsai, who was deeply interested in promoting the connection between industry and academia, submitted his application the following year to establish the EMTRC under the Research and Services Headquarters. Now having 23 years of history, the EMTRC continues to be a mainstay of the NCKU research community.

The EMTRC employs full-time researchers to carry out research commissioned by industry corporations while guiding students to "learn by doing and do while learning." Tsai's approach is similar to the internship system seen in Taiwanese medical education. "I believe that the most well-rounded example of industry-academia cooperation in Taiwan is the internship system between medical students and teaching hospitals. If engineering students could have opportunities for similarly solid practical training, we could better close the gap between theory and practice."

Since industry-commissioned cases have an inherent degree of difficulty, it is necessary to take a comprehensive look at the technical, design, and practical aspects to find a solution. Through honing their skills by solving such problems, the team at the EMTRC has continued to expand their capabilities, thus becoming prime targets of highly-paid talent poaching by industry corporations. "In the end, my challenge has become how to make my colleagues not want to leave," Tsai said with a smile.

Unlike most university research centers in Taiwan, the operation of the EMTRC is not reliant on subsidies from the school, and is entirely self-sufficient; it is not affiliated with any single department. Thanks to both the NCKU name as well as a strong research team, the center has been able to solve numerous problems for businesses, establishing a reputation that continues to an endless stream of commissioned cases and cooperative projects.

Together with its broad technical perspective and business model, organizational behavior management is the third pillar of the research center's operations. The EMTRC is affiliated with NCKU's Research and Services Headquarters and the research students there come from all

colleges and departments, creating varied, matrix-like management structure. Tsai knew from the beginning that it would be necessary to use more diverse management methods to reduce the impact of parochialism on the organization.

Tsai also reminded himself that in order to run a successful research center on a university campus, one cannot be arrogant or insular but rather must maintain a positive feedback relationship with the university in order to grow sustainably.

Service to the Government and Research Institute Acting with Sustainability Mindset

From 2011-2017, Tsai was successively appointed director of the NCKU's Research Headquarters, chairman of the MIRDC, and deputy minister of the Ministry of Science and Technology. During each appointment, he handed the directorship of the center to his colleagues.

“Educating and conducting research is my career; everything else is done on the side.” Tsai has been teaching at the NCKU Mechanical Engineering department since 1990 and is currently a chair professor.

Anywhere he works, Tsai spends time establishing a system that can operate sustainably. While in charge of NCKU's Research and Services

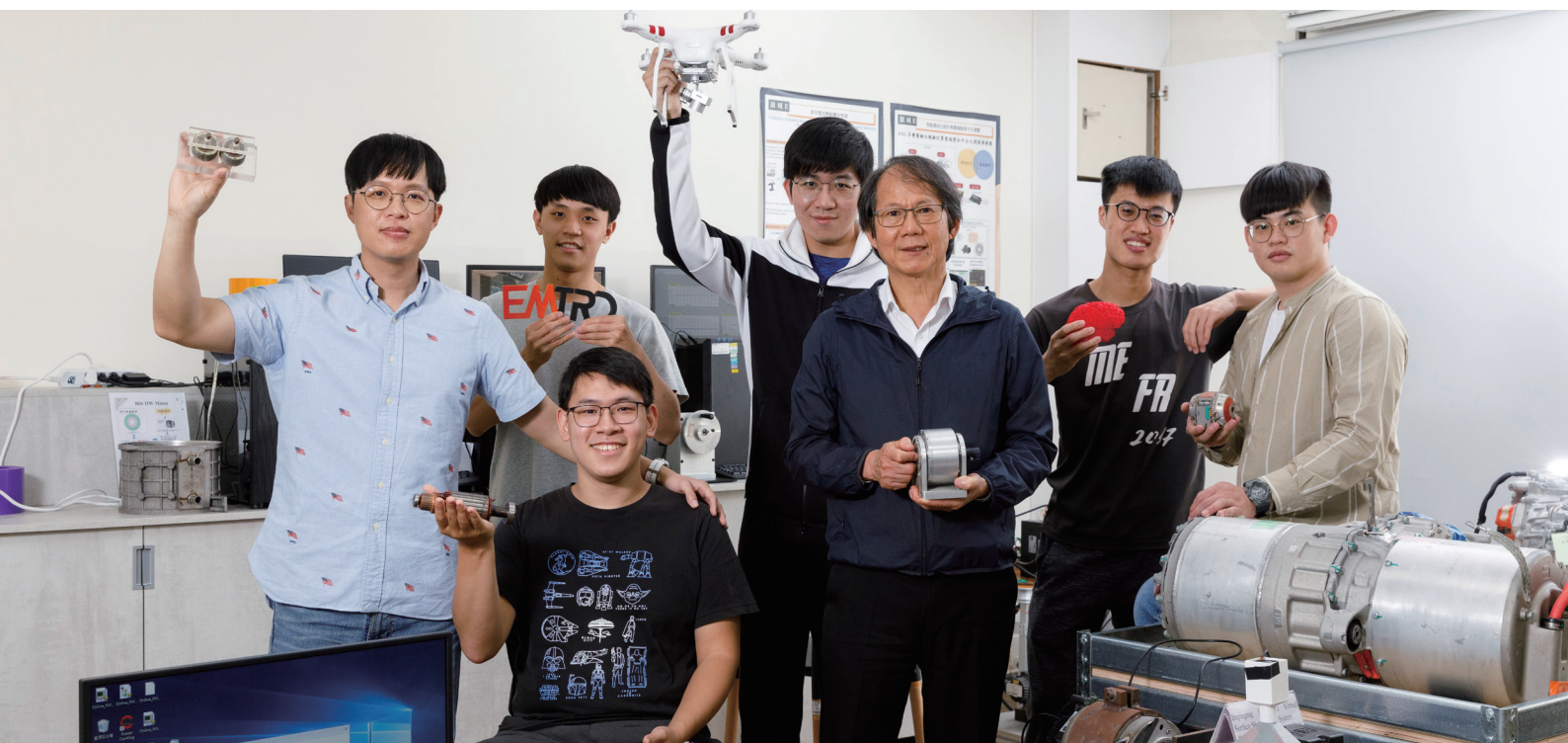
Headquarters from 2011-2015 for example, Tsai reformed the technology transfer policy and activated “dormant patents,” thereby setting the best record for industrial-academic cooperative performance. Revenues from technological transfers reached hundreds of millions of NTD, while the headquarters' overall yearly revenue reached a record high of 1 billion NTD.

“I build systems that my successors can continue to use. It all comes down to the thought process. When you take a position, you know that eventually you will have to step down. Once you have left, you will see if your original design is viable based on whether or not the organization continues to grow. Organizational sustainability is very difficult. My goal is for the Research and Services Headquarters to continue to grow,” Tsai said.

New Positions, Same Dedication to Industry-Academia Research Cooperation

As chairman of the MIRDC and deputy minister of the Ministry of Science and Technology, Tsai had the opportunity to harness the innovative potential of the industry, government, academia, and research from a higher vantage point.

Lin Chih-Lung, vice president of the MIRDC, said this about working with Tsai: “At the time, under Chairman Tsai's leadership the MIRDC as a



research-oriented organization successfully played the key role of a transformative bridge.”

Tsai led his colleagues at the MIRDC to systematically review academic research results to find potential technologies or patents that might be transformed into industrial products. Then, the MIRDC would translate theory into practice, thereby adding value and helping to implement the technology in industry or even support new startups.

Tsai also brokered the cooperative effort between the MIRDC and China Steel to establish an engineering research center for value enhancement in the metals industry. He believes that academic research often merely creates “results,” and that to create meaningful “achievements,” it is necessary to find the intersection between industry and research.

Lin gave the case of when the EMTRC and the MIRDC joined forces and successfully developed online motor rapid testing equipment. Measurements could be completed in just three minutes, allowing motor manufacturers and system application companies to complete relevant inspections quickly to ensure good product yield.

As this testing method was well-received by the industry, trust in the EMTRC began to build and Tsai’s ambition and vision grew. He leveraged industry contacts and specialized technology to assist dozens of enterprises such as China Steel, the MIRDC, and Ta-Ya Electric Wire & Cable in creating a motor industry cluster.

During his tenure as deputy minister of the Ministry of Science and Technology, Tsai continued in this vein to launch the “Innovation Link Program for Corporations.” This program brought corporate bodies together to deepen the link between academia and industry, and effectively harness its research potential.

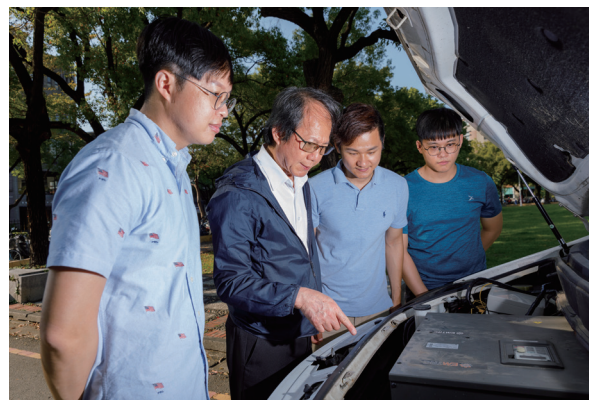
Achievements in Motor Research Recognized Twice by the R&D 100 Awards

The years that Tsai has invested in researching motor technology have since garnered fruitful results. Two of his R&D achievements in cooperation with the MIRDC have won and also have been shortlisted for the American R&D 100



Awards respectively, also known as the Oscars of science and technology.

The first of these R&D achievements was the coin-type DC brushless motor, the thinnest in Asia at the time; at only the size of a penny, it had an innovative axial magnetic flux design. Integrating motor components and driving circuits into a PCB not only reduced the motor thickness, but also simplified the manufacturing and assembly process. The design had advantages in energy saving, high yield, ease of mass-production, and affordability. Being the first technology co-developed by the MIRDC and EMTRC to be shortlisted for the R&D 100 Awards, it received award honor in 2013. The technology was then transferred to Yen Sun Technology Corp. and Risun Expanse Corp. and





used for cooling devices in car electronics, tablet computers, drones, micro projectors, and other products.

The Smart Motoring-Gear Module, developed by Tsai and his colleagues at the MIRDC, was also shortlisted for the R&D 100 Awards in 2021. Lin Chih-Lung explained, “This technology is perfect for wind power generation systems. It can adapt different wind strengths to efficiently convert wind energy into stored electricity, and can also be directly connected to the grid. The miniaturized, low-maintenance mechanism design is also applicable to offshore wind power turbines.”

Spin-in Mechanism and Cultivating Cross-Disciplinary Talent

After Tsai resigned from public office at the Ministry of Science and Technology, he returned to his position as director of the EMTRC. He continued to improve a number of industry-academia service models, including the innovative “spin-in” mechanism that let partner businesses to send personnel for study at the center. The program offered Master’s research base courses directed at meeting the talent needs of industry, pre-matched employment, and tuition fees covered by corporations. Employment could then begin

immediately following graduation and industry talents would be seamlessly integrated into the workforce.

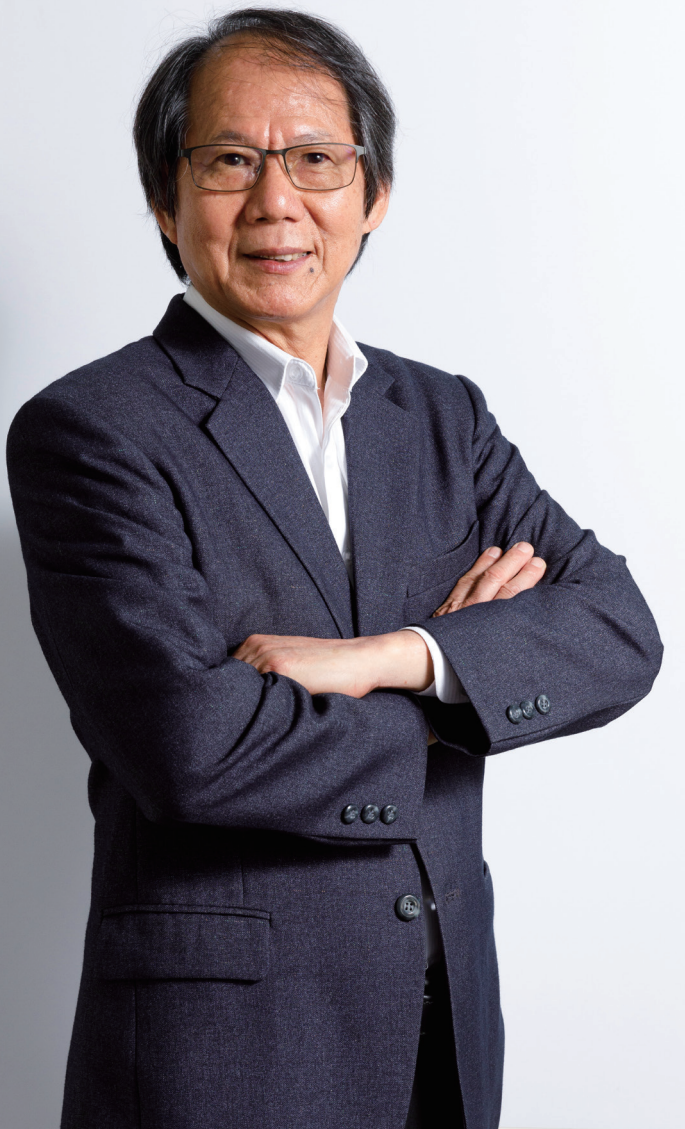
Tsai established the “Motor Tech Digital Learning Network” to promote popular science education, publish weekly e-newsletters, and set up a specialized motor library and digital museum with around 15,000 participating members. In the same vein of cooperative thinking between industry and academia, he promoted the Motor Intellectual Property Alliance, SkyLab Co-Research Platform, and Motor Smart Service Platform. The EMTRC has thus far acted as a magnet of influence that has successfully attracted the trust and participation of many industry players across multiple disciplines.

As for Tsai’s innovative “spin-in” mechanism, Erik Huang, head of Giant’s i-WOW Research Center, is certain of its benefits. Seeing that electric-related technology would be an inevitable trend in transportation, the company began looking for suitable personnel training units. The EMTRC is a partner they have relied on for many years.

“Tsai’s innovative ‘spin-in’ talent cultivation method I think, not only satisfies businesses that desire to seek solutions to specific problems but is also significant for academic research; it does not practice favoritism nor pursue short-term results.” Huang emphasized that expectations for industry-academia cooperation should focus on technical fundamentals rather than short-term research results. At present, there are more than ten researchers at Giant’s i-WOW Research Center who were trained at EMTRC, an experience they continue to draw from in their work.

“Motors involve a great deal of fundamental electromechanical technology, so cross-disciplinary learning is really important.” Huang went on to say that instead of demanding short-term results, they put more emphasis on the ability to develop cross-disciplinary technology integration through training at the EMTRC.

When it comes to effective talent training, Giant has already benefited greatly in overall R&D capability improvement. For example, before investing in cultivating talent at EMTRC, specifications for product commissioning were usually written in vague terms—high power and high efficiency. Now, the process has been completely revamped.



Knowing that electric vehicles would be an inevitable trend in Taiwan, in 2018, Tsai brought together China Steel, Solpower, and Syntec to organize a cross-disciplinary R&D team to propose an industry-academia plan to the Ministry of Science and Technology centered around electric vehicle powertrains. Five main technical components were outlined, including the silicon steel sheet material, battery system, intelligent transmission system, traction motor, and high-efficient heat dissipation technology. After three years, the plan has resulted in technical breakthroughs, talent cultivation, and successful technology implementation. One result of particular note is that China Steel successfully entered the electric vehicle market and is now the most important motor electromagnetic steel sheet manufacturer for the American electric vehicle manufacturer Tesla.

For 23 years, Tsai has cultivated several high-quality motor R&D talents for Taiwan and helped launch many industry-academia research breakthroughs.

Now, as the global trend of low-carbon emissions and electrification continues, electric motor technology is bound to play greater key role in application markets such as manufacturing, electric transportation, and medical equipment. Industry, academia, and government all expect that Tsai will continue to exert his influence as “Taiwan’s father of motors” and live up to the name of “Motor Tsai.” With his enthusiasm and insight into motor research, he will continue to promote innovation through the synergistic collaboration of industry, government, academic, and professional research institutes, ensuring that Taiwan’s motor industry will continue to develop steadily.

“Our engineers trained at the EMTRC can now provide detailed design specifications as well as product analyses before delivering them to manufacturers. They can even explicitly point out potential challenges they may face during production, and which points to pay particular attention to.” Huang continued, “Now we can have a direct and professional dialogue with motor manufacturers, keeping a firm handle on the ODM design stage.”

Making an Impact and Promoting Motor Innovation

Taiwan’s motor industry is very strong in terms of basic technology and manufacturing strength, having a complete supply chain system. The revenue pulled in by the over 200 manufacturers each year exceeds 500 billion NTD.



“

Mantra for Success

Mi-Ching Tsai has been devoted to motor design and drive technology for many years and has successfully established an industry-academia cooperative research center that is operated self-sufficiently on a university campus, as well as established a pragmatic talent training system. Through teamwork and resource sharing, he pushed forward the Motor Intellectual Property Alliance as well as joint research platforms made up of academia, equipment suppliers, and industries. During his tenure as a government official, he put forth the idea of “reinvigorating the system for sustainable growth,” breaking through rigid administrative restrictions and providing the impetus for a number of successful achievements through industry-academia research cooperation.

He has cultivated a team of post-graduates at the EMTRC, and so far, more than 200 of them have become involved in relevant industries, working in organizations such as the China Steel Corporation, Delta Electronics, GIANT, and Gogoro. He has great insight into the trends and evolution of motor technology applications, including products that range from electric vehicles, automated equipment, driverless vehicles, and green power systems for wind turbines. His outstanding achievements in talent cultivation have been recognized with various awards from the Executive Yuan, Ministry of Economic Affairs, Ministry of Science and Technology, and Ministry of Education.

”





Mi-Ching Tsai (1956)

Highest Education : Ph.D., Oxford University, United Kingdom

1999

Founded the Electric Motor Technology Research Center (EMTRC), promoted industry-academia cooperation, linked more than 100 domestic and foreign corporations and provided services to highly esteemed industries, became a key promoter of motor technology innovation in Taiwan, was nicknamed “Taiwan’s Father of Motors” and became well known in motor related industry, academic, and research circles.

2002

Established the “Motor Tech Digital Learning Network” and served as the editor-in-chief, publishing a weekly Motor Newsletter that shares basic principles and new findings about motors with more than 1,000 issues and 15,000 participating members. Set up a motor library and a digital museum, and provided technical consultation services including prototyping, characteristics measurement, etc. to support and grow the international competitiveness of Taiwanese motor industries, which gave EMTRC the name “Motor Temple”.

2007

Proposed the “spin-in” mechanism that allows industries to deploy their research personnel to the EMTRC for joint research and on-job training; a pioneering foray for the university to nurture industry talents and empower industries with the independent research and development capabilities.

2014

Organized an industry-supported Master’s program called the “Motor Design and Drive Curriculum” and initiated a mentor-advisor-supervisor guidance system to implement collective learning, narrow the gap between theory and practice, and alleviate R&D manpower shortages in traditional industries.

2017

Founded the Motor Intellectual Property Alliance to flip the idea of “owning” IPs to “sharing” IPs, which successfully transformed patents from “liabilities” to “assets.” Academic R&D achievements were revitalized and brought into a sustainable cycle of intellectual properties; furthermore, the view taken towards university intellectual property management was revitalized.

2018

Initiated the SkyLab Research Partnership Platform to better utilize university core equipment, human resources, and intellectual properties in assisting industries to accelerate the proof of concept (POC) process for mass production, as well as provide solutions for the problem of insufficient R&D manpower.

Timeline

- 2008-Present Chair Professor, Department of Mechanical Engineering, National Cheng Kung University (NCKU)
- 1999-Present Director, Electric Motor Technology Research Center (EMTRC), NCKU
- 2019-Present Consultant, Ministry of Education, Executive Yuan
- 2016-2017 Deputy Minister, Ministry of Science and Technology, Executive Yuan
- 2015-2016 Chairman of the Board, Metal Industries Research and Development Center (MIRDC)
- 2012-2013 Director, Technology Transfer & Business Incubation Center, NCKU
- 2011-2015 Director General, Research and Services Headquarters, NCKU
- 2007-2010 Director, Development of Engineering and Applied Sciences, National Science Council, Executive Yuan
- 2003-2004 Visiting Professor, Department of Engineering, University of Cambridge, United Kingdom
- 1998-2003 Division Director, Office of Research and Development, NCKU

Special Honors

- 2021 National Excellent Teacher Award, Ministry of Education
Outstanding Achievement Award, Phi Tau Phi Scholastic Honor Society
- 2020 Engineering Medal, Chinese Institute of Engineers
Honorable Scholar Award, K.T. Li Technology and Literature Lectureships
Academia Award, Ministry of Education
- 2019 Outstanding Research Award, Pan Wen-Yuan Foundation
- 2014 Award for Outstanding Science and Technology Contribution, Executive Yuan
- 2013 Merit Research Fellow Award, National Science Council, Executive Yuan
R&D 100 Awards, United States
- 2012 Distinguished Academic and Research Institution Innovation Award of National Industrial Innovation Award, Ministry of Economic Affairs
Innovative Trailblazer of the Year, National Industrial Innovation Award, Ministry of Economic Affairs
- 2007 Industrial Technology Advancement Award of University Outstanding Contribution to Industry Award, Ministry of Economic Affairs
- 2002 Outstanding Research Award, National Science Council, Executive Yuan (1999, 1997)

Fellow, Institute of Electrical and Electronics Engineers (IEEE), USA
Fellow, Institution of Engineering and Technology (IET, former IEE), UK
Fellow, Chinese Institute of Engineers
Fellow, Chinese Automatic Control Society
Fellow, Chinese Institute of Automation Engineers



Individual Category

...

Macronix International Co., Ltd.

Miin-Chyou Wu, Macronix Chairman & CEO

Keeping an Open Mind, Taiwan's Semiconductor Pioneer Makes Great Strides

A self-made entrepreneur, Miin-Chyou Wu has made indelible contributions to Taiwan's semiconductor industry for over 30 years. Throughout his journey, this semiconductor maven has shown bravery and great skill in leveraging the international arena, leading the digital transformation movement, and confronting transnational litigation. In terms of promoting international capital injections and talent cultivation, he has shown an altruistic spirit and unabating dedication. Most impressive is that he was able to do all this without a penny of government funding.

In the Taiwanese semiconductor industry, Miin-Chyou Wu, the founder of Macronix, has undeniable pioneer status.

In an era when the government was funding the establishment of wafer fabrication plants, Wu took the lead from scratch. He recruited 40 semiconductor specialists from the United States to come to Taiwan and built the first six-inch wafer fab with funds from original shareholders. He also leveraged the US-Japan trade war to break into the Nintendo supply chain.

He anticipated the competitiveness of computerized factories and introduced big-data systems that combine statistics with semiconductor knowledge. His industry peers learned from his system, helping Taiwan become an enduring global hub of semiconductor production.

Attaching great importance to research and development, he used forward design in place of Taiwan's then-mainstream reverse engineering to retrain local Taiwanese R&D personnel. Plenty confident in the strength of his own patents, he was not afraid to compete in the market despite the patent war waged by two major memory manufacturers in the United States and Japan. He eventually forced them to settle, winning hundreds of millions of US dollars in settlement funds in the process and becoming Taiwan's first winning case by the United States International Trade Commission (USTIC).

He proposed to the Ministries and Commissions on Economic and Financial Affairs that the tech industry would be perfectly suited to the third board stock market. He successfully promoted injection of international funds into Taiwan, launching a prosperous era for high-tech industries.

Committed to cultivating young talent in science and technology, he established the Macronix Golden Silicon Awards and Macronix Science Awards, which have been honing talent for over 20 years now. Recently, he proposed a ten-year, one-billion NTD donation plan to National Cheng Kung University (NCKU) to establish Taiwan's first School of Computing institute with cross-disciplinary programs, beginning a precedent for Taiwan's innovative AI applications and cross-disciplinary talent cultivation.

Adept at Finding Solutions and Prepared to Start a Business

Wu, the founder of Macronix and its current chairman and CEO, graduated from NCKU's Department of Electrical Engineering. According to Wu, he had a difficult childhood, so throughout his life, he has had to find solutions himself, such as finding scholarships to study abroad. "Because of these life lessons, finding solutions has become a special skill of mine and something that has helped me realize my entrepreneurial dreams." Wu said.

In 1976, he graduated with a master's degree in materials science and engineering from Stanford University in the United States and then spent 12 years working in different positions for companies such as Siliconix, Rockwell International, Intel, VLSI Technology and Macronix (USA). "All these different jobs helped me prepare to be an entrepreneur," Wu said. He first studied the fundamentals of technology before learning its higher complexities and planning management at large companies, followed by joining a startup to learn about building new factories. He then started learning business operations at his own company.

"I learned to do sales," he said. "When I was working at an American company, I sold technology to Japan and South Korea." When he finally returned to Taiwan to start his business, he had not only mastered all aspects of starting a business, but he also had practical experience.

To challenge what no one has done before—that's the true meaning of innovation. The goal is to strive for excellence and create your own value.

Macronix International Co., Ltd.
Chairman & CEO



"I am a very organized person," said Wu. "Although I never disclosed my intentions to others, I knew my own goals and worked towards them step by step."

Leveraging the US-Japan Trade War to Enter the Nintendo Supply Chain

The semiconductor industry requires a large amount of capital as building fabs is very expensive. In the early stages of Wu's business (1989), original shareholders invested more than NT\$800 million plus NT\$2.4 billion of incremental investment to help build the first six-inch wafer fab with a production capacity of 10,000 pieces.

The entirety of the original shareholders' investment was spent on building the factory, so additional funds had to be procured to further invest in product development.

The first fundraising opportunity that Wu encountered was selling his independently developed technology. At that time, Nippon Kokan (NKK) was looking for the right tech to branch out into the semiconductor industry. Through a friend's introduction, he proposed to them a list of more than ten tech products, eventually selling several in a US\$16 million deal. This became the first influx of capital to support Macronix R&D after its founding.



However, for a business to grow at a significant rate, the key is finding a strong customer base. Wu found one as a supplier for Nintendo, the world's largest game console manufacturer. This deal is the crown jewel in his innovative "leveraging strength" strategy.

In its early days, Nintendo made a name for itself selling Nintendo Entertainment Consoles, which required a large number of read-only memory (ROM) chips. Wu and his partners were already well-known in that field at the time, as they had licensed technology to Japanese companies such as RICOH and Sharp.

"Based on our experience, making non-volatile memory, or NVM as it's commonly known, is a great choice and for a buyer we targeted Nintendo, the world's largest buyer, said Wu." However, Nintendo already had Japanese companies supplying its memory at that time, so it was very challenging to find a way in.

However, the results of the US-Japan trade war of the 1980s gave Macronix the rare opportunity it needed. In order to narrow its deficit, Japan needed to increase the amount of purchases from the United States by 20%. Wu seized on this opportunity to supply Macronix Inc. (USA), a company he co-founded in his early years, so that they could trade in memory with Nintendo as an American business, successfully entering the Japanese market, notorious for having strict quality requirements.

Drawing Up a Win-Win: TSMC Borrows Fab/Gives Equipment to Macronix

As Nintendo gradually increased its orders, however, Macronix began to suffer from a lack of funds to buy equipment and expand production. This time, Wu once again used "leveraging strength" to cooperate with Taiwan Semiconductor Manufacturing Co. (TSMC) and solve the issue.

In the 1990s, TSMC, planning to expand business, built a new eight-inch fab. It would take at least two or three years to complete construction and then another two or three years before customers could begin to use it.

Wu, upon hearing that TSMC was planning to expand production, came up with a proposal that



would be a win-win for both sides. The equipment purchased by TSMC would be installed at Macronix and all production would be dedicated to TSMC customers to develop a customer base for the eight-inch fab. Both sides also agreed that, after three years, all machines and equipment would be transferred to Macronix.

C.C. Wei, Chief Executive Officer of TSMC, reflected on how the deal was a win for both sides, “Our goal is to serve our customers—our customers’ problems are TSMC’s problems,” said Wei. “Customers want timely availability of sufficient supply, so, after weighing the pros and cons, we agreed to this deal in order to support them.”

“To be frank, it’s not very profitable to give equipment away. However, Macronix needed funds to buy equipment, and TSMC needed the production capacity to keep customers supplied, so it was a small compromise in terms of profit that led to a successful cooperation.” Wei went on to say. “This kind of a cooperation model requires specific time and space conditions, so it would not be very easy to do again now.”

This story of mutual gain continues even 30 years later.

TSMC estimated that its production capacity would be tight again last year. They thought about

making a deal with Macronix to repeat the same strategy from last time. The timing was not right this time, and the plan was abandoned due to insufficient production capacity.

“Production demand on the entire semiconductor industry is very high right now, and it is hard to repeat the fab borrowing strategy,” Wei said, “However, the plan proposed by Mr. Wu back then made both sides very happy as we both got what we needed. We approve of and welcome this kind of win-win cooperation.”

Statistics + Semiconductors: Pioneers in Big Data

When Wu worked for the US semiconductor industry, he saw that they were the best in terms of IC design but lagged in production when compared to Japan. Because Japan has a stronger work ethic, production management prospered and, Wu wondered: “Going back to Taiwan, I could bring back American design capabilities, but how could I compete with the highly disciplined Japanese?”

The solution he came up with was to computerize the fab. However, there was not yet a precedent for the computerization of production lines, so he had to come up with his own method. He hired a group of people from the US to come to Taiwan and develop information systems for Macronix.



A pioneer in fab computerization, Wu quickly realized that vast amounts of data were being collected. With the idea that this data could be used for more effectively, he decided to add statisticians to the data mining team.

In those days, most statistics graduates were employed in the insurance and finance fields. Wu recalled the first statistics master's graduate to join Macronix and how their professors were skeptical of what they could do at a semiconductor company. Years later, though, that graduate was named a distinguished alumnus by the school.

It's not difficult to imagine how unfamiliar with one another's subjects these newly acquainted statistics and semiconductor professionals were. Wu asked them to be patient and slowly get to understand one another, gradually identifying problem areas through data mining and analysis. The problems they found, ranged from the production process to equipment, environment, and product design. Therefore, Macronix was able to improve across the board, gradually increasing yield from generation to generation. This system would come to be known as Super NOVA, or sNOVA.

Combining statistics with semiconductor production is an innovative method that had never been done before. The synergy created between the two have significantly improved the production yield and efficiency while shortening Macronix's product development time.

"It could be said that through the continuous tempering of the sNOVA process, Macronix truly demonstrated its value in the second half of its 30 years of operation, Wu said." Now, Macronix's product defect rate has reached 500 PPB (per billion parts is less than 500). It is the first semiconductor company in the world to measure product defect rate in parts per billion rather than million.

After Macronix took the lead in promoting full computerization of semiconductor factories, several other semiconductor factories in Taiwan, including state-of-the-art wafer fabs, began to introduce the sNOVA process. This is one of the key factors that helped Taiwan become a global semiconductor production hub.

"It's amazing, Wei said candidly, when asked about sNOVA. "At a time when we didn't know much about artificial intelligence, Mr. Wu saw the importance of production data integration early on, which is why the production line could work so well."

"Every semiconductor factory wants to improve yield rate. They use AI deep learning tech, configure the production line in a reasonable way, and strive for the highest production capacity and most efficient production method possible. Many people in the semiconductor industry talk about it now as if it's nothing special. But 30 years ago, to have this kind of thinking and practice was, to put it frankly, really quite innovative."

Unafraid of a Patent War: Fighting the US and Japan

Wu always says that he brought the spirit of American tech — groundbreaking innovation — back to Taiwan.

Macronix products are all designed and developed in-house. Through this process, the company developed numerous patents and slowly established an IP portfolio. Because the products were so high-quality, the company could continue to expand into the global high-end application market.

At that time, Spansion, the largest manufacturer of NOR Flash, accused Macronix of patent infringement for several of Spansion's old patents.

They launched a patent war in the United States, perhaps with the idea that they had a home-field advantage.

Negotiations between the two parties having failed, and Macronix suited up for battle. In the process of researching their patents and products, Macronix realized that Spansion had actually infringed on Macronix's patents. Working with IBM, they leveraged the USITC to sue Spansion.

As the lawsuit entered the trial phase, what Spansion accused Macronix of infringing on was never clearly established, but what Spansion infringed on became more and more clear. So, before the case was even announced, the two sides were able to settle.

In addition, this patent war spurred on other battles. During the lawsuit with Spansion, Japan's Toshiba also filed a patent infringement charge. Wu didn't want to fight two battles at once, so he opted for negotiation instead of litigation. Once they had reconciled with Spansion, he shifted his concentration to Toshiba.

Toshiba, determined to have the upper hand, insisted on filing a lawsuit. Macronix, however, took advantage of its momentum after winning the Spansion settlement in the US to directly sue Toshiba for infringement through the USITC. Toshiba separately sued Macronix in Japan and Taiwan. This lawsuit developed similarly to the first. Toshiba eventually realized the disadvantages of infringing on Macronix's intellectual property and agreed to settle out of court.

"These two international lawsuits just go to show that our quality patents can withstand any battle as we develop them all ourselves." said Wu. He added that after the two patent battles, he received over US\$100 million in settlement funds.

Promoting Third Board Stock Market as a Way to Inject International Capital

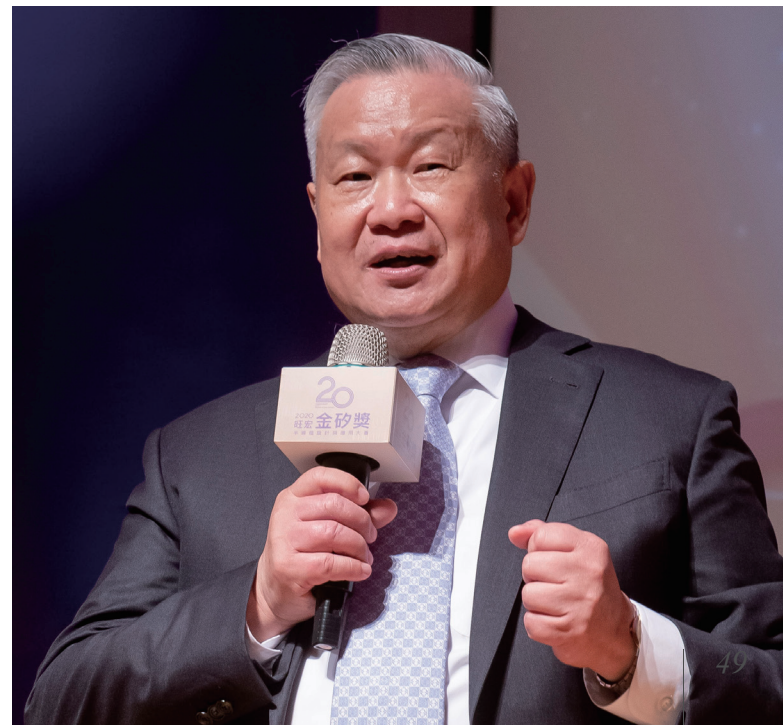
From 1993 to 1994, Wu observed that the rapidly developing semiconductor industry was in great need of an injection of capital. At that time, although listing regulations for the third board stock market

had been announced for many years, no company had yet passed the listing review.

Thus, he met with Chiang Pin-Kung and Vincent Siew, then the Minister of Economic Affairs and chairman of the Council for Economic Planning and Development, respectively, and shared with them his personal experience. He told them how Intel almost closed several times during its first ten years of business and it was venture capital and the stock market that rescued them in the US. Through investment and going to market, they found the funds they needed to survive in the capital market.

Wu carefully analyzed the pros and cons of technology companies going to market and, after approval from the two officials, the Industrial Development Bureau took over responsibility for the case. At that time, Macronix, who had been receiving guidance from a share broker for a year, gave a briefing stating why it was worth going to market as a third board share. In 1995, Macronix became the first company of its kind to be listed on the third board.

Wu emphasized that his focus was not on whether or not Macronix could go to market, but rather on investing more in Taiwan's high-tech industry through the securities market. "The first few years Macronix went to market were profitable." he said, "The government had confidence in our performance, so they opened up a lot. For this



reason, listed high-tech companies could raise funds overseas through different methods such as ADR, GDR, and CB.”

Today, more companies are approved to go to market and can raise funds overseas. These two factors have stimulated the vigorous development of Taiwan’s high-tech industry, resulting in the large scale of the tech industry as we see it today.

Innovative Design and Talent Cultivation

Before Wu returned to Taiwan to start Macronix, Taiwan’s IC design industry mostly worked as follows: look at foreign IC’s, take photos, and copy them exactly. This is what is known as reverse engineering. Wu brought the American-forward design style back to Taiwan and, with about 40 senior engineers in tow, it took root.

At that time, some locals also offered their services to the new company. However, people trained in reverse engineering were not very helpful, so Wu decided to train his own talent. He recruited a group of graduates from universities such as National Taiwan University, National Tsing Hua University, National Chiao Tung University, and National Cheng Kung University, and started training them up from scratch.

In Macronix’s first ten years, Wu trained hundreds of engineers who would eventually end up in important positions at major IC design companies and develop their own specialties. Looking back now, Wu has been cultivating talents since the beginning of his business. For over 30 years, Wu has contributed immensely to Taiwan’s semiconductor industry.

Wu also founded the Macronix Education Foundation in 2000, as well as the longest-running IC design and application competition in history, the Macronix Golden Silicon Awards. This competition provides students of electronics/electronics-related disciplines in Taiwan with a stage to develop IC application and design ideas. Wu believes this kind of practice is very important and can help stimulate tech research and development in Taiwan.

NT\$ 1B over ten years to strengthen cross-disciplinary learning

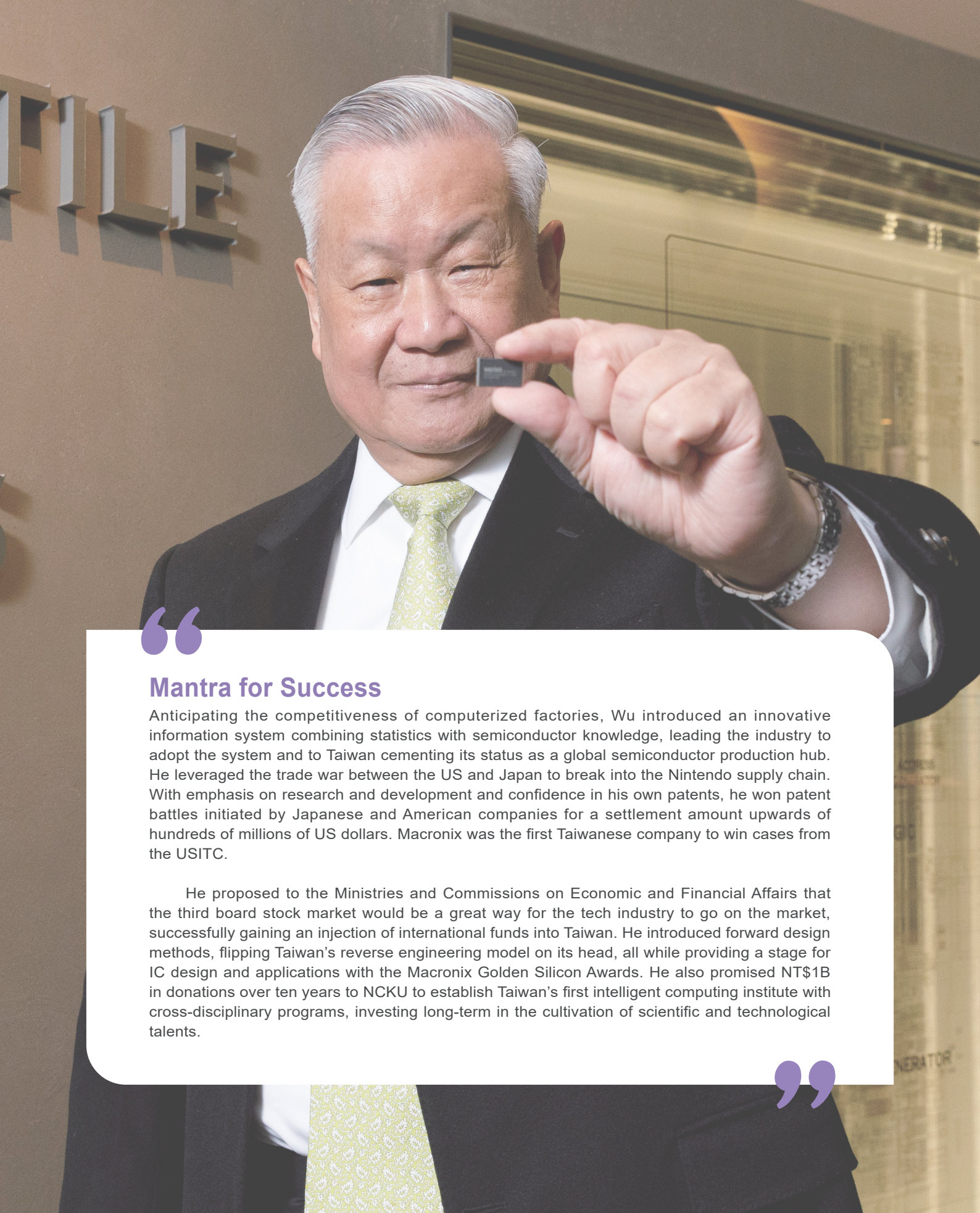
In 2021, Wu and NCKU jointly announced the founding of the Miin Wu School of Computing, with a donation of NT\$ 1B over ten years. Wu proposed this initiative to the president of NCKU, hoping to strengthen cross-disciplinary learning between computing and mathematics.

How did the NT\$1B over ten years plan come about? Wu, along with president of NCKU, Dr. Huey-Jen Jenny Su, and then-vice president Dr. Wu Cheng-Wen, met with Taiwan’s Minister of Education Pan Wen-Chung to express the importance of cross-disciplinary, AI innovation and application talent cultivation and their idea to establish a specialized institute. He proposed that whatever the government grants to the institute, the NCKU alumni association will match in donations. This design for the institute was approved, but Wu did not want to burden other alumni, so he decided to pledge NT\$100M per year from Macronix, thus finalizing the ten-year donation plan.

The ten-year donation plan from Macronix to NCKU does not stipulate that the university must put forward any specific plan. Like the Macronix Golden Silicon Awards and Macronix Science Awards, the plan is meant to help Taiwan without expecting any benefits for the company.

“Breadth of mind determines how much you can do,” said Wu. “Why should you only think of yourself whenever you do something?” Wu said, concluding the interview with a powerful statement: “If you are broad enough of mind, only then can you contribute to your country, your society, and onwards to the world.”





Mantra for Success

Anticipating the competitiveness of computerized factories, Wu introduced an innovative information system combining statistics with semiconductor knowledge, leading the industry to adopt the system and to Taiwan cementing its status as a global semiconductor production hub. He leveraged the trade war between the US and Japan to break into the Nintendo supply chain. With emphasis on research and development and confidence in his own patents, he won patent battles initiated by Japanese and American companies for a settlement amount upwards of hundreds of millions of US dollars. Macronix was the first Taiwanese company to win cases from the USITC.

He proposed to the Ministries and Commissions on Economic and Financial Affairs that the third board stock market would be a great way for the tech industry to go on the market, successfully gaining an injection of international funds into Taiwan. He introduced forward design methods, flipping Taiwan's reverse engineering model on its head, all while providing a stage for IC design and applications with the Macronix Golden Silicon Awards. He also promised NT\$1B in donations over ten years to NCKU to establish Taiwan's first intelligent computing institute with cross-disciplinary programs, investing long-term in the cultivation of scientific and technological talents.





Miin-Chyou Wu (1948)

Highest Education : Master's in Materials Science and Engineering,
Stanford University, USA

◎— 1989

- During the first wave of overseas professionals returning to Taiwan, Wu brought 40 semiconductor specialists from Silicon Valley to Taiwan to found Macronix. He bucked Taiwan's trend of reverse engineering, replacing it with forward design while retraining local Taiwanese R&D talent.
- He built the first sNOVA system, combining statistics and semiconductors. A global leader in introducing AI and big data, Macronix became the world's first semiconductor fab with fully computerized production lines, ushering in an innovative manufacturing model for semiconductors that has contributed immensely to Taiwan's semiconductor industry.

◎— 1995-1996

- Helped Macronix become the first benchmark business to be listed on the third board stock market in Taiwan, attracting overseas investment and helping to initiate Taiwan's prosperous high-tech era.
- In 1996, Macronix became the first Taiwan high-tech company to be listed on the American Nasdaq stock market.

◎— 2000

Used his “leveraging strength” strategy to create blue ocean business opportunities and solve the major issue of semiconductor investment. In the first 10 years after founding Macronix, turnover exceeded one billion US dollars, making Macronix the fastest-growing semiconductor company in the world. This outstanding achievement was recognized internationally, and Wu was the first Taiwanese entrepreneur to appear on the cover of Forbes in 1998.

◎— 2001

Founded the Macronix Education Foundation and the Macronix Golden Silicon Awards and Macronix Science Awards to help nurture domestic technology innovators. After over 20 years, nearly 40 thousand teachers and students have participated and received scholarships totaling over NT\$170 million.

◎— 2013、2018

Fearless in the face of international patent wars, Wu led Macronix to become the only Taiwanese company to win a lawsuit through the USITC, defeating US NOR flash manufacturer Spansion and the Japanese NAND flash manufacturer Toshiba. Settlement compensation exceeded hundreds of millions of US dollars, testament to the great importance of original R&D and patents.

◎— 2011、2016、2020

Made important contributions to Taiwan in business management and social welfare, eventually receiving honorary doctorates from Tsing Hua University, National Cheng Kung University, and National Chiao Tung University.

◎— 2019

Donated NT\$420 million to NCKU to build the Cheng Kung Innovation Center – MACRONIX Hall, as well as pledged NT\$100 million a year over ten years to establish the Miin Wu School of Computing. The institute integrates cross-disciplinary studies and promotes Taiwan's digitalization education while helping Taiwan cultivate inter-disciplinary AI talents.

◎ — 2021

Macronix has the world's largest market share of ROM and NOR flash memory. It is also the first to mass-produce next-generation, high-end 3D NAND memory products in Taiwan, and the world's first semiconductor to reach a PPB (parts per billion) defect rate. For these outstanding achievements, Wu was awarded the "Digital Transformation Leader Award" by the Harvard Business Review and named an ITRI Laureate, among other honors.

Timeline

- 2005-2007 Chairman and President, Macronix International Co., Ltd.
- 1989-2005 Founder and President, Macronix International Co., Ltd.
- 1984-1989 Founder and Vice President, Macronix Inc. (USA)
- 1981-1984 Process Development Manager, VLSI Technology Inc.
- 1979-1981 Process Development Engineer and Program Manager, Intel Corp.
- 1977-1979 Process Development Engineer and Section Manager, Rockwell International
- 1977 Process Development Engineer, Siliconix Inc.

Special Honors

- 2021 19th Global Views Leaders Forum, Lifetime Achievement Award
ITRI Laureate
Harvard Business Review, "Digital Transforming Leader" of
Ding-Ge Digital Transforming Award
- 2020 Pan Wen Yuan Foundation, ERSO Award
National Chiao Tung University, Honorary Doctorate
- 2018 EY Entrepreneur of the Year Awards, "Country Winner" and
"Business Paradigm Entrepreneur"
- 2017 Ministry of Education, Social Education Contribution Award
- 2016 National Cheng Kung University, Honorary Doctorate
- 2011 National Tsing Hua University, Honorary Doctorate
- 2010 Chinese Society for Management of Technology, a Fellow and "Outstanding Performance Award in the Field of
Management of Technology"
Outstanding Entrepreneur by The General Chamber of Commerce of the R.O.C.
Professor Shen Wen-Zen Memorial Award for outstanding contributions to integrated circuit and system design
- 2008 Taichung First Senior High School, Outstanding Alumni Award
- 2002 National Cheng Kung University, Outstanding Achievement Award
- 2001 BusinessWeek, Stars of Asia
- 2000 Taiwan Electronics Devices and Materials Association, Outstanding Contributions Award
- 1998 Forbes magazine Cover People
- 1997 US Electronics Buyers News, The 25 Industry executives who made a difference
- 1996 ELECTRONIC BUSINESS ASIA, Top Executive
- 1993 Taiwan Business Weekly, Premier Award on Contemporary Business Leader



Youth Category

...

Changhua County Fire Department

Ming-Che Sung, Firefighting Inventor

A Firefighting Inventor Calls on the Public to Innovate Disaster Relief Equipment

During the military's disaster relief efforts in the aftermath of Typhoon Morakot, Ming-Che Sung, a soldier at the time, wanted desperately to get to the disaster sites and offer aid. After leaving the army a few years later, he passed the police/firefighter exam and joined the local fire brigade, realizing one of his long-term dreams. After numerous missions to rescue floating bodies, his natural inventive spirit inspired him to improve firefighting and rescue equipment. Respecting the deceased, comforting their families, and protecting his disaster relief colleagues are all part of Sung's journey as an inventor, a journey that proves that if you really want to do something, the universe will come together to help you accomplish it.

Ming-Che Sung is a professional firefighter specializing in disaster relief as well as an amateur inventor keen on research. While he's not working on fire and disaster relief, he devotes himself to developing technology such as the water recovery body bag, which not only helps increase disaster relief efficiency, but also respects the humanity of the deceased.

He continued to develop more disaster relief equipment, taking out personal loans year after year to pay for research expenses and product trials, also exploring a donation model that does not violate regulations. After making some headway, Lin Chia-Lung was moved to assist in matching him with associations and foundations that might assist him in forming corporation aggregates. He called on other firefighters who are interested in research to help develop better equipment to help on the front lines of disaster relief.

Although he always sees things that can be improved, he does not take the drastic route of clashing with the system, but rather believes that as long as people are practical and work hard, anyone can make a difference.



Smallness cannot hinder our dreams; setbacks help us grow. Bravely take that first step for anyone is capable of making a difference.

Changhua County Fire Department Firefighting Inventor

Sung Ming che

Developing Innovative Body Bags that Respect the Dignity of the Deceased

Sung, a graduate of the National Defense University where he was a second lieutenant supply officer, worked for the Puyan Township fire brigade in Changhua County. Following the devastating 2009 Typhoon Morakot, he participated in the military's disaster relief logistics coordination. Realizing that he was eager to get to the frontline and help with search and rescue was his impetus for changing career paths. He left the army in 2013 and passed the special examinations for firefighters and was assigned to the local fire brigade, realizing his dream of working on the front lines of disaster relief.

From 2017 to 2018, Sung was honored by Changhua County as an "Excellent Disaster Relief Personnel" and "Outstanding Youth Representative." Three years later, he was featured in national media coverage for the Taiwan Chivalry Awards and Taiwan Inventor Awards. The deeds of this "inventing firefighter" gradually attracted society's attention.

What did he invent? The first of Sung's inventions to attract attention was the water recovery body bag. This invention was inspired



by his experience saving floating bodies. Due to corpses having been dead for many days and exposed to the sun, they not only looked miserable, but had a distinct smell. Most of the work of bringing the bodies ashore was done by hand by rescue workers, while family members who came to identify the bodies would be crying and besides themselves. He thought to himself, is there not a better way to go about this?

"Just imagine, what if the victim was a member of your family or a friend? If we could handle deceased people's remains more delicately, wouldn't we be able to alleviate the grief of family members upon receiving such bad news? Could we help protect rescue workers and even reduce mental health impacts?" Sung said.

With Sung's rescue expertise, he knows what kind of equipment is helpful for rescues, and what is not. Once he has an idea for equipment design, he uses Microsoft Paint to draw up a first draft. Then, his process includes contacting a manufacturer, listening to their opinions on materials and production costs, and adjusts his design accordingly.

His ideal water recovery body bag contains several key features: the bag should be able to fully unfold so as to reduce contact with the body and also be able to fully seal with a zipper so that bodies can be delivered to a prosecutor/forensic unit for autopsy. Because it is used in the water, the bag must have a drainage mesh and a strong pull ring so that water will be removed when a pulley lifts the body up.

It took two years of designing and production until the finished products began to appear on the front lines of disaster relief. The final product covered all the aforementioned key points and even obtained a national invention patent after just one year.

Award-winning Affirmation Inspires Series of Donations from the Public Community

After winning several domestic and foreign innovation design awards, Sung's inventions began to attract more attention. For each



new product, dozens to hundreds of private institutions, businesses, and individuals pledged to buy and assist in donating them to fire brigades and coast guard units.

As a firefighter, Sung is part of the civil service and thus not allowed to handle any donations. Therefore, the production cost of hundreds of pieces of equipment each year is partially absorbed by manufacturers. In some cases, like Puji Temple, a pledge is made to the manufacturer for a few hundred pieces which are then donated to the units that will use them. Over the past three years, about 5,000 body bags have been donated to firefighting, coast patrol, and international rescue organizations.

“This charitable donation model is what has allowed us to continue to this day. I have always believed that grassroots power can make it through operational bottlenecks in firefighting and disaster relief.” Sung said.

However, when these firefighting products are donated to front-line units, they are not necessarily always welcomed with open arms. When a new method appears, to a certain degree that is a denial of past disaster relief methods, so it is expected

that they may be met with resistance or rejected outright. However, once one firefighter tries a product and can testify to its worth, gradually, the rest of the team will begin to adopt it. Many relief workers start to realize that they should have done it that way to begin with.

In 2019, the Gangshan fire brigade began to use the water recovery body bags. According to Sung, a reporter who stood ashore waiting for the body to be lifted shouted, “I have never seen a body handled with such care.” Of course, that reaction made him feel as though the hard work was all worth it.

That same year, the body bags donated by Taipei’s Puji Temple came in handy following the Nanfang’ao Bridge Collapse. Television news repeatedly broadcast images and reports of the deceased migrant workers neatly packaged in water recovery body bags and hoisted ashore. This incident led to inquiries from rescue workers in Taiwan about the new equipment and the representative office of the Philippines in Taiwan, where the migrant workers were from, expressed their gratitude to Sung and the Taiwan rescue team for such dignified treatment of their citizens.

In 2021, a Taroko Express train tragically derailed in Hualien, and local firefighters decided to use the body bags during the rescue. “This shows that firefighters have begun thinking differently about how to handle human remains in a dignified and safe way.” On that day, it had been two years since Sung’s invention was used for the first time.

Sending 50 Letters for Manufacturer Support

After the first generation of his water recovery body bags, Sung continued to use the original main parts as a basis for adjusting other parts and components to local conditions and different kinds of disaster settings such as mountains and fires. Through the process of R&D and production, he also tried to establish his own supply chain list. Some manufacturers cooperated in a discreet manner, while others were more than willing to participate publicly.

How could Sung, a humble firefighter, get involved in the industry chain? He relied on his courage—courage to take the first step, to ask questions, and to write letters and call manufacturers he thought had a good chance of working together with him. According to him, he has written 50 letters to major companies introducing his research and inventions to them and inquiring about donation opportunities. The majority of his messages were left on read.

“I used to be in the army; I was a major when I retired. What I learned from my military career is: don’t give up. Once you’ve taken the first step, the rest is not as difficult as you think,” Sung said.



For example, Ain Tec industrial co., ltd. a local bicycle accessories manufacturer in Puyan Township, specially produced aluminum alloy lifting rods capable of bearing 270 kg for him. Atunas, a Taiwanese outdoors brand, worked together with him to develop a new generation of high-tech swimming buoys. Chunghwa Telecom, a leader in Taiwan’s telecommunications industry, set up a Chunghwa Telecom fire protection R&D task force under General Manager Kuo. They worked with Sung on R&D, with no cost limits, and cooperated with ASUS to create an integrated communication and information platform. Other companies such as Formosa Taffeta, Formosa Chemicals and Fiber, and Entire Technology met with Sung to discuss suitable materials, including fireproof materials for fire rescues.

Of these, Formosa Taffeta was the first local manufacturer to support Sung’s research. “Mayor Hsu Wen-Ping of Puyan Township introduced us. They have given donations since my first invention. Vice President Lin Zhen-Zhi once came to see it being used in action and was touched by his own pledge. This time, we put forward our need for high-strength aluminum alloy lifting rods, and Vice President Lin provided free support. The quality is so good that even after using it for two years, the surface paint is still intact.” Sung said.

Utilizing the Power of People to Expand Influence

Ninety-nine percent of firefighting equipment and fire truck disaster relief equipment in Taiwan are from large foreign firefighting brands. Sung is eager to have the chance to help the local firefighting equipment industry develop. He even hopes to set up his own research institution where people from across the country who are enthusiastic about firefighting technology can gather and work on more inventions that improve the safety and efficiency of firefighting and disaster relief. However, in reality, this idea would be extremely challenging to carry out, and he must find a stable source of R&D funding first.

In order to support his focus on research and development without violating the civil service code while promoting practical use for his inventions, he is currently assisting in the establishment of

a firefighting R&D office through the Taichung Development Association, which will be responsible for handling donations. “In the future, the ‘ROC Love and Progress Firefighting Public Welfare Association’ will be formally established to provide the necessary resources for inventing, protecting the rights and interests of donors, and properly manage production and financial affairs under the supervision of competent authorities and accountants.” Sung said.

Under this ideal framework, Taiwan will still adopt a donation model which does not involve commercial transactions. The recipients are firefighting and coast guard units, and there are plans to make regular donations and cooperate with international rescue organizations. Businesses who intend to develop into the international market in the future will also have access to this Taiwan-made disaster relief equipment.

In the past, Sung approached Huang Chun Yuan, an old acquaintance at the Japanese rescue organization Asia Pacific Alliance for Disaster Management (APADM), and sent him the body bag he developed for inspection. Huang, who has more than 20 years of volunteer disaster relief experience in Taiwan, said in a video interview, “I think what Ming-Che Sung wants to change are all things that need to be changed. Even if the process takes decades, it will still be worth it.”

Huang further reminded those who are interested in researching firefighting equipment to look to the international R&D arena. What does their starting line look like? One day, when you are qualified enough to stand on that starting line, then you will be able to truly go head to head in the disaster prevention equipment industry chain with the same universal values and see whether your innovation can really help. Huang used this perspective to look at Sung’s inventions. At first, he received the body bag design that Sung sent him. In addition to affirming him his efforts, he also updated him on the equipment status in Japan and other countries. He reminded him that globally, the type of equipment he developed is actually very cutting-edge.

Regarding Sung’s ambition to expand and develop, Huang believes that a legal person (such

as a foundation) is a good choice. “Taiwan’s NGO community has developed quite rapidly. They have a lot of people power as well as a clear vision. They have done a great job in many fields. I think that this kind of approach through an NGO is feasible for research resources for disaster relief equipment.”

Taking the Hard Road and Deserved Attention

On the other hand, Chen Ching chih, the business manager of a firefighting equipment company and a good partner of Sung’s, often discuss research together with him. He has had a personal glimpse into this firefighting inventor’s life.

“Because firefighting is an unpopular industry, firefighting seems to be dispensable to society and most people don’t spend much time thinking about it. It took a long time for Sung’s inventions to get the public’s attention.” While Chen felt sorry for Sung, he was also happy to see that he finally got the attention he deserves. “Over the past two years he has won award after award. Last year he received the Taiwan Chivalry Award and now the Presidential Innovation Award. This kind of attention is far beyond anything we could have ever imagined at the beginning. I am really touched.”

Over the past four years, Chen watched as Sung took out millions of NTD in loans to cover R&D and production costs. “Unlike a company’s R&D department, which has plenty of financial





support, he spends almost all his free time from firefighting looking for resources. These hardships have really tested his passion and his resolve.”

From Water to Fire: Devoted to Disaster Relief Development

In 2022, Sung will continue to invest in developing his fire rescue bag. The impetus for his research comes from his experience with fire rescue.

“During a fire rescue, if a flashover occurs, firefighters at least have their protective jackets, but the people they are rescuing do not.” When he realized this problem, Sung thought up a solution in the form of a fire rescue bag.

First of all, the bag must be made of fire-resistant material that is resistant to high temperatures. It also cannot be airtight and completely opaque, or people would get claustrophobic. It also needs an air circulation system. “The material has to be able to withstand

at least 1,200 degrees of heat. Plastic can be rolled and pressed to take up less space when being carried by firefighters to the scene of a fire. In addition, two transparent windows are added so that people being rescued can see what’s going on outside, which will help keep them from panicking.” Sung described his design.

This invention is particularly difficult to make, so Sung feels fortunate to have such specialized manufacturers on board. For instance, Formosa Chemicals & Fiber Corporation can provide materials with heat-resistance of up to 1,200 degrees. Taiwan K.K. Corp., which makes firefighting gear, is responsible for producing the finished product. The final bag is two layers thicker than Sung has originally specified in his plans.

Encouraging Investors, Keeping Tragedies a Thing of the Past

From developing the idea to producing the finished product, Sung has to undergo numerous trials and adjustments, which has given him the chance to explore various high-quality materials and technologies from different manufacturers. “Since I have been through the process myself, I hope I can help other innovators with creative ideas to use the technologies and materials from various manufacturers to make great supplies and equipment.”

“Inventing is just the beginning. As we develop more fire rescue equipment and actually manufacture it, whether it is donated and used in Taiwan or in international rescue organizations, or even promoted to international rescue organizations, that is what we really want to see happen.” Sung never thought that he would make it this far. He used a quote from the movie Spider-Man to describe his expectations for himself: “With great power comes great responsibility.”

In addition to his responsibilities as a firefighter, Sung hopes to gather more resources from civil society as a firefighting inventor. Independent research leads to team-based R&D, which in turn leads to the development of better firefighting equipment and better safety for disaster rescuers so that no unnecessary tragedies ever happen again.



Mantra for Success

Although he always sees things that can be improved, he does not take the drastic route of clashing with the system, but rather believes that as long as people are practical and work hard, anyone can make a difference. While he's not working on fire and disaster relief, he devotes himself to developing technology such as the water recovery body bag, which not only helps increase disaster relief efficiency, but also respects the humanity of the deceased. He continues to develop more disaster relief equipment, taking out personal loans year after year to pay for research expenses and product trials, also exploring a donation model that does not violate regulations.

As a firefighter who is also an inventor with numerous awards, he attracts a variety of industry-research cooperation opportunities. For example, the public good, promoting corporations' image, and supporting individual research and development to give back to the country and society all attract manufacturers to join and explore the potential of civil power. With many achievements under his belt, he motivates private foundations to assist in establishing corporation aggregates. He intends to call on more colleagues with an interest in research to help develop better equipment and make an impact on the frontlines of disaster relief.





Ming-Che Sung (1982)

Highest Education : Department of Business Administration, School of Defense Management, National Defense University

◎ — 2002

Graduated as second lieutenant officer in Republic of China army.

◎ — 2013

Resigned from military and passed fourth-class fire/police special exam.

◎ — 2015

Joined the Third Brigade of the Puyan Township, Changhua County Fire Department.

◎ — 2018

Began development on water recovery body bags.

◎ — 2019

Completed mass production of water recovery body bags and continued development of other disaster relief equipment.



Timeline

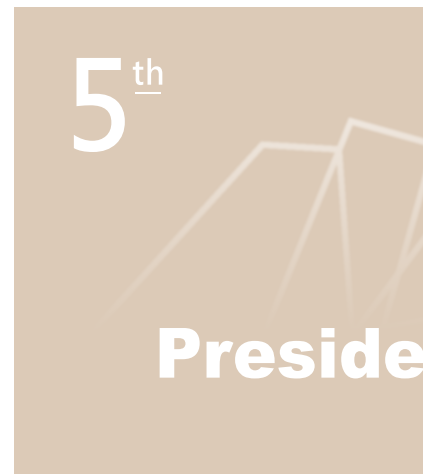
- 2020-Present Working group member, Fire Fighting Workwear Improvement, National Fire Agency, Ministry of the Interior
- 2015-Present Third Brigade Puyan Township, Changhua County Fire Department
- 2019 - 2021 Present-Secretary General, Taiwan KIA Club RV Family
- 2013 - 2014 Deputy Director General, Taichung Association for the Blind
- 2002 - 2013 Retired major, ROC Army

Special Honors

- 2021 3rd Taiwan Chivalry Awards
- 2021 Taiwan International Inventor Awards-Outstanding International Inventor
- 2017 Excellent Disaster Relief Personnel, Changhua County Fire Department
- 2018 Outstanding Youth Representative, Changhua County
- 10th International Innovation and Invention Competition, Gold Medal for water recovery body bag
- 2020 3rd Zayton Cup International Design Competition, Bronze Medal for water recovery body bag
- 3rd Conti Awards for Arts and Interdisciplinary Design, Gold Medal for water recovery body bag
- 3rd Conti Awards for Arts and Interdisciplinary Design, Innovation Award for emergency service warning system
- 2020 Wenzhou International Design Biennial, Finalist for water recovery body bag
- 2020 Wenzhou International Design Biennial, Finalist for emergency service warning system



Photo of Activity





ential Innovation Award



Photo of Activity





The 5th Presidential Innovation Award Report

Publisher : Ministry of Economic Affairs

Address : 15 Fuzhou St., Taipei, 10015, Taiwan, (R.O.C.)

Tel : (02) 2321-2200

URL : <https://www.moea.gov.tw/>

Production : Chinese Association For Republic of
China Industrial Technology Promotion Association

URL : <https://www.caita.org.tw/>

Address : 11F.,No.149,Sec.3 Xinyi Rd., Taipei City 106,Taiwan(R.O.C.)

Tel : (02) 2325-6800

Author : Yu-Feng Chen

Photography : Shih-Hao Tsai

Publication Date : Dec. 2022, first edition

Complimentary Publications

ISBN : 978-986-533-336-2

GPN : 1011102303

All rights reserved

Copyright © 2022 Ministry of Economic Affairs, R.O.C.



5th



ISBN 978-986-533-336-2



9 789865 333362

The 5th
Presidential Innovation Award