Ying-Yao Cheng – President, National Sun Yat-sen University (NSYSU), Taiwan

The development of medical research in NSYSU is quite different from other medical centres in Taiwan because we bring different areas of expertise to create cross-disciplinary innovations

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Ying-Yao Cheng, president of National Sun Yat-sen University, highlights the institution's specialized expertise in marine sciences and goes on to elaborate on the important role of NSYSU in developing talent, translational research, and innovation both domestically and internationally. Cheng also describes the university's capabilities in cross-disciplinary research projects, particularly in medical and artificial intelligence.

Dr Cheng, can you briefly introduce National Sun Yat-sen University and your priorities as president?

NSYSU was founded in 1980 and is a mid-sized research-oriented university located in Kaohsiung City, a global port city and Southern Taiwan's industrial, economic, and cultural hub. The university is leading research in a diverse range of fields, particularly marine sciences, business, material science, electrical engineering, environmental science, and applied chemistry. We have seven colleges including liberal arts, management, social sciences, science, engineering, marine sciences, and Si-Wan.

When the university was first founded, many young and talented professors from around the world were recruited to NSYSU and have created a unique campus culture of academic research. As president of NSYSU, I am committed to envisioning the future of the university and daring to dream

big! I have made it my mission to embed a diverse, novel, and adventurous DNA to shape the spirit of all members of NSYSU.

What is it about the university's academic and research environment that differentiates NSYSU from other universities?

Today we are ranked number seven out of the top ten research universities in Taiwan. Most of our faculty are graduates from leading institutions like MIT and Berkley in the US. This helps to create a diverse learning environment and an international research ecosystem. Furthermore, the university is strategically located in close proximity to major research institutions and science parks, for example, Tainan Science Park, Luchu Science Park, Ciautou Science Park, and Kaoshiung Software Park. Being in this dynamic area is a key success factor for cultivating innovation within the university while also being able to link our projects with industries through translational initiatives and academia-industry collaboration.

The Ministry of Science and Technology's GLORIA program aims to form global research and industry alliances that are centred around Taiwan's leading universities. As a member organization, to what extent is NSYSU contributing advanced knowledge base and technologies to further industry in Taiwan?

My duty is to create an environment with many support mechanisms that will allow NSYSU's faculty to connect outwards through their projects. Our university is not just focused on publications, but we highly encourage our researchers to transfer their projects from the bench to society by collaborating with industries. Furthermore, these technology transfers and cooperation are not just limited to local Taiwanese companies, but our researchers often work with international corporations in the most advanced industries. For example, NSYSU plays an important role in the international development of the most advanced technologies such as 5G and radar technology. A portable radar was developed in NSYSU which can detect conditions such as heartbeat, pulse, and breaths of living organisms to effectively control their health; thus the application is to better control the quality of live stocks. This technology was transferred to an American company in Miami for more than two million USD.

What are the university's strong suits when it comes to the sciences?

Our strategic geography prompted our feature advancements in marine research, which heeds to Kaohsiung’s aspiration to develop into a Marine Capital, as we are the leading academic institution of marine sciences in Taiwan. The university encourages interdisciplinary collaboration between marine studies and other academic fields so as to stimulate new ideas and research directions.

In 2016, our distinguished Professor Yang-Yih Chen of the College of Marine Science had successfully experimented power generation from Kuroshio Current on the eastern coast of Taiwan. The Kuroshio Current travels along the east coast of Taiwan which can reach the speed of 1.27 meters per second and can generate an average of 26.31 kilowatts of electricity. This form of energy is significant in that it is sustainable, as long as the earth is revolving, there will be ocean current. The research result attracted global attention since it is the world’s first ocean current power generation at this level.

Going deeper, NSYSU has committed to developing an underwater vehicle to further expand research in marine sciences. The manufacturing of the vehicle is a pioneering project in Taiwan which will help to further advance the country’s shipbuilding and mechanical engineering capabilities. To accomplish this task, NSYSU assembled the Alliance of Developing Manned Submersibles for Academic and Technological Purposes in 2017. Here we are developing the pioneer personal submersible in Taiwan and foster the development of underwater research, shipbuilding, and mechanical engineering.

NSYSU is focused on developing next-generation innovation by working with emerging technologies such as artificial intelligence which can be applied to a number of industries. How are you encouraging inter-disciplinary development of AI research at the university?

NSYSU’s research team developed the AI-based farming system by using underwater image enhancement and recognition technologies and achieved success when they applied the system in the university’s farming pools. The AI technologies enable automatic estimation of shrimp population, body size, activity level, and feeding frequency. This AI farming system enables each shrimp to gain three grams per week versus using the traditional method and with a gain of two grams, increasing the growth by 30 percent. Presently, our team is introducing the AI farming system to private shrimp farmers and is conducting on-site trials with white shrimp and Asian tiger shrimp.

This research project was sponsored by the Department of Life Science, Artificial Intelligence Policy Action Plan, Moon Shot Project, and the Ministry of Science and Technology. It involved cross-disciplinary collaboration involving farming equipment, Internet of Things, cloud service, data storage, and the farming sectors.

Where does NSYSU stand when it comes to its capabilities in the fields of life sciences and medicine?

The development of medical research in NSYSU is quite different from other medical centres in Taiwan because we bring different areas of expertise to create cross-disciplinary innovations. For example, we are currently focusing on AI-driven big data analysis in the application of genomic sequencing and precision medicine. Additionally, NSYSU has basic research projects on genetic targeting which we can apply to different areas of healthcare such as biomedical imaging for target-based treatment. Furthermore, we are focused on developing novel drug formulations using natural products produced by our college of marine science.

NSYSU is planning to establish its own medical school in the upcoming years. We are forming alliances with hospitals and will have the support of top professionals to cultivate talents for the rising demands of medical care. NSYSU has already established cooperation with ten hospitals in Southern Taiwan. The collaboration between the academic community and the health care and medical community can foster the development of medical equipment as well as new drug discovery.

Do you have any particular examples of impactful health research projects that NSYSU is currently working on?

Air quality has become a serious problem in Taiwan. In order to face this challenge, NSYSU has established the first Aerosol Science Research Center in Asia to further study and control the effects related to PM2.5. The goal of this research is to study the impacts of aerosols in the atmosphere, oceans, ecological environment, and to public health. Furthermore, we will explore how to reduce the emissions of aerosols from transportation and various manufacturing industries. Lastly, we are also aiming to better understand the potential implications of aerosols in biomedical science. As the number four leading cause of disease in Asia, this research is critical in the prevention, management, and treatment of health issues connected to air quality. The centre is

cooperating with leading hospitals and doctors in Taiwan in pursuit of this ambition. NSYSU hopes to play an essential role in reducing this major health burden which is highly preventing in Asian countries. Even internationally, we have recently entered into an Agreement of Collaboration with the University of California San Diego's Center for Aerosol Impacts on Chemistry of the Environment (CAICE), the only aerosol research centre in North America.

Looking outside of Taiwan, how is NSYSU building an international network of collaborations for the advancement of education and research?

We are dedicated to creating an internationalized campus. NSYSU has sister-university agreements with over 230 universities from more than 40 countries around the world. Within these partnerships, we engage in student exchange programs, dual degree programs, joint dissertation supervisions, research collaborations, and co-sponsorship of symposiums. The vast array of activities provides ample opportunities for domestic students and foreign students to interact and bridge their understanding of different cultures.

What makes NSYSU a world-class university?

Outstanding academic achievements exhibited by many departments have landed NSYSU among the world's top universities in many academic rankings. For example, NSYSU is ranked worldwide in the top 200 by ESI in the fields of engineering, mathematics, and information engineering – placing us in the global one percent in these scientific fields, especially in the field of mathematics where we are the only university from Taiwan.

What is your ultimate vision for NSYSU during your tenure as president?

My vision looking forward is for NSYSU to become one of the top 200 research universities in the world. For my faculty and students, I want to inspire them to consider how they can make a difference in society. Creating a strong university culture is essential. I want to support each member of my university to enjoy their studies and their research. Before I retire, I hope to be able to achieve this new future along with everyone at NSYSU.

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