

2022 NTU

Social Responsibility and Sustainability Report

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A Word from the President



Challenged with climate change considerations and post-pandemic perturbances, "Sustainable Development" and "Net-Zero Emissions" have become key foci for countries, companies, and organizations around the world. Tackling this tide, universities serve the critical roles as incubators for talent and innovative research. National Taiwan University (NTU), as the largest leading institution of higher education, is always concerned with cultivating altruistic spirits and sustainable thinking within students and accumulating their resilience toward societal ebbs and flows.

In 2020, NTU made a pledge to reach carbon neutrality by the year 2048. Since then, NTU has prepared, in conjunction with its 100th anniversary in 2028, to establish a smart, sustainable campus through software and hardware facilities that centers around energy conservation, decarbonized energy and nearly zero-emission building. In this year's NTU Social Responsibility and Sustainability Report, NTU further demonstrated its strategies and plans for achieving carbon neutrality and presented annual sustainability highlights, such as hosting its first ESG competition to foster students' creativity on campus sustainability. In addition, the Taiwan University Alliance for Sustainable Governance was established, gathering higher education institutions to communicate and exchange innovations on sustainable governance. Lastly, the social impact chapter in this report focuses on NTU's teaching, research, and service achievements regarding on the UN's 17 Sustainable Development Goals, demonstrating again NTU's determination and deed toward promoting sustainability.

Sustainable development requires the involvement and dedication of each and every one of us. NTU will continue to collaborate with industries, the government, and academia, leveraging our respective expertise and strengths to accelerate sustainable development. We hope that no matter how difficult the challenges ahead may be, all members of NTU will be able to step forward bravely and make significant contributions to our country and the world to better our society and our earth.

NTU President Wen-Chang Chen



50%

Carbon **Neutrality** by

100% Carbon **Neutrality** 2028 2048

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NTU's Pathway to Carbon-Neutrality

In 2022, with insights from the 2020 GHG emissions inventory and the NTU Social Responsibility and Sustainability Governance Action Plan, the NTU Office of Sustainability formulated carbon-neutrality strategies suitable for NTU's development, specified feasible measures for implementation, and estimated the potential carbon reduction. The **five major strategies** for achieving carbon-neutrality are Equipment Electrification (reducing Category 1 carbon emissions), Energy Decarbonization, Energy Conservation (reducing Category 2 carbon emissions), Negative Emissions Technologies (NETs) and Carbon Offset.

In terms of **Equipment Electrification**, NTU plans to replace fossil fuel-powered vehicles, machines and boilers with electric ones. Equipment that cannot be replaced promptly (such as marine research vessels) will be allowed to operate with the current carbon footprints.

As for **Energy Decarbonization and Energy Conservation**, well-developed decarbonized energy (such as solar PV) will be installed on campus. Moreover, a survey will be conducted to identify energy-intensive equipment and to determine a reasonable energy use index (EUI) for campus buildings. More importantly, we strive to

Five Major Carbon-Neutrality Strategies



contribute to Taiwan's energy transition through R&D on lowering the national electricity carbon emission factor, thus effectively reducing Category 2 carbon emissions.

Regarding **NETs** and **Carbon Offset**, we will focus on developing emission reduction technologies, such as forest carbon sink mechanisms and carbon capture and storage (CCS). In the long run, the goal is for NTU to generate carbon credits using forest carbon sink mechanisms and to attain carbon offset certification through transferring CCS to high-emission industries.

To make NTU carbon-neutral, pathways have been developed for various scenarios and several working groups have been formed. Looking ahead, we will continue to communicate and coordinate with different parties involved to consolidate our efforts. According to the achievements made each year and in light of the latest scientific and technological findings, the pathways and strategies will be revised for the ultimate objective of becoming a 50% carbon-neutral campus by 2028 and a 100% carbon-neutral campus by 2048.



NTU's Pathway to Carbon-Neutrality

Note 1: Category 1 refers to direct GHG emissions. Note 2: Category 2 refers to indirect GHG emissions from imported energy. Note 3: Based on 74,000 metric tons of carbon emissions in 2020. Note 4: The Pathway was formulated by the NTU Office of Sustainability. **O2** Sustainability Highlights of the Year

WORLD QS UNIVERSITY RANKINGS **QS World University Rankings:** Sustainability 2023 Top 50 #1 in Taiwan #69 in the world UNIVERSITY CommonWealth Magazine USR University Citizen Survey Public university category (with more than 6,000 students) #1 three years in a row (2020-2022)

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Energy Conservation Workshop:In-depth Insight of Electricity Consumption in Campus Buildings

According to the Greenhouse Gas inventory conducted by NTU in 2020, the main source of NTU's carbon emissions is electricity usage. Therefore, reducing electricity consumption and improving energy efficiency is one of the key strategies for NTU to achieve carbon neutrality. As a result, NTU organized 12 energy conservation workshops from September to December 2022, which were attended by 106 participants, including faculty members, students and staff from all 11 colleges.

The energy conservation workshops enabled faculty, staff and students from different divisions and disciplines to gain a sound knowledge of electricity usage data and energy consumption patterns of buildings and equipment. Through this knowledge, participants can improve building management policies and perhaps even change the personal electricity consumption behaviors. In each workshop, the Energy Use Intensity and electricity usage patterns of the venue building were presented and discussed, enabling participants to explore the reasons for variations in power usage due to seasonal or day/night differences. Additionally, they could compare the energy consumption of air conditioning, lighting, and classroom electrical equipment. During the workshop, multimeters were provided to the participants for measuring the current power usage of electrical appliances. To conclude the workshop, the feasibility and potential obstacles to promoting energy conservation in the building were discussed. The goal of these workshops was to encourage more colleges throughout the university to actively participate in energy conservation effort.



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The First NTU Sustainable Campus & ESG Student Creative Competition

To encourage students to explore creative solutions and ideas for a sustainable campus, NTU held the first Sustainable Campus & ESG Student Creative Competition in 2022. The competition gained significant momentum, starting from grassroots levels upwards. Students were encouraged to form crossdisciplinary teams to develop action plans and practical solutions addressing eight sustainable campus themes: Energy, Air, Transportation, Buildings, Food, Water, Waste, and Landscape and Biodiversity. Students can also respond directly to relevant issues raised by the university's administrative offices. Through a partnership with Gogoro, students were able to leverage the company's professional insights and extensive experience in promoting electric vehicles and developing innovative energy technologies.

The competition received a wide range of submissions, covering problem discovery, solution design to sustainable action. A total of 49 teams participated, and their proposals were evaluated by a diverse panel of judges, including faculty members, administrators, students, and an entrepreneur specializing in relevant fields. Eight teams successfully passed the proposal evaluation and received awards.

Students showed the greatest interest in issues like campus energy usage (20%) and the circular economy (17%), followed by food, campus bicycles, and landscape and biodiversity. Moving forward, NTU hope that through proposals from the university community, creativity will be transformed into action, making a more sustainable campus a reality.



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Award ceremony for the NTU Sustainable Campus & ESG Student Creative Competition. (December 6, 2022)

	《競賽排	名》
名次 隊名		提案名稱 CRE
No.1 U&M		U&M共享雨傘
No.2 稍微湊们	國隊 (TUL)	臺大再生倉庫
No.3 戀上換裝	专屋頂	低維護需求之 模組化校園綠屋項裝置
佳作 氣根綠含	診療室	一起走「節」徑: 綠舍生活,減碳同行
佳作 藍帶豬排	非青蔬沙拉	臺大校園生態計畫
佳作 水源阿如	夷們	水源阿伯,休息囉~
佳作 鳳眼水美	美妹	智慧水循環海綿臺之
佳作 鳳眼水身 佳作 土壤糾絮	美妹	智慧水循環海綿 臺大校總區

List of winners of the NTU Sustainable Campus & ESG Student Creative Competition.

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Profiles of the top three winners of the NTU Sustainable Campus & ESG Student Creative Competition



First Place: U&M Umbrella Sharing

Based on the concept of the sharing economy, U&M's proposal called for an umbrella leasing service to reduce the number of umbrellas that end up in landfills.



Second Place: Recycle Warehouse, NTU

The Recycle Warehouse, NTU aims to promote environmental awareness. They targeted materials left over or unused from events and activities held by student clubs and associations. The goal is to create new value through circular practices by recycling, reorganizing and reusing these materials.



臺大情境的輕量化綠屋頂裝置





骨豊

新聞品書: 344年

Third Place: Campus Green Roof Installation

A lightweight green roof, designed by the team using PVC pipes, is suitable for installation on a campus building. The design aims to overcome the challenges in promoting and implementing green roofs, while also achieving the goals of creating more green spaces on campus and reducing net carbon emissions.



Nine Universities Joint Forces to Create the Taiwan University Alliance for Sustainable Governance

To expand our social influence, NTU partnered with eight other institutions of higher education throughout Taiwan to establish the <u>Taiwan University Alliance for</u> <u>Sustainable Governance</u> in 2022. These institutions were: National Taiwan Normal University, National Taiwan University of Science and Technology, National Central University, National Chung Hsing University, National Sun Yat-sen University, National Taiwan Ocean University, National Pingtung University of Science and Technology, and National Dong Hwa University. The purpose of this alliance is to bring together the talent and research capabilities of these higher education institutions to collaborate and share experience in education research, service and governance for campus sustainability. Together NTU hope to bear collective responsibility as universities and help society to move towards a more sustainable future.



NTU partnered with eight institutions of higher education to establish the Taiwan University Alliance for Sustainable Governance, marking a new chapter of cooperation in sustainability among universities. (November 18, 2022)





NO POVERTY

Appendix

Dream Field Comprehensive Support Program





Comprehensive Efforts to Aid Underprivileged Students

To promote overall public welfare in higher education, NTU is committed to its <u>Dream Field</u> <u>Comprehensive Support Program</u>, which aims to provide comprehensive assistance to underprivileged students. The Program features "Hope Stipends" and "Hope Scholarship", which aim to reduce students' financial burden and actualize equal opportunity. The Program also offers the substitution of part-time work hours with learning hours and promotes diversified counseling and financial support mechanisms. Funding and beneficiaries of the Program have been increasing yearly, with funding reaching NT\$21.68 million, accepted students reaching 3,990, and the number of beneficiaries increasing to 1,010 in 2022.

In addition, to help underprivileged students transition to university smoothly, NTU launched the Hope Enrollment program. Besides youth from lowincome, low-middle-income, special-needs, and immigrants families, NTU additionally admitted more students from remote areas, giving underprivileged students greater access to higher education.

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NTU EMBA Charity Concert for Rural Medical Care

To honor the front-line healthcare workers of the COVID-19 pandemic, the NTU EMBA Alumni Foundation, in collaboration with the Taipei Philharmonic Foundation for Culture and Education, organized a charity concert on April 6, 2022 at the National Concert Hall, bringing together young musicians from home and abroad to perform together. All proceeds from the concert were donated to medical institutions in Penghu and Hualien, contributing to medical care in rural area.

Many NTU EMBA Alumni Foundation members not only play a leading role in their respective fields, but also give back to society. The 2022 charity concert invited hundreds of healthcare professionals, expressing gratitude for their hard work through beautiful music. NTU EMBA alumni hope to continue helping medical institutions with few resources, which in turn will benefit even more people.

NTU Museums Children's Camp Offers Free Spots to Underprivileged Children

<u>NTU Museums</u>¹, rich in cultural assets, are committed to applying the scientific and humanistic knowledge to our lives through social education. Since 2010, the NTU Museums has held a children's camp every summer to provide children with fun and in-depth learning experiences through handson exploration and interactive games. Through the camp, they can experience the different museums and further learn about the historical treasures on NTU's campus.

Since 2018, NTU Museums have partnered with the Taiwan Fund for Children and Families to offer free spots to underprivileged children, inviting them to participate in an enjoyable summer activity and thereby fulfilling the University's social responsibility.



Note 1: NTU Museums are currently comprised of 11 individual museums, namely the Gallery of NTU History, the NTU Museum of Anthropology, the NTU Geo-specimen Cottage, the NTU Heritage Hall of Physics, the NTU Insect Museum, the NTU Agricultural Exhibition Hall), the NTU Herbarium, the NTU Museum of Zoology, the NTU Archives, the NTU Museum of Medical Humanities, as well as the NTU Art Museum Preparatory Office, which joined NTU Museums in 2021 as its newest addition.



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NTU Plant and Animal Health Team Protects Local Food from Pests and Diseases -23 24 (122)

Yunlin County is a major hub for Taiwan's agriculture and livestock industries, but suffers from a serious lack of resources for animal and plant health. In the past, when farmers were faced with livestock epidemics, crop diseases, and pests, the treatments they used were often selected based on prior experience or word-of-mouth, resulting in numerous instances of animal drug or pesticide misuse and excessive pesticide residue. The NTU College of Bioresources and Agriculture therefore established a diagnostic center for animal diseases and a plant teaching hospital in the Agricultural Incubation & Promotion Center at NTU's Yunlin Campus, aiming to provide local diagnosis and treatment services to construct a more comprehensive medical system for animals and plants in the region.

From 2020 to 2022, NTU's animal and plant health team conducted more than 1,000 diagnostic tests in the Yunlin area and set up plant disease diagnosis and consultation stations in 20 villages and townships. The team's specialists were not only able to promote their research to local industry through lectures and spread accurate knowledge about agriculture and disease treatment, but also collect and share the challenges faced by the industry with university research teams to analyze and solve problems. Through such close connections, the team continues to help Yunlin promote proper medication, precision pesticide usage and ecofriendly farming. These actions strengthen market confidence in Yunlin agricultural products and fulfill its mission to provide local services with no distance between farmers and food.



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Dynamic and Intelligent -2.4 (2.a) (12.2) Knowledge Traceability Project Turns Over New Leaf for Taiwan's Agriculture

With support from the Council of Agriculture, the NTU College of Bioresources and Agriculture is promoting its Dynamic and Intelligent Knowledge Traceability project, which integrates blockchain technology and knowledge mapping for application in smart agriculture, allowing farmers to record every step of their planting process in a simple and intuitive way. The project not only tracks agricultural production and calculates carbon emissions, but also enables companies to identify emission hotspots and helps the country move closer to net-zero.

The project team has also taken into account the impact of global warming on crop growth schedules. To mitigate the agricultural damage caused by climate change, the team has developed a dynamic cultivation calendar for precision agriculture, which can estimate crop growth schedules based on information inputted by farmers and alert farmers to adjust harvesting schedules corresponding with meteorological monitoring and forecasting information. Through blockchain technology, production and marketing traceability can become even more credible, and the security of our crops can be inspected and verified. From farm to fork, food security can be guaranteed.





NTU Farm Horticultural Branch: An Urban Oasis

Located at the foot of Toad Mountain in Taipei, the NTU Farm Horticultural Branch supports the College of Bioresources and Agriculture's teaching and research activities, cultivating seasonal fruits, vegetables, herbs, and traditional native plants. The farm has long used eco-friendly farming techniques, and with its rich biodiversity, it makes for an idyllic oasis. In 2020, the Horticultural Branch was certified as an environmental education facility by the Environmental Protection Administration. Over the years, it has organized various kinds of educational activities related to ecology, food and agriculture, and horticulture, as well as courses for all ages, ranging from kindergarteners to senior citizens. Through these activities, NTU Farm hopes to help the people of Taiwan understand the importance of environmental sustainability.



In 2022, a total of **4,330** external visitors visited the NTU Farm Horticultural Branch.

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In the 2022 GAADP Project Achievement Exhibition,

the stage play "After Jiazi" (Jiazi means life over-sixty) features a 92-year-old actor

portraying life after Jiazi, conveying the concept of autonomous aging.

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GOOD HEALTH AND WELL-BEING



NTU College of Medicine's Nucleic Acid Medical Research Aims to **Overcome Limitations of Traditional Drugs**

Over the past few decades, the development of mainstream drugs has mainly focused on smallmolecule drugs or protein-based biologic therapies, which use disease mechanism-related proteins as therapeutic targets. However, when it comes to diseases caused by genetic variations, the therapeutic effects of these traditional drugs have limitations. Utilizing nucleic acid drugs as a means of treatment has become a revolutionary trend for overcoming the limitations of traditional drugs.

Recognizing the potential of nucleic acid drugs to change the way diseases are treated, NTU College of Medicine is in the process of establishing a core facility for nucleic acid medical research. This facility will bring together researchers specializing in nucleic acid biology, information engineering, pharmacy, and clinical medicine from different disciplines and institutions. They will collaborate to develop novel nucleic acid-based therapies and delivery systems. The developed technologies will first be applied to genetic and degenerative diseases. Furthermore, the facility will integrate with the NTU Hospital's gene therapy core facility and Clinical Trial Center, collaborating with external institutions and international partners. The goal is for this core facility to become a forwardlooking center for the development of new nucleic acid drugs in Taiwan and an important hub for bridging preclinical research to human clinical trials.

Taking Control of Later Life: • (3.4) (3.d) (11.a) **Graceful Aging through Advance Directive** Planning (GAADP) Project

"Have you ever thought about how your life will end?" "When I get older, can I still be in charge?" The goal of the GAADP project is to shorten the time people are needlessly bedridden at the end of their lives, encouraging them to think and plan for their aging. The project is being implemented jointly by Professor Pei-Shan Yang from NTU's Department of Social Work, Professor Duan-Rung Chen from the Institute of Health Policy and Management, and the NTU Hospital Bei-Hu Branch. The project integrates palliative and long-term care through social education and service practices. By adopting the concepts of "holistic, whole process, whole family, whole team, whole community," the project helps people understand and face illnesses and decline, preparing for the end of life in advance.

The project was initiated in 2020, and the focus has been on the Wanhua District of Taipei City, which has the highest concentration of elderly people within the city itself. Through social education, community empowerment, and volunteer training, the project promotes important concepts such as palliative care, advanced medical directives, and patient autonomy to the public. It cooperates with local medical institutions, senior service centers, and neighborhood and village chiefs in local communities, providing timely feedback to the community. This approach achieves a win-win operation model for both schools and communities.

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除了上越面向。還有沒有其他 E的心情以及對於生活的態度,我可能會要a 最後·我的生命可能會要 B子/家庭關係,可能會變得. 在以上您所提到的想要的改要?為於 Life Design for the Elderly" book encourages the public to Service-learning courses offered in the community, with students accompanying seniors in creating life storybooks. thoroughly consider and plan for their later lives.

The GAADP project's four main implementation aspects

Collaborating with medical institutions, elderly care institutions, and local community associations in Wanhua. The project integrates NTU's servicelearning courses, where students accompany seniors in art creation. This helps activate seniors' mental cognition and muscular endurance. At the same time, the project promotes community volunteer empowerment and improves the capabilities of elderly care workers. It has completed a total of eight instructional videos and trained over 400 participants.

Organizing multiple in-person and online social education lectures, such as interactive lectures, online book clubs. and community movie sharing sessions. Inviting physicians, holistic care lecturers, and judges to answer important agingrelated social issues for the public up close. Over 430 participants have attended so far, with a 98% satisfaction rate. The project also published the "Life Design for the Elderly" book and its accompanying workbook, enabling the public to think about their action plans for later life through self-practice.



Offering courses such as "Methods and Practices for Community Health Promotion" and "Community Building" to help students understand community building and development, conduct community diagnosis, and master community resources and diverse network relationships. A total of 87 students have completed these courses.

In collaboration with Dynalab Inc., a tablet-based information integration platform centered on individual cases is being developed. Additionally, interactive robots are being utilized at dementia care sites to accompany seniors.

NTU Collaborates with International Research Institutions on Genetic Study of Bipolar Disorder in Asia

Bipolar disorder (BP) is a predominantly genetic and multifactorial neuropsychiatric disorder with a lifetime prevalence of approximately 1-2%, and its clear genetic architecture is yet to be identified. Professor Po-Hsiu Kuo's team from NTU's Department of Public Health has been conducting research on mood disorders for a number of years. They are aware that large-scale research samples for BP are primarily from European and North American populations, with Asians accounting for only about 10% of participants. The research findings and progress in new drug development may not be compatible with non-European populations, potentially exacerbating disparities in medical development among different ethnic groups.

In 2022, Professor Kuo's team received a five-year research grant from the U.S. National Institute of Mental Health to collaborate with several top international institutions. They focus on understanding genetic variations and mapping the BP genetic landscape in Asian populations, marking the first large-scale BP genomic study in Asia. The team plans to recruit 27,500 BP patients and 15,000 healthy people as control subjects from East Asia and South Asia. They expect to identify genetic variations related to Bipolar I Disorder in Asian populations and investigate the interactions between phenotypes, genetic variations, and environmental risk factors. Additionally, they will compare their research data with mental illness data from other ethnic groups through cross-lineage and cross-disease comparisons to further understand the molecular mechanisms of severe mental illnesses. Through this international project, they aim to enhance data diversity, reduce potential inequalities in health care, and develop better treatments in the future.

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So far, over 70 high schools have applied to join the program.

NTU MOOC Project for High School Students Opens New Path for Self-directed Learning - (4.1) (4.5) (4.7)

The NTU Office of Academic Affairs' Digital Learning Center is committed to promoting the development of digital learning on campus. The Center has long been operating the NTU OCW and NTU MOOC x Coursera. Both of which are open educational resource platforms that offered over 300 courses. To provide more access to these educational resources, and to promote the spirit of self-directed learning as highlighted in the Ministry of Education's curriculum guidelines, the Center launched the NTU MOOC Project for High School Students in the 2020-21 academic year, offering online course resources to high school students free of charge. These educational resources give students more options for self-directed learning and can encourage them to explore their own fields of interest.

The Center expanded the program in the 2022-23 academic year, no longer limiting it to six high schools (Taipei Municipal Chenggong High School, The Affiliated Senior High School of National Taiwan Normal University, New Taipei Municipal Hsin Tien Senior High School, New Taipei Municipal Bangiao Senior High School, Taipei Municipal Jingmei Girls High School, and Taipei City Fanghe Experimental High School). The program is now offered to the whole country, providing high school students from all over Taiwan with the opportunity to access NTU's high-quality online learning resources. So far, over 70 high schools have applied to join the program. Additionally, the Center organizes seminars at the end of each semester, inviting professors from popular NTU courses to engage with students face-to-face and enable them to learn more about different university departments, thus assisting in future career planning.

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NTU Develops Multiple Intelligence and •–4.5 Department Matching System to Help Students Find Their Talent

Assisting students in self-exploration and developing their potential is an indispensable part of education. However, many students still struggle with choosing their university majors even in their final year of high school. In response to this, the NTU USR Program, the "Adaptive Talent Development Action Plan" team, has developed the "NTU Personal Multiple Intelligence and Department <u>Matching System</u>" in collaboration with dozens of NTU departments, based on the theory of Multiple Intelligences¹. The system is free to use, and high school students can self-assess their strengths and further explore suitable majors.

To promote students' exploration of their interests and enhance positive parent-child communication in rural areas, the team also collaborated with multiple organizations to hold family camps at high schools in Zhudong Township of Hsinchu County, Yingge District of New Taipei, and Ruisui Township of Hualien County, attracting a total of 173 participants. Through a diverse curriculum, the team aim to inspire students and parents to understand and explore adaptive careers, while also fostering parental listening and communication with their children, in order to develop children's talents in an adaptive and supportive environment.

Note 1: Multiple Intelligences is a theory from professor Howard Earl Gardner of Harvard University, proposing that everyone has eight major intelligences: linguistic, logical-mathematical, musical, visual-spatial, bodilykinesthetic, intrapersonal, interpersonal, and naturalistic, with varying strengths and weaknesses.





Family camps attracting a total of 173 participants.



Parents and children are guided in group listening and communication exercises, opening up mutual interaction and dialogue through a lively psychodrama method.



NTU's Taiwan Indigenous Peoples Resource Center Organizes Book Donations

To promote research on the ecology, culture, life, and industry of Taiwan's indigenous peoples and integrate related resources, the Council of Indigenous Peoples commissioned NTU Library to establish the Taiwan Indigenous Peoples Resource Center in 2005. The center not only collects various types of information related to indigenous peoples but also regularly organizes promotional activities in the hope of raising awareness of indigenous issues among the general public.

Since 2009, the Taiwan Indigenous Peoples Resource Center has organized an annual book donation program to share library resources with 55 indigenous communities in Taiwan. As of 2022, the Center has visited over 40 indigenous communities elementary and middle schools, rural libraries, indigenous cultural classes, and community development associations. By providing indigenous children with a wealth of books and teaching materials in their native languages, the Center hopes to narrow the urban-rural gap and enhance students' understanding of their cultural and historical origins.

⊷(1.4)(4.5)(5.6)



Cloth Sanitary Pad Workshops Help Women in East Africa Combat Period Poverty

Elle Yang, a PhD student of NTU's International Degree Program in Climate Change and Sustainable Development, served as a volunteer in East Africa after her college graduation, where she became concerned about the plight of local women having to miss school or work because they could not afford menstrual products. After returning to Taiwan in 2015, Yang co-founded a non-profit organization with her friends to help women fight against period poverty. In just five years, over one million volunteers from Taiwan participated in the project, donating enough feminine hygiene products to fill 100 freight containers to be sent to East Africa. Yang also launched the Love Binti Project, which offers cloth sanitary pads workshops to address the lack of menstrual products for local disadvantaged women and to empower them by teaching sewing skills and providing hygiene education.

In 2020, Yang and her partners officially founded

the non-profit Love Binti International, which has provided timely assistance to over 148,000 women and girls in seven countries. Putting local experience to use, they have also run the Uganda Rural Sustainable Development Volunteer Program with the Ministry of Foreign Affairs' International Cooperation and Development Fund since 2021, recruiting young volunteers with backgrounds in agriculture to serve in Uganda.

Yang also represented Taiwan at the 2018 United Nations High-level Political Forum on Sustainable Development and the 2022 United Nations Commission on the Status of Women as the Secretary General of Love Binti International, sharing her practical experience in providing international aid. In the future, Love Binti International will be expanded to Denmark and the United States to provide more channels for young people to serve in Africa.





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Animal Reproductive Technology Laboratory Asia's First IVF Embryologist Training Project

Asia's First IVF Embryologist Training Project

→ (3.7) (5.6)

With late marriage and late childbearing becoming the new norm in Taiwan, the use of artificial reproduction has also increased. To help Taiwan solve problems related to its declining birthrate, the government launched an in vitro fertilization (IVF) subsidy program in 2021. In the artificial fertilization process, embryologists play a key role. Whether it be the fertilization of eggs or embryo development, all important procedures depend on the delicate and precise operations of embryologists. Therefore, embryologists' professional skills are one of the most important keys to the success of a pregnancy.

In view of this, the Animal Reproductive Technology Laboratory of NTU's Institute of Biotechnology, led by Professor Li-Ying Sung, and the Nuwa Fertility Center collaborated to create Asia's first IVF Embryologist Training Program. The program was established based on industry needs and combines academic resources with clinical practice. Its founders hope it can become a pioneer program in Asia for the training of IVF embryologists, increase the influence of Taiwan's reproductive medicine industry, expand international competitiveness, and contribute to the health of future generations.



Book Seminar Promotes Gender Equality in Taiwan

In 2022, NTU Press published the book Salary and Sacrifices: Analyzing Labor Outcomes of Medical Personnel from a Gender Perspective by Chin-Fen Chang. Through the lens of gender, the book emphasizes the results of women's labor from their perspectives and shows the high level of work-family conflict and poor health of female healthcare workers through the analysis of questionnaire results from more than 4,000 nursing staff and physicians from three hospitals.

Since the perspectives explored in this book can promote readers' understanding of gender differences in the healthcare workplace, NTU Press held a book seminar in May 2022, inviting the book's author, Chin-Fen Chang, a researcher at the Institute of Sociology of Academia Sinica, as well as retired Professor Ling-Fang Cheng from the Graduate Institute of Gender Studies at Kaohsiung Medical University, Associate Professor Yu-Fan Chiu from the School of Law at the National Yang Ming Chiao Tung University (NYCU), retired Professor Zxy-Yann Jane Lu from the College of Nursing at NYCU, and many experts to hold a discussion. The seminar helped to raise public awareness of the working conditions of women healthcare professionals in Taiwan and promote gender equality in the labor market.



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NTU's Water Consumption in the Last 3 Years

Tons





monitoring the ecological conditions of rivers. (October 1, 2022)

Northern Taiwan River Conservation Center Joins Forces with -63 (66) (6.6) **Local Residents to Safeguard Rivers**

To combat the pollution of our rivers more effectively, the Environmental Protection Administration (EPA) established the Water Watch Program in 2002 and created aquatic environment patrol teams to monitor several key rivers around the country. With considerable government resources and the help of dedicated volunteers, a total of 486 such patrol teams are currently in service up to 2022. The responsibilities of these patrol teams include maintaining the aguatic ecosystems, monitoring water quality, reporting instances of pollution, and promoting environmental education. To help the EPA support the Department of Environmental Protection of local governments in manage river patrol teams, NTU established the Northern Taiwan River Conservation Center in 2015¹. The Center is responsible for organizing annual training sessions to train seed teachers and introduce

emerging technologies to assist in law enforcement. The latter includes using resin packs to monitor heavy metals and employing drones to aid in patrolling waters and monitoring ecological conditions along the rivers.

The Center hopes to leverage these various tools to implement the Water Watch Program with local characteristics in jurisdictions and to motivate local residents to participate in these efforts, fostering collaboration between the public and private sectors to ensure the cleanliness and health of rivers.

Note 1: The eight areas served are: Hualien County, Yilan County, Keelung City, New Taipei City, Taipei City, Taoyuan City, Kinmen County and Lienchiang County.

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The delegation from Taiwan was awarded a gold medal and six silver medals

•-<u>(6.3)</u>

High-tech Water Filtration Capsule Improves **Efficiency of Industrial Wastewater Treatment**

The Malaysia Technology Expo 2022: SDG International Innovation Awards & Expo (MTE-SDG), the second incarnation of the event, was attended by 217 teams from across the world. Unlike other competitions, MTE-SDG encourages the use of innovative technologies to tackle challenges faced by modern society, and it specializes in showcasing innovative inventions that address global issues while satisfying the UN's Sustainable Development Goals (SDGs). The delegation from Taiwan was awarded a gold medal and six silver medals. The sole gold medal was won by the team led by Dr. Hsien-Yeh Chen, Professor of the Department of Chemical Engineering at NTU. Their "vapor deposition of multi-functional porous water purification device," which is the size of only a medicine capsule, contains certain bacteria and uses a highly biocompatible polymer material to induce these bacteria to produce a large number of active enzymes capable of degrading organic solvents, plastics, dioxins, and other contaminants and pollutants in water. The capsule-sized, low-cost water purification device employs an innovative and eco-friendly manufacturing process and has been patented in a number of countries. This technology has also been successfully transferred to the industry. If implemented in industrial areas, it is expected to significantly improve water quality and increase the recycling and safe reuse rate of water resources.

Establishing a Campus Water Monitoring and Management Mechanism to Safeguard Water Supply

The school campus is where interaction between teachers and students, learning and gathering take place. We simply cannot carry out various daily activities, such as quenching thirst, washing, cooking and keeping the environment clean and tidy, without the use of water. Therefore, safe campus water supply and its management are crucial to a school's operation and the health of its members. Of particular concern are some schools that are located in remote areas of the country that are without running water. It is important for government authorities and school administrators to pay more attention and make proper plans to address the needs of these communities, whether it is the acquisition of water sources, the maintenance of water storage facilities and pipelines, or the treatment and supply of safe drinking water.

To promote public awareness regarding water supply management and provide assistance to schools without access to tap water, the K-12 Education Administration of the Ministry of Education has commissioned NTU to carry out a water safety management and maintenance program for school campuses around the country over the years. The program includes: Preparing campus water safety maintenance and management manuals, organizing regular seminars, and implementing databases with water management information collected and compiled from various schools. For campuses without tap water and have access only to groundwater or mountain spring water sources, the program has also provided assistance by assigning advisory teams to conduct on-site surveys at these locations, including inspecting water treatment equipment, analyzing water quality, and conducting interviews with school water resource administrators, after which appropriate recommendations are made. Over the past dozen years or so, these advisory teams have paid over a thousand visits to schools in remote areas and spared no effort in helping elementary and secondary schools ensure the safety and quality of their water supply.



Professor Gen-Shuh Wang from the NTU College of Public Health led a team to inspect the water storage facility of a school located in a remote mountainous area.

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AFFORDABLE AND CLEAN ENERGY

NTU's Electric Energy Consumption and Electricity Usage Intensity in the Last 3 Years¹

Electricity Consumption (kWh) 🔶 EUI² (kWh/sq m)



Note 1: Statistics of NTU's Main Campus, Shuiyuan Campus, College of Public Health, College of Medicine (excl. NTUH), College of Social Sciences'old building, and Zhubei Campus.
 Note 2: Covering a total floor area of 1,284,750 m² in 2020, 1,322,863 m² in 2021, and 1,369,230 m² in 2022.

Possible Electricity Generation with All-solid-state Na-CO₂ Battery even on Mars

Smartphones, tablet computers and laptops are modern conveniences that we cannot live without. These consumer electronic devices are becoming lighter and more pervasive by the day, thanks in part to advances in battery technology. The predominant battery type used in portable consumer electronics is the lithium-ion battery, but with electric vehicles beginning to take off, lithium mines are now greatly sought after, and the price of lithium has skyrocketed.

To find an alternative to lithium, Dr. Ru-Shi Liu, Professor of NTU's Department of Chemistry, has pioneered the all-solid-state sodium–carbon dioxide (Na-CO₂) battery, comprising much less expensive sodium in place of lithium. At the same time, the reaction between Na and CO₂ can effectively reduce carbon. The Na-CO₂ battery is also ideal for Mars exploration, as the red planet's atmosphere is composed of 95% CO₂, and the Na-CO₂ battery is capable of utilizing this greenhouse gas to generate kinetic energy, which will in turn drive unmanned exploration vehicles. The results of Dr. Liu's research have been published in the prestigious international journal *Nano Energy*. In addition, Dr. Liu was awarded the Future Tech Award from the Ministry of Science and Technology for inventing the Na-CO₂ battery.



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"Taiwan-Netherlands Offshore Wind Joint Talent Cultivation Cooperation" a Force in Nurturing Local Talent

The goal of "net-zero carbon emissions" by 2050 has become an important policy objective in many countries across the world, and Taiwan is no exception. Green energy is the new engine that will drive economic development in the future, and it is expected to play a crucial role in a new wave of industrial revolution. In Taiwan, which possesses abundant natural wind resources, offshore wind power plays an important role in renewable energy, so a great demand for wind power-related talent exists.

Officially launched in March 2020, the "Taiwan-Netherlands Offshore Wind Joint Talent Cultivation Cooperation" program was a training initiative formed by Netherlands Organisation for Applied Scientific Research, TU Delft/DUWIND and Deltares to provide systematic training to Taiwanese seed teachers. The courses were co-designed by NTU Energy Research Center and the Dutch training team. NTU and the Metal Industries Research & Development Centre were responsible for promoting the program and facilitating cooperation between Taiwan and the Netherlands in talent cultivation. The COVID-19 epidemic, however, prevented the Dutch instructors from coming to Taiwan as originally planned, so the training courses had to be conducted online. Despite these limitations, a total of 31 trainees from Taiwan's industry, academia and research institutions completed the program successfully after more than two years of training. These graduates will act as seed teachers to train the country's next generation of engineers and designers in the offshore wind power generation industry. NTU will continue to play an active leadership role in academia to accelerate the pace of talent cultivation in the industry and contribute to its success.





NTU Kicked off Industry-Academia Collaboration with Japan on Carbon Sequestration

To address the goal of "net-zero emissions" by 2050, NTU began preparations for the establishment of the <u>Science and Technology Research</u> Institute for DE-Carbonization in May 2022. As Taiwan is located in a region with active geological activities with frequent and widespread geohazards, it is necessary to rely on high-resolution and high-precision geological exploration technology for site selection for offshore wind farms, geothermal and carbon sequestration. One of the Institute's most important tasks, therefore, is to provide support to the efforts of acquiring complete terrestrial and oceanfloor geological characteristics of Taiwan to ensure that carbon sequestration technology can be developed safely.

In December 2022, Dr. Chung-Ming Kuan, then-President of NTU, led a delegation to visit Japan's world-leading research organizations in carbon sequestration, including Japan CCS Co., Ltd., Japan Agency for Marine-Earth Science and Technology, and Kochi University. During the visit, the NTU delegation was introduced to the macro vision and the determination shown by the Japanese government, academia, and industry in investing in research related to underground and marine geology. In addition, the NTU delegation was able to conduct fruitful exchanges with their Japanese counterparts, and the two sides agreed to facilitate opportunities for technology exchange in the future. NTU will continue to deepen our partnerships with these institutions, which demonstrates our commitment and contribution to sustainable development.

DECENT WORK AND ECONOMIC GROWTH





NTU International Mentorship Program: Coaching International Talents Entering Into Taiwan's Workforce

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About 3,000 international students from 70 countries come to NTU to study every year. Many international students would like to stay and work in Taiwan after graduation, as they find Taiwan's work environment and living conditions quite attractive. However, not many job opportunities are available to them due to language and cultural barriers. In 2022, NTU Office of International Affairs launched the NTU International Mentorship Program to connect global talent with the local job market and to help international professionals adjust to life in Taiwan.

The NTU International Mentorship Program is the first mentorship-based internship program in Taiwan specifically for international students. The program invites foreign chambers of commerce, government agencies, start-ups, local enterprises, foreign companies, civil organizations, academia, and research institutions to provide international students with an internship. Senior executives of the sponsoring organization serve as mentors, enabling students to not only combine theory and practice during internships but also explore their career paths under the guidance of mentors.

In 2022, a total of 71 business enterprises and organizations sponsored the NTU International Mentorship Program, successfully recruiting 58 international students from 22 countries and 33 departments into various internship programs. Going forward, the mentorship program plans to include local students, providing additional opportunities for more students to connect with the global community and workplace.

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Celebrity Lectures – Tennis player Lu Yen-Hsun, who represented Taiwan in five Olympic Games, was invited to share his tennis career.

NTU Faculty and Staff Holistic Care Service Safeguards Employees' Health

In 2021, NTU launched the <u>NTU Faculty and Staff Holistic Care</u> <u>Service</u> in partnership with a dozen organizations within and outside the university, providing a variety of innovative services to faculty and staff. NTU aims to promote holistic health care and provide support to faculty and staff at different stages of their lives. In terms of mental and physical health, since 2021, Good Liver Foundation has provided free health screening services to NTU. NTU also collaborated with the NTU Cancer Center and Taipei City Hospital to establish a low-dose discounted program for computed tomography lung screening. A total of 963 faculty and staff members have benefited from these services. Additionally, NTU provided diverse psychological counseling services to help faculty and staff effectively relieve stress. In 2022, a total of 653 individuals received these services.

Furthermore, NTU regularly organizes various sports and fitness courses, leisure activities, art and cultural events, book and movie clubs, special lectures, workshops, and DIY handicrafts. In 2022, a total of 76 events and activities were held, with 5,896 participants and an average satisfaction rate of 97.8%. The NTU Faculty and Staff Holistic Care Service will continue to build a friendly working environment, assisting faculty and staff in achieving a well-balanced life, and ultimately realizing a happy campus.



In 2022, a total of 76 events and activities were held, with **5,896** participants and an average satisfaction rate of 97.8%.



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NTU Students Developed Employment Platform to Help New Immigrants Land Jobs

According to the National Immigration Agency, Ministry of the Interior, Taiwan has nearly 580,00 immigrants. Numerous studies and news reports, however, have pointed out that new immigrants often face challenges in employment and adapting to life in a new land, including language barriers, inadequate access to information, and unfriendly work environments.

To help lower the employment barriers for new immigrants, a group of students in the Data Science and Social Analysis Program (Yi-Tzu Wang, Yi-Hsuan Ko, Wei-Nung Lee, Sheng-Fu Wang and Hung-Jui Li) formed a team under the guidance of Associate Professor Ji-Lung Hsieh, Director of the NTU Behavioral and Data Science Research Center, to participate in the "2022 Data for Life, Technology for the Future" competition. The team utilized data from the government's Open Data Platform, the Ministry of Labor, the Taiwan Jobs website, and other job market-related open data to develop a "New Immigrants Employment" platform. The platform aimed at improving new immigrants' career prospects, undertaking followup monitoring of their employment progress, and conducting data analysis. The team was awarded a bronze medal in the Diverse and Innovative Employment Applications category.

INDUSTRY, INNOVATION AND INFRASTRUCTURE



To achieve Taiwan's 2050 net-zero emissions goal, methods such as afforestation, improved management of forest land, and long-term use of wood materials are implemented to increase natural carbon sinks and carbon fixation. In recent years, the NTU Experimental Forest management team has been promoting both the value-added utilization of domestic timber and domestic timber use in construction and engineering materials. With the assistance of the Forestry Bureau, NTU has built processing equipment and technologies for emerging engineered timber products such as Glued-laminated timber and Cross-laminated timber. The team has also collaborated with experts in related fields to conduct fire resistance and seismic tests on largescale wooden materials, laying the foundation for the development of domestically engineered wood and

low-carbon construction.

The NTU Experimental Forest and the Forestry Bureau also collaborated with the National Yang Ming Chiao Tung University Graduate Institute of Architecture to build the heavy timber structure "1 House for All," which won gold in the Architecture category and bronze in the Innovation category of Solar Decathlon Europe 21/22, held in Wuppertal, Germany in 2022. "1 House for All" is Taiwan's first heavy timber structure built with domestic materials, using Japanese cedar for the beams, columns, walls, and floor. The stable structure is two stories high and has an area of roughly 2,135 square foot. The NTU Experimental Forest will continue to promote the use of domestic timber as a sustainable building material.

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"1 House for All" won the first prize in Architecture and third prize in Innovation in Solar Decathlon Europe 21/22



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Industry-Academia-Research Alliance Promotes Digital Transformation of Taiwan's Industries

To usher in the 5G communications era and develop 5G industrial applications, the 5G Smart Manufacturing Industry Flagship Team and Industry Cluster Alliance calls on the ICT industry, high-level tool manufacturers, key component manufacturers, automation manufacturers, the automotive and electric vehicle industry, water and metal hardware industries, the aerospace manufacturing industry, and others to unite their efforts to bring Taiwan-made equipment into the international supply chain. The Alliance is composed of five universities and college-level institutions including NTU, 15 industry partners, and two corporations. It connects three major sectors of industry, academia, and research, proposing value-added service solutions, integrating cross-industry collaborations, and assisting Taiwan's industries in digital transformation.

The Alliance will unit Taiwan's expertise in the machinery and ICT industries. The goal is to assist the smart machinery industry in implementing the automation of equipment and components, as well as introduce new and innovative Al, IoT, AR, and 5G technologies to accelerate Taiwan's development of smart modules to domestic and overseas markets. Additionally, through the five universities in the Alliance, 100 talented individuals in related fields will be trained every year, further upgrading the equipment manufacturing capabilities and core technologies of Taiwan's industries.



MakeNTU 2022: sustAlnable develOpmenT

Under the theme of "sustAlnable develOpmenT", MakeNTU 2022, an electrical engineering makerthon, encouraged participants from all over Taiwan to bring their maker spirit into play and put the UN's Sustainable Development Goals into practice with AloT technology. In the competition, participants were required to design and make an innovative and practical product within 24 hours.

Teams used a variety of hardware and software technologies, putting their problem-solving skills to use to complete their product within a short period of time. One of these products was a smart socket that outputs the status and schedule prediction of corresponding electrical appliances. It also detects abnormalities in electric current by incorporating non-contact current detection, power information, and Al combined with electric current

information. Another product was a smart streetlight that saves energy and incorporates an IoT weather detection function. It uses AI to issue warnings to pedestrians to prevent accidents. One team even applied image recognition technology to determine the type and growth rate of plants. The device also simulates the current mood of plants and provides feedback to users.



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REDUCED INEQUALITIES



NTU Children and Family Research Center's PILOT Course Promotes Child Welfare

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As society continues to develop, children and teens enjoy unprecedented advanced technologies, which exposed them to more risks, including excessive screen time, school bullying, domestic violence, child abuse and neglect, and drugs. To address the difficulties and challenges that children may encounter as they grow up, NTU established the <u>Children and Family Research Center</u> sponsored by the CTBC Charity Foundation in 2012. The Center has worked with many local and foreign organizations over the years to propose innovative service models and policy suggestions related to issues facing children and families, aiming to become a first-class think tank for child welfare in Taiwan.

To strengthen children and teens' psychological resilience and social adaptability under stress, the center developed localized teaching materials for junior high and elementary schools, called "Positive Interpersonal & Life Orientation Training" (PILOT). The center has also assisted many schools in training teachers and promoting the PILOT materials. Research on the results of implementing the PILOT course, Taiwan's first preventative empirical study, shows that PILOT is effective in improving the psychological

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The PILOT teaching materials for elementary schools



The PILOT teaching materials for junior high schools

The NTU Children and Family Research Center's localized PILOT teaching materials for elementary and junior high schools in 2017

health of children and teens, reducing screen addiction, and preventing drug abuse. Currently, the course has already been implemented in over 130 elementary and junior high schools, as well as children's groups in New Taipei City, Taipei City, and Keelung City, benefiting more than 15,000 students. In the future, the course will also be expanded to other cities and counties. With the PILOT course, the Children and Family Research Center was awarded first prize in the 2023 Visionary University Social Responsibility Awards in the Talented Scholarship category.

Time Banking Program Drives New Era of Community Mutual Aid

According to the World Health Organization, Taiwan became an aging society in 2018 and is expected to become a super-aged society1 in 2026. Facing the challenges of an aging society, the Ministry of Health and Welfare introduced the concept of "Time Banking2" through a program which allows different groups to develop service models according to the needs of their respective communities.

A team led by NTU D-School Professor Sheng-Lin Chang and Dr. Szu-Hung Fang conducted a time banking consultation tour to explore the implementation of time banking in Taiwan. The team held several focus group discussions to understand the challenges in promoting time banking, including



those related to the legal system, social culture, and community associations. In November 2022, the team held a presentation of their results and invited government agencies, organizations with successful implementation, and relevant technology platform teams to exchange their experiences and enhance social communication.

Through effectively mobilizing human and material resources, investing in community services, and identifying groups not covered by existing social welfare, the concept of time bank will empower individuals and build a supportive community.

Note 1: A society in which more than 20% of the population is over 65 years old.

Note 2: The concept of time banking was developed by Edgar Cahn, J.D. of Yale University in 1980 as a mutual exchange system using time as a currency. People can convert their service hours into money, and then exchange the currency for services they need when they need them

The Financial Literacy Program Helps High School Students develop a proper financial mindset

To help high school students gain a better understanding of finance and stimulate their interest in the field, the NTU Department of Finance invited 14 of its professors to record an online financial literacy course, which is now available online for high school students to enroll in for free. The course is subtitled for those with special needs. The course in general is for students with no background in finance and economics, so subtitled text may make understanding the terminology and content easier.

The financial literacy course has already been enrolled by 2,939 high school students. In addition to students from urban areas, there are also many from remote areas, outlying islands, and even overseas who have enrolled. So far, 1,487 students have completed the course and received a certificate. Through this course, NTU intends to spread financial knowledge across the country, giving high school students from previously inaccessible places to develop financial literacy earlier.

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SUSTAINABLE CITIES AND COMMUNITIES



People-Oriented Public Transportation for a More Livable City

Advanced public transportation systems incorporating multiple disciplines have become more common around the world as a way to increase livability and provide greener, more sustainable and innovative people-oriented services. The need for a usercentered public transportation system has become even more imperative due to advanced onboard information and communication technologies, increased demand for suburban public transportation, the rise of innovative operating models, and the challenges faced in an aging society. To achieve this goal, NTU established the Advanced Public Transportation Research Center in 2010 with subsidies from the National Science and Technology Council and support from the Intelligent Transportation Society of Taiwan, the Ministry of Economic Affairs Telematics Promotion Office, and the Industrial Technology Research Institute's Information and Communications Research Laboratories. The Center aims to train top public transportation professionals, expand knowledge and skills to all sectors, and establish an exchange platform between industry, government, and academia to promote public transportation research and development in Taiwan and the Asia-Pacific region.

In 2022, the Center was invited to participate in the 2022 Taiwan Climate Action Exposition, where visitors were encouraged to submit green transportation calls to action through an interactive board. The Talanoa Dialogue was also held, sharing the latest developments and applications in Mobility as a Service and green transportation. The Center looks forward to continuing to work with its partners to make a positive impact in promoting sustainable transportation and achieving Taiwan's 2050 net-zero emissions goal.



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The Yuanshan Prehistoric Site: Cultural Preservation, Community Building, and Educational Outreach

The Yuanshan Prehistoric Site is one of the earliest archeological sites discovered in Taiwan. Dating back to the Neolithic period, it contains seven different cultural layers from different periods and marked the beginning of archaeological research in Taiwan. The NTU Department of Anthropology was commissioned by the Ministry of Culture to implement a national protection plan of the Yuanshan Prehistoric Site. In addition to daily overseeing and patrolling the site, the Department also regularly conducts a variety of educational and promotional activities to provide the public with information about archaeology, site preservation, and cultural heritage. In addition, through community-friendly activities and seminars, the Department discuss issues on heritage preservation and community building with those affiliated with other historical sites.

In June 2022, the Department of Anthropology held a family event allowing both adults and children to learn about archaeology and the Yuanshan site through hands-on excavation and pottery making. Monthly Open Days are also held to introduce archaeology and the site through visits and tours. Through its proactive management, the site has become a point of convergence for heritage preservation, community building, and educational outreach.



Faculty members from the Department of Anthropology lead students in a two-day educational program at the Yuanshan site which enabled the public to learn the basics of archaeology and participate in excavation.

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NTU Helps Nangang Residents Improve Community Resilience

The Resilient Nangang team, led by Associate Professor Li-Ling Huang from the NTU Graduate Institute of Building and Planning, has been focusing on the interaction between residents and the natural environment along the Dakeng River in Nangang District of Taipei City since 2018. The team also pays attention to issues such as climate change, resilient communities and sponge cities.

Faculty and students from the Graduate Institute of Building and Planning have been working with Nangang's Chiuchuang neighborhood and Nangang Community College to help residents of the area learn more about their local environment, all while gradually building community resilience through infrastructure, promotion of the Satoyama Initiative, and organic planting. In the spring of 2020, the team installed rainwater recycling facilities, set up gardens, and recruited community sponsors in Nangang. In 2021, they received assistance from the Taipei Garden City Project to expand the garden plots and obtained a drip irrigation system donated by the Hsi Liu Environmental Greening Foundation. In the spring of 2022, the team began the fifth phase of the garden sponsorship program, which focuses on biodiversity and environmental education, and engages children and parents in activities; this network will also be expanded to other districts of Taipei City.

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RESPONSIBLE CONSUMPTION AND PRODUCTION

NTU's total value of the investment pool and sustainable investment



Note 1: Investment in equities and funds only. Note 2: Including investment in corporations and mutual funds with benchmark sustainability performance.



Fermented feather meal can effectively replace hydrolyzed feather meal and has the potential to reduce the costs of animal feed.

Improving Feather Meal Production via Microbial Fermentation and Converting Waste into Quality Animal Feed -24 (123) (125)

Feathers is a significant waste product from poultry processing and Taiwan produces approximately 40,000 metric tons of feathers each year, according to the Council of Agriculture. Currently, the principal method to process feathers involves using high temperature and high pressure to produce hydrolyzed feather meal, which is then added to animal feed. This process, however, is energy-intensive and may not be readily digestible and absorbed by animals if handled improperly.

To address this issue, Associate Professor Hen-Wei Wei of NTU's Department of Animal Science and Technology applied the process of dry fermentation using microorganisms on feathers. This method not only improves the digestibility of amino acids in feathers but also eliminates the need for treatment via high temperature and high pressure, thus reducing energy consumption, lowering carbon footprint and enhancing the efficiency of waste recycling. This new technology has not only solved the problem of high energy consumption in the production process but also increased the utilization rate of feathers. In addition, through experiments on the growth of broilers, the result shows that fermented feather meal can effectively replace hydrolyzed feather meal and has the potential to reduce the costs of animal feed. This technology is expected to be widely deployed in the industry in the future.





Appearance of dry-fermented feather meal

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The First Task Force on Climate-related Financial Disclosures (TCFD) Survey Released by NTU - 126 (133)

To investigate the willingness and behavior of Taiwanese companies on making financial disclosures related to the impact of climate change, NTU's Risk Society and Policy Research Center conducted a survey on TCFD¹-aligned disclosures by domestic companies, which was released in May 2022. The survey comprised seven major dimensions, namely the driving force for the company, climate change perception, policy perception, governance, strategy, risk management, and metrics and targets. The survey was designed to help gauge the attitudes of and actions taken by Taiwanese companies when confronted with climate risks.

The survey revealed that the driving force for making TCFD-aligned disclosures among Taiwanese companies remained clearly insufficient. Among the 404 companies surveyed, only 35 reported to have provided TCFD-aligned disclosures, and they were motivated by seeing TCFD as an important corporate strategy, that their corporate image could benefit from it, and that carbon emissions could be reduced. In terms of climate change perception, most of these companies generally recognized the importance of implementing TCFD, with manufacturing companies with high carbon emissions being particularly concerned and supportive. As for policy perception, 50% of the companies believed that domestic carbon pricing would affect their revenues, but as many as 90% of the companies were unclear about the exact carbon price that would be imposed on them. Additionally, the survey also found that the level of detail in implementing TCFD was different between companies, with only less than 10% of them actually disclosing adequate information on quantitative assessment and low-carbon supply chain management as well as climate action and planning.

This was the first large-scale survey conducted in Taiwan focusing on the willingness and behavior of domestic enterprises regarding climate-related financial disclosure. It was hoped that the survey's findings would provide a reference for the industry, government, and academia. The survey would also serve as a guide for companies and supply chains in establishing low-carbon transformation capabilities, so that the industry could move toward a more sustainable and resilient future.



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Sustainable Fashion Contributing to a Circular Economy Ecosystem

Enrolled in the Entrepreneurship and Innovation MBA (EiMBA) program at NTU, Evelyn Chen is also co-founder of DYCTEAM, a company that takes advantage of plastic particles produced from recycled clothes and turns them into gifts, furniture, clothes, and other products, thus creating a circular economy ecosystem and increasing the efficiency of resource utilization. DYCTEAM uses eco-friendly materials as foundations for its designs, and the company is constantly looking for ways to incorporate sustainable concepts into fashion design. From using recycled or eco-friendly materials such as recycled PET varn, seawool (yarn made from recycled oyster shells), pineapple fiber, recycled fishing nets, and organic cotton, to repurposing product scraps into accessories such as cup sleeves and coin purses, DYCTEAM balances fashion and sustainability through experimentation and breakthroughs. Its Recycled Oyster Shell Yarn Collection received recognition from the 2021 Golden Pin Design Award and the 2022 iF Product Design Award in Germany. With the ESG movement taking off globally, the EiMBA program at NTU will continue to focus on "entrepreneurship" and "innovation" as its core educational objectives to cultivate sustainability talent with the capacity of change as well as to be a positive force in society.

Note 1: Climate-related financial disclosure is a set of guidelines for disclosing climate-related financial information developed by the Financial Stability Board in 2015 in response to climate change and the Paris Agreement. It aims to help companies assess, disclose, and address climate-related risks and opportunities.

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Cross-disciplinary Collaboration Leading to Local Community's Climate Action

Climate change is gradually having an impact on our lives, health and the economy. To raise environmental awareness and promote low-carbon lifestyles to local residents, a team comprised of both students and faculty members of the NTU International Degree Program in Climate Change and Sustainable Development created the Project <u>SC+NTU</u>. This project deployed a network of microsensors to collect a wide range of data, including wind speed and direction, light intensity, humidity levels, temperature, sound levels, and PM2.5 particle concentration. These data will serve as the basis for the community's decisions on climate action.

In collaboration with Jianguo Village in Yingge District, New Taipei City, the team installed a dashboard inside a Tudigong temple. The dashboard displays realtime air quality data, informing residents about the impact of particulate matter caused by incense burning. Additionally, through environmental education, the team aimed to change residents' behavior regarding incense burning. The team also worked with the residents of Daxue Village, Taipei City to develop community-wide carbon-reduction solutions that utilize data from sensors for community green landscaping. This not only helped the residents to understand the dynamic relationship between urban heat island effect, community green landscaping, energy conservation, and carbon reduction, but it also increased their awareness and willingness to take actions on climate issues.

By utilizing scientific communication, the SC+NTU team hoped to build consensus from the bottom up on a climate governance model with local perspective. This approach distinguished the team from other contestants in the 2022 Taiwan Sustainability Action Award (TSAA), where they were awarded the Silver Award for Best Action Plan.

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Improving the Accuracy of Advance Disaster Warning via International Collaboration on Operational Object-based Storm Nowcasting System

The frequency of short-duration intense rainfall has gradually increased in recent years, and sudden downpours have often led to severe flooding and possible landslides and slope collapses as well. However, weather systems of short-duration intense rainfall can develop rapidly in a complex manner, which means that real-time forecasting of these meteorological events has very limited accuracy. In response to extreme weather patterns resulting from climate change, Dr. Li-Pen Wang, Assistant Professor of the Department of Civil Engineering at NTU, worked with a team of international researchers from Imperial College London (UK), KU Leuven (Belgium) and a UK-based startup to co-develop a new object-based radar rainfall nowcasting system for the UK Meteorological Office (Met Office) using tracking technology for convective rain storm and cells to predict short-duration intense rainfall more accurately.

Dr. Wang's rain cell tracking model can provide more accurate predictions regarding the development trends of convective rain cells, providing effective assistance to weather forecasters in the determination of the possible movement of disaster-causing rain cells. A great help to the advance disaster warning system, the model enables the authorities and the general public to mitigate disasters or evacuate in a timelier manner. The forecasting system has passed the testing period in the UK and will be used in real-time operation to support the Met Office's forecasters in predicting the movement of short-duration intense rainfall.



Incorporation of Kalman Filter can effectively correct the faulty 'sharp turns' of the rainfall cells and leads to more realistic trajectory.



Sustainable Development Lecture Series: Raising Public Awareness on Sustainable Development and Urging Citizens to Take Actions

In response to the proclamation of the year 2022 as the International Year of Basic Sciences for Sustainable Development by the United Nations, the NTU Center for the Advancement of Science Education organized a series of lectures entitled "Sustainable Development at a Crossroads" in 2022, aiming to bring awareness to faculty, students and the general public regarding the UN's Sustainable Development Goals (SDGs), specifically, their key features, objectives and current progress. The lectures focused on the impact of climate change and net-zero carbon transition on national development and industry trends, as well as ways to address these issues. The objectives were to raise public awareness of sustainable development, with the hope of inspiring them to take actions and make the necessary lifestyle changes. The lectures were open to live audiences and were also livestreamed on the Internet. In addition, the recorded videos have also been made available to everyone. So far, the lecture series has garnered more than 16,300 views and has been guite influential.

A Word from the President Appendix

LIFE BELOW WATER

NTU Team Makes Breakthrough in Aquatic Ecosystems Research

•<u>14.2</u> <u>14.3</u>

Biodiversity is vital for maintaining the stability and balance of ecosystems. However, biodiversity and ecosystems not only have complex causal relationships but also vary according to different environmental conditions. Ecologists have long tried to understand the effects of biodiversity on ecosystems through lab experiments; however, their results are often difficult to verify in real environments.

Taking on the challenge to quantify the complex causal relationships of ecosystems under naturalistic observation, an international research team led by Dr. Chun-Wei Chang of the National Center for Theoretical Sciences and Prof. Chih-Hao Hsieh of the Institute of Oceanography at NTU adopted a novel convergent cross mapping (CCM) method to analyze the long-term time series data of 19 aquatic ecosystems from around the world and reconstruct the causal networks of natural systems. The team successfully quantified key ecological factors and identified the causal relationships and feedback regulators. Their results were published in the leading scientific journal <u>Nature Communications</u> in March 2022.

Conceptual causal network of biodiversity and ecosystem functioning (BDEF) relationships. The macroecological patterns identified by the team will help us understand the response of ecosystems to climate change and allow us to further assess the impact of environmental changes and biodiversity loss on ecosystems. It also provides a more comprehensive and integrated research framework for ecosystem management for the future.



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Marine Migration under the Impact of Global Warming

•<u>14.2</u> (14.a)

Global warming has caused seawater temperature to increase, forcing fish to leave their original habitats and gradually move to the polar regions; this phenomenon can be observed in the biogeographic transition zones of various sea areas. To better understand this phenomenon, NTU Institute of Oceanography postdoctoral researcher Yu-Ting Vicky Lin and Associate Prof. Vianney Denis conducted research focusing on Taiwan's waters that stretches from tropical to subtropical zones. The research aims to investigate the effects of benthic habitat and seawater temperature on the distribution of reef fishes in the biogeographic transition zone, and to analyze seawater warming in the last 30 years in order to more accurately predict future geographic distribution of fishes.

The results of their research showed that of the 58 species distributed in the subtropical or tropical zone, 13 were affected by seawater temperature, 19 by benthic habitat, and 26 by both. In addition, the study identified indicator species for monitoring the tropicalization of biota and found that the poleward movement of tropical reef fish is not only constrained by temperature but also by the distribution of benthic habitats, and is likely to be accelerated in subtropical regions where winter warming is more pronounced. The study was published in the Journal of Biogeography in July 2022.





Due to the high cost of artificial reproduction, eel fry are mostly wild-caught

Eel Education: Promoting Eel Conservation to Benefit Future Generations

Has it ever occurred to you that one day we may no longer be able to eat delicious dishes such as eel rice? Japanese eels are the most common and economically valuable eel species in Taiwan, but due to the high cost of artificial reproduction, eel fry are mostly wild-caught. In recent years, wide eel fry resources in East Asia have been rapidly depleting due to the destruction of river habitats, overfishing, and climate change. In view of this, the International Union for Conservation of Nature has listed the Japanese eel (*Anguilla japonica*) as an endangered species. For the purpose of striking a balance between ecological sustainability and industrial development, Prof. Yu-San Han of the NTU Institute of Fisheries Science has long called on the government and the fishing industry to invest in the conservation and management of eel resources. In 2022, the Institute of Fisheries Science held two eel food and agriculture-themed events, giving the public a glimpse into the mysterious lives of these endangered species through film discussions, ecological education, aquaculture experience sharing, and fishing demonstrations.

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NTU & E.SUN Bank Launch ESG Centenary Project

With its rich resources, NTU Experimental Forest not only vigorously promotes corporate-sponsored forestation, but also has long been committed to preserving the culture of indigenous peoples in the area. To this end, NTU and E.SUN Bank have joined hands to launch the ESG Centenary Project, which consists of two sub-projects, one aimed at planting 100,000 trees native to Taiwan and the other at reviving millet cultivation in Xinyi Township of Nantou. Joining forces and their resources, both NTU and E.SUN demonstrate a commitment to their social responsibility by taking actions on environmental protection, ecological conservation, and safeguarding native species.

The 100,000 Cypress Trees for Yushan Project will involve the planting of Taiwan cypress, Taiwan red cypress, Taiwania, Taiwan incense cedar, Luantafir, and other endemic cypress species in Yushan. It is estimated that 100,000 trees will be planted within 10 years, covering an area of 50 hectares, which will reduce CO₂ emissions by 242,000 tons in 100 years - an amount equivalent to the yearly carbon sequestration capacity of 617 Da'an Forest Parks.

— (2.5) (15.2) (15.4)

Meanwhile, the millet revival project aims to revive 28 varieties of millet that were once native to Xinyi Township in Nantou but are now rarely seen in the area. Through the efforts of Professors Hua-Ren Warren Kuo and Yann-Rong Lin of the NTU Department of Agronomy and their research team, a few varieties of millet were brought back home to Taiwan from a seed bank in the United States. Through the cultivation and promotion of native millet, NTU and E.SUN hope to revitalize the millet industry and the culture of the Bunun people, as well as pass on the cultural values of Taiwan's indigenous peoples.

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Rooftop Farms Enhance Urban Biodiversity

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In recent years, people have increasingly valued healthy, safe, and consumption of local and in-season ingredients. But how can one find a piece of pollution-free land for growing produce in an urban environment filled with high-rise buildings? "Green roofs," which provide space and do not have the issue of soil contamination, are now being considered an important way to develop urban agriculture. Besides these advantages, green roofs can also provide many ecosystem services for the urban public, including microclimate regulation, rainwater management, air quality improvement, and even recreation.

In collaboration with the New Taipei City government's Low Carbon Center, a team led by Associate Professor Bau-Show Lin of the NTU Department of Horticulture and Landscape Architecture conducted a one-year survey of eight rooftop farms located in different geographic regions. Their study found that through eco-friendly farming practices, growing seasonal and diverse "food sources" on the rooftop farms directly or indirectly attracted many species of insects, some of which can even help crops grow, making rooftop farms mutually beneficial for humans and other organisms. In addition, because many of the rooftop farms were built on high-rise residential complexes. The larger roof areas allowed for a greater variety of crops to be grown, which increase species abundance and diversity. Furthermore, the surrounding environment had little impact on the species composition and diversity of the rooftop farms, suggesting that rooftop farms have the potential to create unique habitats for urban species and enhance urban biodiversity.





Forest Fire Restoration Program for Mountain Farms

• (13.3) (15.2) (15.4)

Since its establishment in 1936, the NTU Highland Experimental Farm has not only supported environmental education and research nationwide but has also been responsible for protecting 1,000 hectares of virgin forest. However, the forest's Cuifeng section is prone to forest fires during the dry season from winter to spring. In February 2021, a local wildfire in the section spread over an area of 15 hectares, leaving the ground bare and causing the forest to lose its function as a water source and carbon sink, not to mention harming a precious habitat for plants and animals. The burned forest was also located just above the farmland of an indigenous protected area. When the steep slopes of that land lost its vegetation cover in the fire, soil erosion became a risk during the rainy season, impacting nearby residents.

In 2022, NTU Highland Experimental Farm and MiTAC worked together to launch a forest fire restoration Project, with the goal of restoring 7.5 hectares of the affected forest within six years in order to proceed land, water and carbon sink restoration. NTU has already begun the first stage of seedling cultivation, selecting a variety of native tree species in the Cuifeng section including Formosan alder, Taiwan red pine, and Alishan flowering cherry to increase species diversity and restore the forest to its natural form. The project has also called on local youth to plant and preserve trees and to train community mountain rangers to monitor and prevent any possible causes of forest fires and reduce potential risks and hazards. In addition, regular environmental education activities are being held to allow the public to learn about the functions of forests as water sources, carbon sinks, and wildlife refuges in the hope that more will join in the effort to protect forests.

PEACE, JUSTICE

AND STRONG

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WTO Chairs Programme Officially Launched – A Collaboration between WTO and NTU

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The Asian Center for WTO & International Health Law and Policy (ACWH), a research center in NTU's College of Law, has been selected as a World Trade Organization (WTO) Chair for a four-year term and officially launched the WTO Chairs Programme (WCP) on May 17, 2022. The program was initiated in 2010 to support academic institutions in developing and underdeveloped countries, to offer international trade-related courses, academic research, and other exchange activities to enhance their knowledge and understanding of the international trade system. The international chair is selected every four years, and 17 academic institutions worldwide, including NTU, were chosen to participate in the third phase of the WTO Chairs Programme.

In response to Taiwan's accession to the WTO in 2002, NTU's College of Law established the ACWH in 2003. ACWH has long been devoted to researching international trade law, health law and arbitration law, as well as serving as a government advisory body. Its recent research topics focus on the impact of COVID-19 on transportation, port, and trade restrictions, as well as emerging topics such as e-commerce, digital data, and digital trade. For ACWH, being selected as a WTO Chair represents international recognition of its education and research efforts, and ACWH will continue to make contributions in the field of global trade to support Taiwan's public and private sectors in the future.



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Minister of Justice, Ching-Hsiang Tsai, discussing forensic science with students.

Most Popular Liberal Education Course at NTU: Introduction of Forensic Science for Citizen Judges

Taiwan implemented the system of citizen judges, starting in 2023 in order to incorporate diverse perspectives and experiences from citizens into trials and make judicial decisions more comprehensive. To prepare students to serve as citizen judges, Professor Te-I Weng from NTU's Department and Graduate Institute of Forensic Medicine offers a liberal education course titled "Introduction of Forensic Science for Citizen Judges", which provides students with systematic knowledge of forensic science and expertise in the judiciary. This course begins with the topic of "The party independently presents and demonstrates evidence" within the process of civil participation in criminal trials and discusses the legality of evidence acquisition, the interpretation of forensic science results, and the evidence uncertainties through real-life examples. In addition, the course emphasizes the importance of forensic psychology in interpreting scientific evidence and witness testimony to avoid tunnel vision or cognitive biases. Students then learn about forensic psychiatry in assessing perpetrators' behavior to understand the complexity of human behavior and further elaborate on the common causes of wrongful convictions and the importance of preventing them.

Finally, the course encourages students to fight for justice with the belief that "even if we cannot change it, it does not mean that it has nothing to do with us," which is advocated by the philosopher Hannah Arendt. This course not only satisfies students' curiosity about the application of science to legal practice but also provides a greater understanding of forensic science in exploring the truth. It is one of the most popular liberal education courses at NTU.

Family law cases Criminal cases 8.6% 26.5% Public law cases 9.9% Civil cases 55.0% "Know Your Rights!" NTU Legal Service Provides Consultation

Services to the Public

NTU Legal Service is composed of third- and fourth-year undergraduate students as well as graduate students from NTU's College of Law, Since its establishment in 1979, under the leadership of honorary advisor Professor Lian-Gong Chiou, and supervising professors Professor Shu-Huan Shyuu, Professor Ming-Chiang Lin, and Professor Wei-Yu Chen, NTU Legal Service has always adhered to its founding principles, using "Know Your Rights!" as its slogan. Every Saturday afternoon, they provide free legal consultation services to the public, and through interaction with the parties involved, they enhance students' practical experience and inspire their sense of justice and dedication to society.

Due to the impact of the COVID-19 pandemic in 2020, NTU Legal Service started providing online consultation services. It ensured the public reliable support when facing legal difficulties and extended legal services beyond the limitations of physical space, benefiting people with legal consultation needs across the country. During the academic year 2021-2022, the NTU Legal Service handled a total of 290 consultation cases, with civil cases accounting for the highest proportion of these, followed by criminal and public law cases. Through these services, the NTU Legal Service hopes to help build a more comprehensive legal system in society and recruit more law students to join in to protect the rights and interests of the public.

NTU legal service cases in the 2021-22 academic year

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NTU and Malawi Launch Public Health Initiative

Malawi is one of the world's least developed countries, with poor public health infrastructure and a long history of poverty and hunger. The outbreak of the COVID-19 pandemic in 2020 caused the public health problem in the country to become even more severe. In response, the Sustainable Healthy Actions by National Taiwan University (SHANTU) worked with the non-profit organization Luke International Norway (LIN) and the North Mzimba District Health Office (DHO) to assist Malawi in preventing and controlling COVID-19 and other emerging infectious diseases. Their work included epidemic investigation, home visits for patients, and vaccination.

In early 2022, while Malawi's local COVID-19 cases subsided, there was a cholera outbreak along with the first case of wild polio virus in Africa in five years. The team continued its online support for local epidemic prevention and sent over water purification tablets. They also personally brought Personal Protective Equipment (PPE) to Malawi in July. The team further assisted in vaccination monitoring for Malawi's Global Polio Eradication Initiative and collaborated with the local Chiputula Primary School to offer nutrition courses to help children learn proper nutrition and hygiene practices.

In November 2022, the team worked with the Mzuzu University Department of Biomedical Sciences to hold a seminar on epidemic prevention. Staff from the North Mzimba DHO were invited to share their experiences and responses to cholera, polio, and COVID-19 outbreaks in Malawi, and discussions were held among Mzuzu University faculty and students and NTU students led by SHANTU Principal Investigator Prof. Chang-Chuan Chan, facilitating communication between Taiwan and Malawi regarding public health and biomedical sciences.

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NTU Collaborates with International Team to Address Food Crisis in Africa

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Crop wild relatives are plants closely related to domesticated plants; they are highly resistant to pests and diseases in their natural environment and possess genes with high potential for stress resistance. However, due to land use, human destruction of natural habitats, and changes in food culture, many vegetable species in Africa are being lost, and the preservation of crop wild relatives is less than ideal. To enhance biodiversity in the region, the World Vegetable Center (WorldVeg), in collaboration with the NTU Department of Agronomy, World Agroforestry (CIFOR-ICRAF) in Kenya, and the University of Abomey-Calavi in the Republic of Benin, is implementing the Taiwan-Africa Vegetable Initiative (TAVI) to rescue the African vegetable germplasm and address the food and nutrition security problems of the region. The collaboration is financially supported by Taiwan's Ministry of Foreign Affairs and the Council of Agriculture.

WorldVeg Germplasm and Seed Unit Head Dr. Maarten van Zonneveld and researchers from University of Abomey-Calavi, together with Prof. Yann-rong Lin and PhD candidate Wei-hsun Hsieh from the NTU Department of Agronomy, conducted an evaluation and analysis of "forgotten" food crops and crop wild relatives in sub-Saharan Africa in an attempt to identify germplasm resources that are more adaptable to future climate conditions and have nutritional value. Based on their results, the team has prioritized 58 forgotten food crops for planting which are expected to have better climate resilience in 2070 and are suitable for cultivation in different parts of Africa. The team hopes that by improving local food self-sufficiency and nutrition, the sustainable development goal of zero hunger can be achieved.



Annona senegalensis (wild custard) is widely used in Benin, has a potential market for fresh juice production, and is one of the forgotten food crops that are the focus of the team's research.



NTU Student Travels to Uganda to Build Wells of Hope

Yu-Ting Hsieh, a student at the NTU Graduate Institute of Environmental Engineering, learned of a water purification project led by NGO Love Binti International, and without hesitation, decided to travel to Uganda as a volunteer and put her studies into practice to help improve water resources and sanitation in the region. The main goal of the water purification project is to increase the proportion of safe drinking water in Africa by digging wells in areas that lack them and educating communities about sanitation. During her four-and-a-half months in Uganda, Hsieh rode a motorbike to different villages in the region to survey suitable well sites, visited households and schools on foot, and conducted water quality sampling. She wanted to learn how different water resource conditions will affect health and water usage. Hsieh especially valued the sustainable development aspect of the water purification project.

After the completion of each survey, Hsieh then took the initiative to contact local governments to share and discuss her methodology and results in the hope that the local community can continue to establish self-sufficient, clean water resources.



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Global Indicator Framework for the Sustainable Development Goals and Targets of the 2030 Agenda for Sustainable Development

SDG	Goals and targets (from the 2030 Agenda for Sustainable Development)
	Goal 1. End poverty in all its forms everywhere
1.1	By 2030, eradicate extreme poverty for all people everywhere, currently measured as people living on less than \$1.25 a day
1.2	By 2030, reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions
1.3	Implement nationally appropriate social protection systems and measures for all, including floors, and by 2030 achieve substantial coverage of the poor and the vulnerable
1.4	By 2030, ensure that all men and women, in particular the poor and the vulnerable, have equal rights to economic resources, as well as access to basic services, ownership and control over land and other forms of property, inheritance, natural resources, appropriate new technology and financial services, including microfinance
1.5	By 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters
1.a	Ensure significant mobilization of resources from a variety of sources, including through enhanced development cooperation, in order to provide adequate and predictable means for developing countries, in particular least developed countries, to implement programmes and policies to end poverty in all its dimensions
1.b	Create sound policy frameworks at the national, regional and international levels, based on pro-poor and gender-sensitive development strategies, to support accelerated investment in poverty eradication actions
	Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture
2.1	By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round
2.2	By 2030, end all forms of malnutrition, including achieving, by 2025, the internationally agreed targets on stunting and wasting in children under 5 years of age, and address the nutritional needs of adolescent girls, pregnant and lactating women and older persons
2.3	By 2030, double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers, including through secure and equal access to land, other productive resources and inputs, knowledge, financial services, markets and opportunities for value addition and non-farm employment
2.4	By 2030, ensure sustainable food production systems and implement resilient agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters and that progressively improve land and soil quality
2.5	By 2020, maintain the genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species, including through soundly managed and diversified seed and plant banks at the national, regional and international levels, and promote access to and fair and equitable sharing of benefits arising from the utilization of genetic resources and associated traditional knowledge, as internationally agreed
2 .a	Increase investment, including through enhanced international cooperation, in rural infrastructure, agricultural research and extension services, technology development and plant and livestock gene banks in order to enhance agricultural productive capacity in developing countries, in particular least developed countries
2. b	Correct and prevent trade restrictions and distortions in world agricultural markets, including through the parallel elimination of all forms of agricultural export subsidies and all export measures with equivalent effect, in accordance with the mandate of the Doha Development Round
2.c	Adopt measures to ensure the proper functioning of food commodity markets and their derivatives and facilitate timely access to market information, including on food reserves, in order to help limit extreme food price volatility

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SDG	Goals and targets (from the 2030 Agenda for Sustainable Development)
	Goal 3. Ensure healthy lives and promote well-being for all at all ages
3.1	By 2030, reduce the global maternal mortality ratio to less than 70 per 100,000 live births
3.2	By 2030, end preventable deaths of newborns and children under 5 years of age, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1,000 live births and under-5 mortality to at least as low as 25 per 1,000 live births
3.3	By 2030, end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases
3.4	By 2030, reduce by one third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being
3.5	Strengthen the prevention and treatment of substance abuse, including narcotic drug abuse and harmful use of alcohol
3.6	By 2020, halve the number of global deaths and injuries from road traffic accidents
3.7	By 2030, ensure universal access to sexual and reproductive health-care services, including for family planning, information and education, and the integration of reproductive health into national strategies and programmes
3.8	Achieve universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all
3.9	By 2030, substantially reduce the number of deaths and illnesses from hazardous chemicals and air, water and soil pollution and contamination
3.a	Strengthen the implementation of the World Health Organization Framework Convention on Tobacco Control in all countries, as appropriate
3.b	Support the research and development of vaccines and medicines for the communicable and non-communicable diseases that primarily affect developing countries, provide access to affordable essential medicines and vaccines, in accordance with the Doha Declaration on the TRIPS Agreement and Public Health, which affirms the right of developing countries to use to the full the provisions in the Agreement on Trade-Related Aspects of Intellectual Property Rights regarding flexibilities to protect public health, and, in particular, provide access to medicines for all
3.c	Substantially increase health financing and the recruitment, development, training and retention of the health workforce in developing countries, especially in least developed countries and small island developing States
3.d	Strengthen the capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global health risks
	Goal 4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all
4.1	By 2030, ensure that all girls and boys complete free, equitable and quality primary and secondary education leading to relevant and effective learning outcomes
4.2	By 2030, ensure that all girls and boys have access to quality early childhood development, care and pre-primary education so that they are ready for primary education
4.3	By 2030, ensure equal access for all women and men to affordable and quality technical, vocational and tertiary education, including university
4.4	By 2030, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship
4.5	By 2030, eliminate gender disparities in education and ensure equal access to all levels of education and vocational training for the vulnerable, including persons with disabilities, indigenous peoples and children in vulnerable situations
4.6	By 2030, ensure that all youth and a substantial proportion of adults, both men and women, achieve literacy and numeracy
4.7	By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development

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SDG Goals and targets (from the 2030 Agenda for Sustainable Development) Build and upgrade education facilities that are child, disability and gender sensitive and provide safe, non-violent, inclusive and effective learning environments for all 4.a By 2020, substantially expand globally the number of scholarships available to developing countries, in particular least developed countries, small island developing States and African countries, for enrolment in **4.b** higher education, including vocational training and information and communications technology, technical, engineering and scientific programmes, in developed countries and other developing countries By 2030, substantially increase the supply of qualified teachers, including through international cooperation for teacher training in developing countries, especially least developed countries and small island **4.c** developing States Goal 5. Achieve gender equality and empower all women and girls End all forms of discrimination against all women and girls everywhere 5.1 5.2 Eliminate all forms of violence against all women and girls in the public and private spheres, including trafficking and sexual and other types of exploitation 5.3 Eliminate all harmful practices, such as child, early and forced marriage and female genital mutilation Recognize and value unpaid care and domestic work through the provision of public services, infrastructure and social protection policies and the promotion of shared responsibility within the household and the 5.4 family as nationally appropriate 5.5 Ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic and public life Ensure universal access to sexual and reproductive health and reproductive rights as agreed in accordance with the Programme of Action of the International Conference on Population and Development and the 5.6 Beijing Platform for Action and the outcome documents of their review conferences Undertake reforms to give women equal rights to economic resources, as well as access to ownership and control over land and other forms of property, financial services, inheritance and natural resources, in 5.a accordance with national laws 5.b Enhance the use of enabling technology, in particular information and communications technology, to promote the empowerment of women 5.c Adopt and strengthen sound policies and enforceable legislation for the promotion of gender equality and the empowerment of all women and girls at all levels Goal 6. Ensure availability and sustainable management of water and sanitation for all By 2030, achieve universal and equitable access to safe and affordable drinking water for all 6.1 6.2 By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations By 2030, improve water guality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially 6.3 increasing recycling and safe reuse globally By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people 6.4 suffering from water scarcity By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate 6.5 6.6 By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water 6.a efficiency, wastewater treatment, recycling and reuse technologies 6.b Support and strengthen the participation of local communities in improving water and sanitation management

SDG	Goals and targets (from the 2030 Agenda for Sustainable Development)
	Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all
7.1	By 2030, ensure universal access to affordable, reliable and modern energy services
7.2	By 2030, increase substantially the share of renewable energy in the global energy mix
7.3	By 2030, double the global rate of improvement in energy efficiency
7.a	By 2030, enhance international cooperation to facilitate access to clean energy research and technology, including renewable energy, energy efficiency and advanced and cleaner fossil-fuel technology, and promote investment in energy infrastructure and clean energy technology
7.b	By 2030, expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries, in particular least developed countries, small island developing States and landlocked developing countries, in accordance with their respective programmes of support
	Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all
8.1	Sustain per capita economic growth in accordance with national circumstances and, in particular, at least 7 per cent gross domestic product growth per annum in the least developed countries
8.2	Achieve higher levels of economic productivity through diversification, technological upgrading and innovation, including through a focus on high-value added and labour-intensive sectors
8.3	Promote development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity and innovation, and encourage the formalization and growth of micro-, small- and medium-sized enterprises, including through access to financial services
8.4	Improve progressively, through 2030, global resource efficiency in consumption and production and endeavour to decouple economic growth from environmental degradation, in accordance with the 10-Year Framework of Programmes on Sustainable Consumption and Production, with developed countries taking the lead
8.5	By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value
8.6	By 2020, substantially reduce the proportion of youth not in employment, education or training
8.7	Take immediate and effective measures to eradicate forced labour, end modern slavery and human trafficking and secure the prohibition and elimination of the worst forms of child labour, including recruitment and use of child soldiers, and by 2025 end child labour in all its forms
8.8	Protect labour rights and promote safe and secure working environments for all workers, including migrant workers, in particular women migrants, and those in precarious employment
8.9	By 2030, devise and implement policies to promote sustainable tourism that creates jobs and promotes local culture and products
8.10	Strengthen the capacity of domestic financial institutions to encourage and expand access to banking, insurance and financial services for all
8 .a	Increase Aid for Trade support for developing countries, in particular least developed countries, including through the Enhanced Integrated Framework for Trade-related Technical Assistance to Least Developed Countries

8.b By 2020, develop and operationalize a global strategy for youth employment and implement the Global Jobs Pact of the International Labour Organization

Appendix

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SDG	Goals and targets (from the 2030 Agenda for Sustainable Development)
	Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation
9.1	Develop quality, reliable, sustainable and resilient infrastructure, including regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all
9.2	Promote inclusive and sustainable industrialization and, by 2030, significantly raise industry's share of employment and gross domestic product, in line with national circumstances, and double its share in least developed countries
9.3	Increase the access of small-scale industrial and other enterprises, in particular in developing countries, to financial services, including affordable credit, and their integration into value chains and markets
9.4	By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities
9.5	Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development spending
9.a	Facilitate sustainable and resilient infrastructure development in developing countries through enhanced financial, technological and technical support to African countries, least developed countries, landlocked developing countries and small island developing States
9.b	Support domestic technology development, research and innovation in developing countries, including by ensuring a conducive policy environment for, inter alia, industrial diversification and value addition to commodities
9.c	Significantly increase access to information and communications technology and strive to provide universal and affordable access to the Internet in least developed countries by 2020
	Goal 10. Reduce inequality within and among countries
10.1	By 2030, progressively achieve and sustain income growth of the bottom 40 per cent of the population at a rate higher than the national average
10.2	By 2030, empower and promote the social, economic and political inclusion of all, irrespective of age, sex, disability, race, ethnicity, origin, religion or economic or other status
10.3	Ensure equal opportunity and reduce inequalities of outcome, including by eliminating discriminatory laws, policies and practices and promoting appropriate legislation, policies and action in this regard
10.4	Adopt policies, especially fiscal, wage and social protection policies, and progressively achieve greater equality
10.5	Improve the regulation and monitoring of global financial markets and institutions and strengthen the implementation of such regulations
10.6	Ensure enhanced representation and voice for developing countries in decision-making in global international economic and financial institutions in order to deliver more effective, credible, accountable and legitimate institutions
10.7	Facilitate orderly, safe, regular and responsible migration and mobility of people, including through the implementation of planned and well-managed migration policies
10.a	Implement the principle of special and differential treatment for developing countries, in particular least developed countries, in accordance with World Trade Organization agreements
10.b	Encourage official development assistance and financial flows, including foreign direct investment, to States where the need is greatest, in particular least developed countries, African countries, small island developing States and landlocked developing countries, in accordance with their national plans and programmes
10.c	By 2030, reduce to less than 3 per cent the transaction costs of migrant remittances and eliminate remittance corridors with costs higher than 5 per cent

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SDG	Goals and targets (from the 2030 Agenda for Sustainable Development)
	Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable
11.1	By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums
11.2	By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons
11.3	By 2030, enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries
11.4	Strengthen efforts to protect and safeguard the world's cultural and natural heritage
11.5	By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations
11.6	By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management
11.7	By 2030, provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities
11.a	Support positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development planning
11.b	By 2020, substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, and develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015–2030, holistic disaster risk management at all levels
11.c	Support least developed countries, including through financial and technical assistance, in building sustainable and resilient buildings utilizing local materials
	Goal 12. Ensure sustainable consumption and production patterns
12.1	Implement the 10-Year Framework of Programmes on Sustainable Consumption and Production Patterns, all countries taking action, with developed countries taking the lead, taking into account the development and capabilities of developing countries
12.2	12.2 By 2030, achieve the sustainable management and efficient use of natural resources
12.3	By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses
12.4	By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment
12.5	By 2030, substantially reduce waste generation through prevention, reduction, recycling and reuse
12.6	Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle
12.7	Promote public procurement practices that are sustainable, in accordance with national policies and priorities
12.8	By 2030, ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature
12.a	Support developing countries to strengthen their scientific and technological capacity to move towards more sustainable patterns of consumption and production
12.b	Develop and implement tools to monitor sustainable development impacts for sustainable tourism that creates jobs and promotes local culture and products

12.c harmful subsidies, where they exist, to reflect their environmental impacts, taking fully into account the specific needs and conditions of developing countries and minimizing the possible adverse impacts on their development in a manner that protects the poor and the affected communities

SDG	Goals and targets (from the 2030 Agenda for Sustainable Development)
	Goal 13. Take urgent action to combat climate change and its impacts3
13.1	Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries
13.2	Integrate climate change measures into national policies, strategies and planning
13.3	Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning
13.a	Implement the commitment undertaken by developed-country parties to the United Nations Framework Convention on Climate Change to a goal of mobilizing jointly \$100 billion annually by 2020 from all sources to address the needs of developing countries in the context of meaningful mitigation actions and transparency on implementation and fully operationalize the Green Climate Fund through its capitalization as soon as possible
13.b	Promote mechanisms for raising capacity for effective climate change-related planning and management in least developed countries and small island developing States, including focusing on women, youth and local and marginalized communities
	Goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development
14.1	By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution
14.2	By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans
14.3	Minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels
14.4	By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics
14.5	By 2020, conserve at least 10 per cent of coastal and marine areas, consistent with national and international law and based on the best available scientific information
14.6	By 2020, prohibit certain forms of fisheries subsidies which contribute to overcapacity and overfishing, eliminate subsidies that contribute to illegal, unreported and unregulated fishing and refrain from introducing new such subsidies, recognizing that appropriate and effective special and differential treatment for developing and least developed countries should be an integral part of the World Trade Organization fisheries subsidies negotiation4
14.7	By 2030, increase the economic benefits to small island developing States and least developed countries from the sustainable use of marine resources, including through sustainable management of fisheries, aquaculture and tourism
14.a	Increase scientific knowledge, develop research capacity and transfer marine technology, taking into account the Intergovernmental Oceanographic Commission Criteria and Guidelines on the Transfer of Marine Technology, in order to improve ocean health and to enhance the contribution of marine biodiversity to the development of developing countries, in particular small island developing States and least developed countries
14.b	Provide access for small-scale artisanal fishers to marine resources and markets
14.c	Enhance the conservation and sustainable use of oceans and their resources by implementing international law as reflected in the United Nations Convention on the Law of the Sea, which provides the legal framework for the conservation and sustainable use of oceans and their resources, as recalled in paragraph 158 of "The future we want"

Appendix

SDG Goals and targets (from the 2030 Agenda for Sustainable Development) Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations 15.1 under international agreements By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally 15.2 By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world 15.3 By 2030, ensure the conservation of mountain ecosystems, including their biodiversity, in order to enhance their capacity to provide benefits that are essential for sustainable development 15.4 Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species 15.5 15.6 Promote fair and equitable sharing of the benefits arising from the utilization of genetic resources and promote appropriate access to such resources, as internationally agreed Take urgent action to end poaching and trafficking of protected species of flora and fauna and address both demand and supply of illegal wildlife products 15.7 By 2020, introduce measures to prevent the introduction and significantly reduce the impact of invasive alien species on land and water ecosystems and control or eradicate the priority species 15.8 15.9 By 2020, integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts Mobilize and significantly increase financial resources from all sources to conserve and sustainably use biodiversity and ecosystems 15.a Mobilize significant resources from all sources and at all levels to finance sustainable forest management and provide adequate incentives to developing countries to advance such management, including for 15.b conservation and reforestation Enhance global support for efforts to combat poaching and trafficking of protected species, including by increasing the capacity of local communities to pursue sustainable livelihood opportunities 15.c Goal 16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels 16.1 Significantly reduce all forms of violence and related death rates everywhere End abuse, exploitation, trafficking and all forms of violence against and torture of children 16.2 16.3 Promote the rule of law at the national and international levels and ensure equal access to justice for all By 2030, significantly reduce illicit financial and arms flows, strengthen the recovery and return of stolen assets and combat all forms of organized crime 16.4 Substantially reduce corruption and bribery in all their forms 16.5 16.6 Develop effective, accountable and transparent institutions at all levels Ensure responsive, inclusive, participatory and representative decision-making at all levels 16.7 Broaden and strengthen the participation of developing countries in the institutions of global governance 16.8 16.9 By 2030, provide legal identity for all, including birth registration Ensure public access to information and protect fundamental freedoms, in accordance with national legislation and international agreements 16.10 Strengthen relevant national institutions, including through international cooperation, for building capacity at all levels, in particular in developing countries, to prevent violence and combat terrorism and crime 16.a

16.b Promote and enforce non-discriminatory laws and policies for sustainable development

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SDG	Goals and targets (from the 2030 Agenda for Sustainable Development)	
	Goal 17. Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development	
	Finance	
17.1	Strengthen domestic resource mobilization, including through international support to developing countries, to improve domestic capacity for tax and other revenue collection	
17.2	Developed countries to implement fully their official development assistance commitments, including the commitment by many developed countries to achieve the target of 0.7 per cent of gross national income for official development assistance (ODA/GNI) to developing countries and 0.15 to 0.20 per cent of ODA/GNI to least developed countries; ODA providers are encouraged to consider setting a target to provide at least 0.20 per cent of ODA/GNI to least developed countries; ODA providers are encouraged to consider setting a target to provide at least 0.20 per cent of ODA/GNI to least developed countries; ODA providers are encouraged to consider setting a target to provide at least 0.20 per cent of ODA/GNI to least developed countries; ODA providers are encouraged to consider setting a target to provide at least 0.20 per cent of ODA/GNI to least developed countries; ODA providers are encouraged to consider setting a target to provide at least 0.20 per cent of ODA/GNI to least developed countries; ODA providers are encouraged to consider setting a target to provide at least 0.20 per cent of ODA/GNI to least developed countries; ODA providers are encouraged to consider setting a target to provide at least 0.20 per cent of ODA/GNI to least developed countries; ODA providers are encouraged to consider setting a target to provide at least 0.20 per cent of ODA/GNI to least developed countries; ODA providers are encouraged to consider setting a target to provide at least 0.20 per cent of ODA/GNI to least developed countries; ODA providers are encouraged to consider setting a target to provide at least 0.20 per cent of ODA/GNI to least developed countries; ODA providers are encouraged to consider setting a target to provide at least 0.20 per cent of ODA/GNI to least developed countries; ODA providers are encouraged to consider setting at least 0.20 per cent of ODA/GNI to least developed countries; ODA per cent of ODA/GNI to least developed countries; ODA per cent of ODA/GNI to least developed countries; ODA per cent of ODA	
17.3	Mobilize additional financial resources for developing countries from multiple sources	
17.4	Assist developing countries in attaining long-term debt sustainability through coordinated policies aimed at fostering debt financing, debt relief and debt restructuring, as appropriate, and address the external debt of highly indebted poor countries to reduce debt distress	
17.5	Adopt and implement investment promotion regimes for least developed countries	
	Technology	
17.6	Enhance North-South, South-South and triangular regional and international cooperation on and access to science, technology and innovation and enhance knowledge-sharing on mutually agreed terms, including through improved coordination among existing mechanisms, in particular at the United Nations level, and through a global technology facilitation mechanism	
17.7	Promote the development, transfer, dissemination and diffusion of environmentally sound technologies to developing countries on favourable terms, including on concessional and preferential terms, as mutually agreed	
17.8	Fully operationalize the technology bank and science, technology and innovation capacity-building mechanism for least developed countries by 2017 and enhance the use of enabling technology, in particular information and communications technology	
	Capacity-building	
17.9	Enhance international support for implementing effective and targeted capacity-building in developing countries to support national plans to implement all the Sustainable Development Goals, including through North-South, South-South and triangular cooperation	
	Trade	
17.10	Promote a universal, rules-based, open, non-discriminatory and equitable multilateral trading system under the World Trade Organization, including through the conclusion of negotiations under its Doha Development Agenda	
17.11	Significantly increase the exports of developing countries, in particular with a view to doubling the least developed countries' share of global exports by 2020	
17.12	Realize timely implementation of duty-free and quota-free market access on a lasting basis for all least developed countries, consistent with World Trade Organization decisions, including by ensuring that preferential rules of origin applicable to imports from least developed countries are transparent and simple, and contribute to facilitating market access	

SDG	Goals and targets (from the 2030 Agenda for Sustainable Development)
	Systemic issues
	Policy and institutional coherence
17.13	Enhance global macroeconomic stability, including through policy coordination and policy coherence
17.14	Enhance policy coherence for sustainable development
17.15	Respect each country's policy space and leadership to establish and implement policies for poverty eradication and sustainable development
	Multi-stakeholder partnerships
17.16	Enhance the Global Partnership for Sustainable Development, complemented by multi-stakeholder partnerships that mobilize and share knowledge, expertise, technology and financial resources, to support the achievement of the Sustainable Development Goals in all countries, in particular developing countries
17.17	Encourage and promote effective public, public-private and civil society partnerships, building on the experience and resourcing strategies of partnerships
	Data, monitoring and accountability
17.18	By 2020, enhance capacity-building support to developing countries, including for least developed countries and small island developing States, to increase significantly the availability of high-quality, timely and reliable data disaggregated by income, gender, age, race, ethnicity, migratory status, disability, geographic location and other characteristics relevant in national contexts
17.19	By 2030, build on existing initiatives to develop measurements of progress on sustainable development that complement gross domestic product, and support statistical capacity-building in developing countries
Reference:	https://unstats.un.org/

sdgs/indicators/indicators-list/

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