FIRDI 2018 Annual Report

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2018 Annual Report
Food Industry Research & Development Institute
Address：331 Shipin Road, Hsinchu, 30062 Taiwan, R.O.C.
Tel：886-3-5223191, Fax：886-3-5214016, http://www.firdi.org.tw
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Committee member：Shiang-Tang Jane, Shu-Chen Huang, Shan-Shan Chen, Pei-Wen Lo, Hsiao-Tzu Yang, Su-Chen Lu, Kai-Heng Yu, Yi-Hong Chen
Executive editor：Jui-Chuan Loe

Preface

The output value of Taiwan's food industry (excluding Tobacco Manufacturing) in 2018 was 615.3 NTD billion, accounted for 4.4 % (ranked 8th) of the total output value of the manufacturing industry with an increase of 2.18% compared to last year. Along with the development of smart technology, rapid lifestyle changes and the establishment of global interactive cooperation and partnerships, the Taiwan food industry is moving towards diversified and cross-industry integration and transformation based on its mature technologies and management capabilities. Taiwan food industry will be able to contribute its strength to the reliance, abundance and joyful experiences of international dietary requirements, through the creation of roles and values of this new generation that link up global industry chains in the future.

FIRDI was founded on the basis of developmental needs of Taiwan's food industry. Over the past 50 years, we have exploited and developed many of Taiwan's first-hand products or pioneered technologies in Asia and even in the world. To fit in the trends of global food markets, FIRDI initiated new positioning strategies and projects in 2018. These were carried out via design and manufacturing of high texture foods. FIRDI tapped into the technologies required by the food industry from raw materials and processes/equipment/packaging to channels/consumption through food texture design construction platform, characteristic strain application platform, particulates contained beverages aseptic process test platform , and smart cooking equipment and quality prediction technology platform. In addition, high quality production trial fields were set up, and this core energy was extended to the food additives and ingredients industries, manufacturing industries, food services, and wholesale/distribution industries, etc. for the promotion of healthy texture-oriented food innovation.

The clean label of food has become an important global trend, of which FIRDI has also been trumpeting to all sectors for the past several years. FIRDI have also devoted entirely to the development of new concept products, of which, a number of innovative, clean labeling items have been launched. In the year of 2018, the development of novel, original and differentiated products such as plant protein-based vegan meat, instant rice, non-phosphate restructured meat slices for hot pot, boneless pork knuckle products, dried fruit rolls products without artificial additives, betacyanin-rich chicken jerky product and biotransformed healthy wheat bran ingredient have been performed.

The Southern Taiwan Service Center of FIRDI continues to operate the Chiayi Industry Innovation and Research Center of the Ministry of Economic Affairs and assists local industries in Southern Taiwan with the implementation of resource integration, innovation and development, together with the enhancement of the integrated innovation of food processing and equipment. The first EHEDG approved sanitary and hygienic design testing laboratory in Asia was set up to assist Taiwan's food machinery equipment and parts industry in obtaining international certification for continuous value addition. In the meantime, deepen the energy of the aseptic process and the rapid commercialization service platforms were continued. In 2018, the establishment of key equipment and process technologies for particulates contained beverages and formulaic nutrition drinks was done services of pilot-run production and customized services for particulates contained beverages, can be provided, which can assisted traditional food companies in entering the high-value nutritional beverage market.

In terms of biological resource services and innovation, the Bioresource Collection and Research Center (BCRC) of FIRDI is not only the sole biological resource storage provider in Taiwan, but also serves as an important foundation for supporting the development of Taiwan's biotechnology industry. In 2018, works on maintaining and operating high-quality management and services continued, and have obtained numerous international accreditations (new versions) and assessments. Meanwhile, in response to the Ministry of Health and Welfare opened cell therapy program, the unique, high-grade cell resources and service capacity of BCRC as well as the laboratory that conforms to the relevant specifications of Good Tissue Practice (GTP) has enabled BCRC to effectively support the development of regenerative medicine and cell therapy studies. Additionally, in recent years, Taiwan's first service platform for the microbial industry has been established, which allows us to proactively assist in promoting microbiology research. The most exciting development is the introduction of leading international prospective microbial identification technology and related services. Aside from being able to help operators to adapt to reformation of international microbial management regulations, effectively enter the market, and expand the global market, it has earned the recognition of the "2018 R&D Service Excellence Award" granted by Ministry of Economic Affairs.

FIRDI, in terms of analysis services, has continued to improve and expand technical capacities of food analysis, and provide ISO 17025 testing services. Analysis Research and Service Center (ARSC) of FIRDI has been accredited as the TFDA and TAF double-certified laboratory, Ministry of Health and Welfare-approved cosmetics inspection laboratory, and an international export qualified inspection laboratory. ARSC provides a number of adulteration identification services for domestic food products. In 2018, ARSC became the first body to obtain the full accreditation of TFDA food additive (preservative) specification tests. Moreover, ARSC has developed a

customized inspection method under the national food safety standard (GB) for special formula foods for medical use to assist industries and their products to enter the market for special formula foods for specific medical use in China.

As for certification services, for the quality assurance of food industry and in line with international standards, the Certification Service Center has been established since 2017 to provide professional and impartial certification services that conform to the ISO standards for the domestic food industry and has become the SQF certification body that complies with the standards recognized by the "Global Food Safety Initiative (GFSI)" at the same time. To broaden the scope of the certification services, the Institute has actively obtained the JAS-ANZ accreditation in Australia in 2018 and has become the certification agency of food in the Food Safety Management System (FSSC 22000). So far, the Institute has helped three companies pass the certifications, which is conducive to the expansion of international channels.

Furthermore, since its establishment, FIRDI has involved in industrial technology services and a professional training services. The advanced food defense system, introduced in the recent years, combines the aspects of food safety, protection, adulteration and quality, is to assist companies in setting up perfect food defense plans thus to enhance export competitiveness based on the intellect and action of risk prevention. The FIRDI Academy was founded in 2015 and refines the quality of training courses and offers competence appraisal services for industry talent certification that has been certified by the Ministry of Labor, and has also become the training institution of TTQS and international SQF training center at the same time. In addition, to respond accordingly to the urgent demands for food safety management talents in the industry, The FIRDI Academy have taken the lead in introducing Competency-Based Programs in 2018 and have already acquired iCAP certification issued by the Workforce Development Agency, MOL to assist the food industry with improving its talent capabilities and competitiveness.

Over half a century of hard work, FIRDI has become one of the few research institutions in the world that combines with food and biotechnology research and development. 2018 is the first year after celebrating our institute's 50th anniversary, and in order to open a new era and forge ahead vigorously, the "2018 FIRDI Prospective Advanced Consensus Camp" was organized in November, 2018 and government-industry-university-institute specialists and senior research fellows of our institute were invited. This camp aimed to develop a common consensus for future advancement and promotion in the four aspects of "positioning", "R&D", "talent", and "financial affairs". It is expected that the colleagues at FIRDI can continuously promote the progressive development of the food business. Optimistically, ongoing support and encouragement can be given by all sectors of the community to collectively make contributions to the development of Taiwan's food and biotechnology industry.

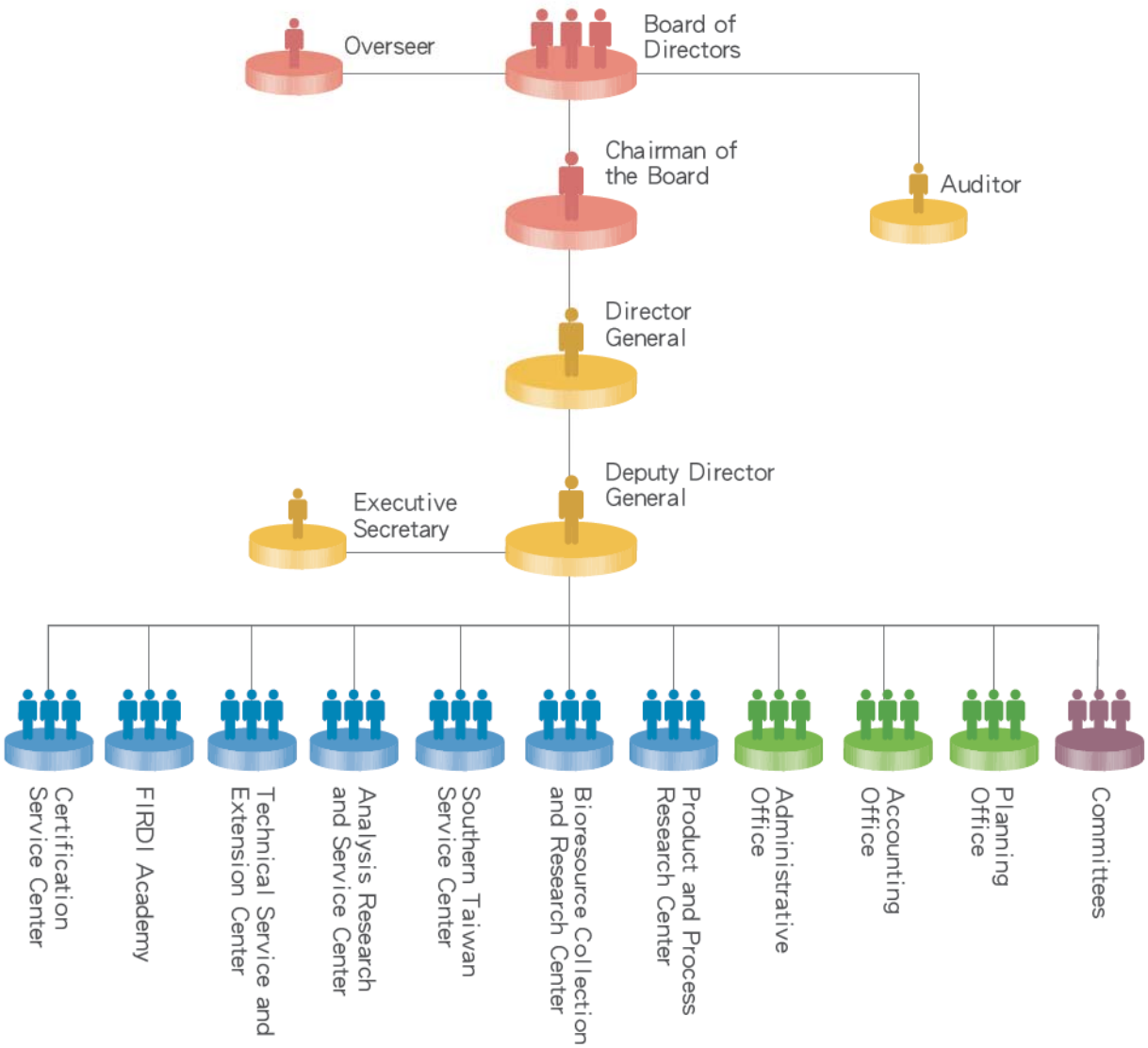
Director General

Chii-Cherng Liao

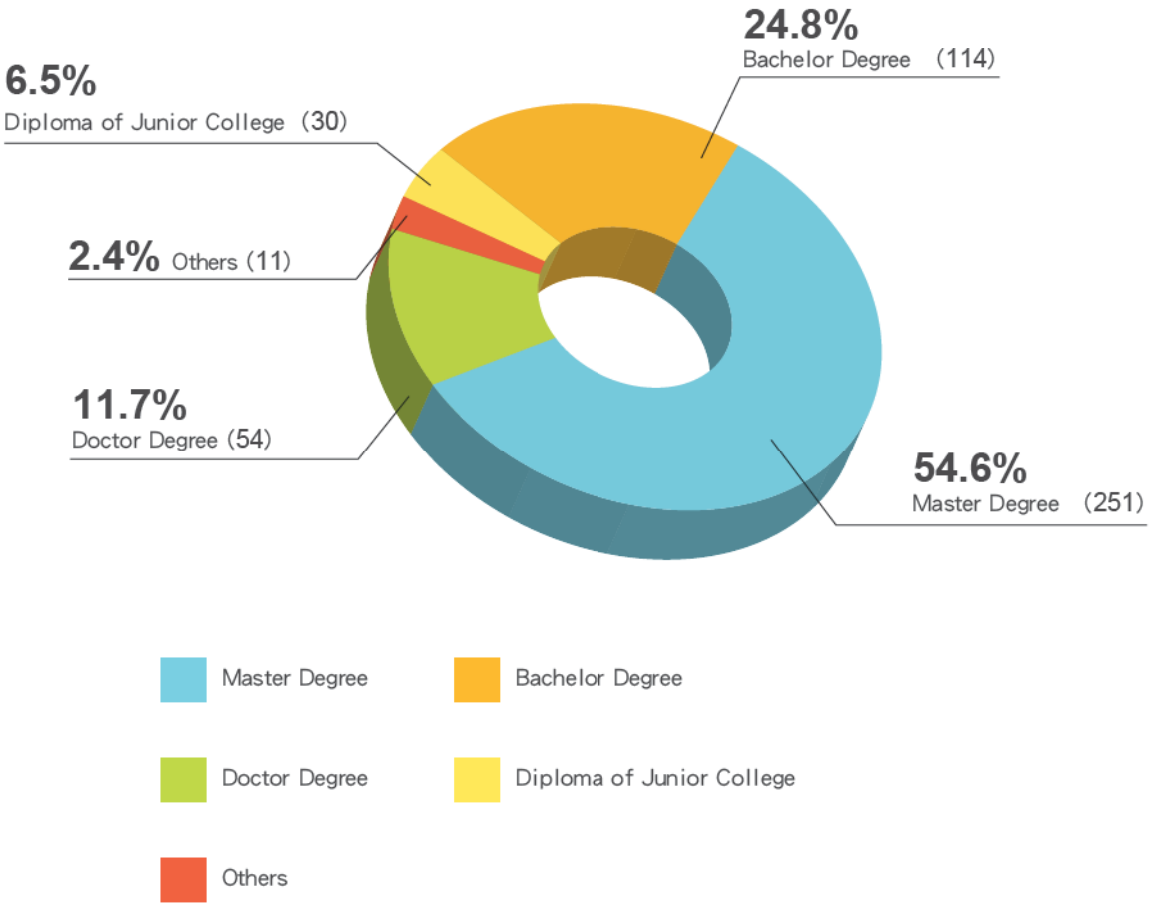
Chii-Cherng Liao
April, 2019

Organization and Human Resources

Organization



Human Resources



Number of employees：460（Dec. 2018）

Technical Research and Development

【Research and Development on Products and Processes】

Commercialization and value-addition of agricultural raw materials

Dried fruit rolls products : Using heat pump drying technology and degraded materials, dried fruit rolls products were developed. FIRDI can provide product formulation, process condition, packaging, and analysis technology to the industries.

Powder of stewed sauce products : Drying technology was used to develop the powder of stewed sauce products for keeping good flavor. FIRDI provide assistance to potential customers to established the process and product specifications, as well as analyzing the quality and advanced glycation of the end products. Aiming to develop safe and delicious powder of stewed sauces, which are easy to transport that is beneficially for overseas market promotions.

Betacyanin-rich chicken jerky products : The meat products were developed by natural pigments retained technology, using beet roots or dragon fruits, applied onto chicken breast so that the pale appearance and dried mouth feel can be improved. This technology not only increases red color to 40% of meat products but also improves natural pigment retained ratio to 23%. This specific chicken jerky product has healthy and clean label concepts that satisfy the market trends and consumer's requirements.

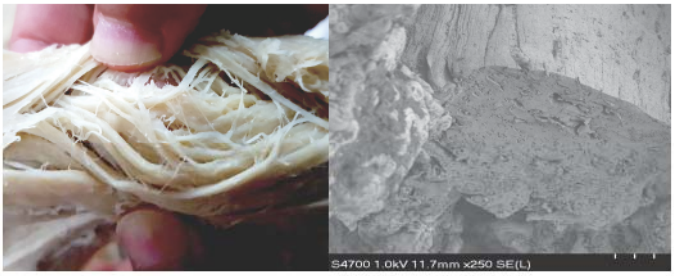
Noodles by two-stage drying : Compare with the heat pump drying, noodles treated by heat pump and radio frequency drying can shorten drying time by 50%. During the radio frequency drying, the temperature of the noodles is above 60℃, which could efficiently eliminate the eggs of flour pest insects.

Development of non-additive fruit rolls products

Powder of stewed sauce products

Betacyanin-rich chicken jerky product

Noodles of two-stage drying–"heat pump and radio frequency drying techniques" Drying time can be shorten by 50%



Flesh-like muscle fiber bundle of meat analogues

Functional property modifications of food ingredients and food texture design

A semi-continuous process of anisotropic structure of meat analogues : Mild and controllable low shear and heating operations that resulted in an anisotropic structure, which gave the meat analogues a flesh-like muscle fiber bundle. The products can be directly prepared and consumed, of which, secondary processes using food additives, are not required. This technique not only could meet the consuming trends of clean label, but also could further be used for the design of tailor-made fiber structures for other plant protein-based materials, and develop innovative food products.

Formulation design and processing technology for noodles of diverse shapes : This technique can be used to design a noodle shape that provides unique textural properties. The multi-configuration design is advantageous in terms of reducing cooking time and at the same time retaining the quality characteristics of the product. In conclusion, this technique provides different dietary experiences and various perceptions of the texture.

Technique for analysis of the rheological properties of the wheat dough by the mixolab instrument and the measurement technology of surface electromyograph for assessing the food texture were established. These techniques can grasp the key factors of dough quality and be a useful tool for product developments that meet different consumption needs.

A semi-continuous process of simple shear operation for anisotropic structure of meat analogues

1. Heart-shaped Asian noodles

2. Polygonal noodle extruder

3. Dough rheological behavior analysis-Mixolab2

4. sEMG chewing behavior analysis

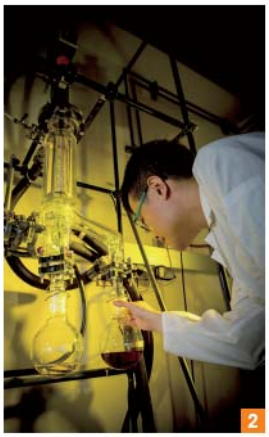
Biotransformed healthy wheat bran:

The wheat bran was biotransformed by yeast fermentation and cellulase hydrolysis process. The tightly folded structure of wheat bran was unfolded by the biotransformation process. The soluble dietary fiber content, eating quality as well as processing suitability of the biotransformed bran-containing breads was effectively improved. The biotransformed wheat bran has high-quality probiotic characteristics, and can be used to develop delicious high dietary fiber or whole wheat baking product with low glycemic index.

Biotransformed healthy wheat bran and biotransformed bran-containing breads

Development and application of food texture controlling technology

1



2

3

1,2.Separation sesamin from by-product of sesame oil refining

3. Preparation of flavor microcapsules by membrane emulsification technique

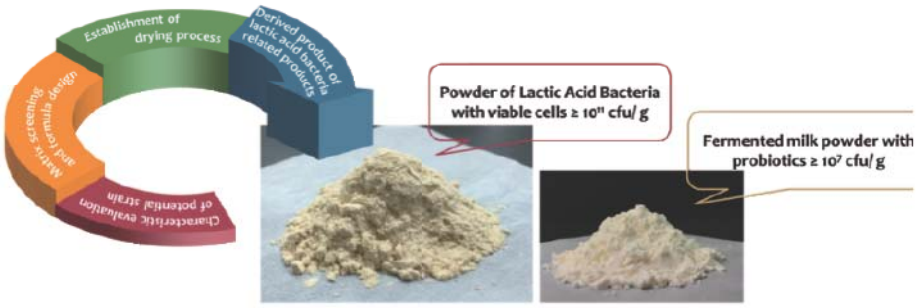
Ingredients extraction technology :

Subcritical water extraction (SWE) utilizes hot water (100℃≤T≤374℃) under an appropriate pressure (1-8 MPa), which can maintain water in the condensed phase. This technology has been shown to be effective in improving the efficiency of organic bioactive components extraction through enhancing the matrix permeability and reducing the dielectric constant, surface tension, and viscosity. In this study, an SWE system was designed and developed in FIRDI. This system was utilized for plant fibers extraction and the results were compared to those of conventional methods. The results showed that SWE has shortened the extraction time by over 40 %, increased the yield of soluble fiber by 20 %, and reduced the product loss.

Food ingredients purification : Molecular distillation technique separates the components of a mixture according to the different mean free paths of molecular movement under high vacuum condition. Thus, low-temperature operation and high performance of separation are among the benefits of this technique. In this study, a sesamin rich fraction (sesamin purity > 30%) was obtained from a by-product of sesame oil refining with the sesamin purity of about 1.5% using two-stage molecular distillation process.

Technology for production of flavor microcapsules: The membrane emulsification technique allows flavor materials to pass through a porous glass membrane (Shirasu Porous Glass, SPG) at low pressure (30-40kPa) to form oil-in-water (O/W) emulsions. This technique can combine with spray drying for the preparation of flavor microcapsules. Low energy consumption, the uniform particle size of emulsions and narrow particle size distribution are among the benefits of this technique. The encapsulation efficiency in this method is greater than 85%, and 90% of the flavor materials in the product can also be retained using this method.

Development and application of multiple emulsions : Multiple emulsion was developed using fish oil by oil-in-water-in-oil (O/M/O) emulsion, and the formulated solution with both glutathione and curcumin in-oil-in-water emulsion in specific microcapsules system was established. This specific microcapsule product presented a rather promising achievement in terms of liver protection by animal studies. In addition, a proper formulation maintaining the viable cell number of lactic acid bacteria up to 10^{11}cfu/g was also developed. It is possible for providing enterprises with the bases of these techniques to get stronger competitiveness by developing powerful and diverse products.



Powder preparation of lactic acid bacteria with proper formulation

Product developments for clean labeling concept

Instant rice : Porous structure of food materials, such as rice, was formed via innovation patents "the hot air expansion technology" (I630876, I626895, JP6362653B) and "the airflow type utility model" (M548447, ZL201720890068.0). This process was suitable for developments of instant foods and non-fried foods. The instant rice had many features, such as rehydrate faster, uniform structure, kept the grain appearance, and similar mouth felt that was as delicious as of the cooked rice by only microwave heating for 3 minutes. This technology has been transferred to four manufacturers, of which Yuan Shun Food Co. Ltd. at the 2018 Taipei Food Show had exhibited the "Instant Rice with Mushroom". It is expected to expand the instant rice market by diversifying its taste.

Instant rice

Plant protein-based vegan meat : Multi-dimensional fiber structures produced from innovative technologies of semi-continuous simple shear process for vegan meats using plant proteins were developed. The products can be directly prepared and consumed, of which, secondary processes using food additives are not required. This also meets the global market trends of less additives, more health and meat protein alternatives.

Plant protein-based vegan meats

Phosphate-free restructured pork slice : Through screening and formulation design of animal-based and plant-based proteins and polysaccharide materials, the natural phosphate substitutes were developed. Combined with process control technology, improvements in adhesion strength and water retention capacity of restructured pork slice in the absence of artificial phosphate were achieved. The restructured pork slice remained its appearance and intact after frozen slicing.

Application of sensing techniques on the food manufacturing process

The near-infrared spectroscopy sensing technique : Near-infrared spectroscopy (NIRS) was used to set up nondestructive tests for raw materials, half-finished products and final products for abundant, fast and accuracy identifications. It has been applied for the measurement of pork floss. It could be applied in fields, such as improvements in product quality and in efficiency of process quality control.

An optical approach for monitoring food processing and controlling quality targets : This is an integrated technology consisting of food science, electro-optics, and chemometrics data multivariate processes. The principal goals are to search for critical quality targets and establish customized quality parameters (i.e. criteria) for raw materials, food processing, and final products. Real-time detection could be performed by constructing optical predictive models. Two steps were involved in this technique, correlating spectrum with the results of chemical/sensory analysis of quality targets and selecting the representative wavelength. Detective parameters had been established for controlling sausage formulation and roast terminating point of pork floss. This technology could be used for collecting big data, leading the food industry towards the development of intelligent manufacturing.

Development of senior-friendly foods

The development of senior-friendly food texture levels : To prevent the occurrence of sarcopenia and aspiration, the texture modified food can improve the malnutrition and weight loss of the elderly people. This research started in 2017, integrations of several standards for food texture levels and establish an analysis operating procedure of texture measurement suitable for the food industry to develop senior-friendly food in Taiwan were achieved in 2018. The texture analysis of 10 categories of 53 solid foods and 5 categories of 12 semi-solid food textures has been finished and building solid and semi-solid senior-friendly food texture grading system,

which could be used by food operators to develop texture modified products and quality management basis.

Development of the commercialization processing for diversified elderly foods : Technology platform for commercialization processing services for diversified elderly foods was continuously strengthened. Compound enzyme treatment, heating with high pressure and high temperature, formulation design and beverage preparation technology were integrated for application of product developments. The technology platform could help the industry to establish processes for the creation of product features meeting elderly market demands, including improvements in terms of eating pleasure of those who have chewing and swallowing difficulties, and providing eating conveniences of quality protein meals, or offering more choices of products with clean labeling concept.

Seniors-friendly food appraise and elect event : To expand the application of Taiwan domestic agricultural products and to promote the food industry developing senior-friendly food, "The Third Senior-friendly Food Appraise and Elect Event" was held. Total of 27 senior-friendly foods were awarded, and a sensory evaluation and awards ceremony was held at the "2018 Taipei International Food Show". Also, other promotional activities such as product displaying and food preference tests were shown in "The Senior-friendly Food Zone" set up at the Agricultural Health Museum in "2018 Healthcare Expo Taiwan ".

Texture analysis of solid and semi-solid foods

1. The Senior-friendly Food Awards Ceremony in the Taipei International Food Show (2018.6.27 ~6. 30)
2. The establishment of Senor-friendly Food Zone in 2018 Healthcare Expo Taiwan (2018.11.29 ~ 12.02)

Development examples of the diversified elderly food products

Sensory evaluation of the elderly panel (from sports groups, care institutions etc.)

【Integration in Processes and Equipment】

Development of key equipment and processing technology for particulates contained beverage

Aseptic processing and packaging pilot test of particulates contained beverage： The colloidal cross-linking process technology was applied for the development of innovated colloidal particulates contained beverage products. The ultra-high-temperature processing platform was used to evaluate heat resistance and fluidity of these colloidal particulates contained beverage products. The combination of the liquid food production equipment and process optimization technology, FIRDI is capable for providing customized process design and product storage stability assessment according to the manufacturing equipment available of the delegates. Providing customized pilot test of particulates contained beverage services could contribute the product development in respect to reductions of the developmental duration.

Development of key equipment and processes for particulates contained beverage： The particulates contained beverage markets are one

of the future beverage market trends. However, when conducting high temperature sterilization during aseptic processing, the maintenance for the appearance integrity of food particles is still the technical bottleneck. An aseptic rotary lobe pump, which could transport food particles intact and maintain the pipe pressure simultaneously, has been developed. The aseptic rotary lobe pump also fulfilled the EHEDG guidelines of testing method and proved for accomplishing cleanability, steam sterilization and bacterial tightness. This technology could assist the food industries for new beverage items innovations and move to the "high-tech and high-value" aseptic particulates contained beverage market.

Aseptic rotary lobe pump

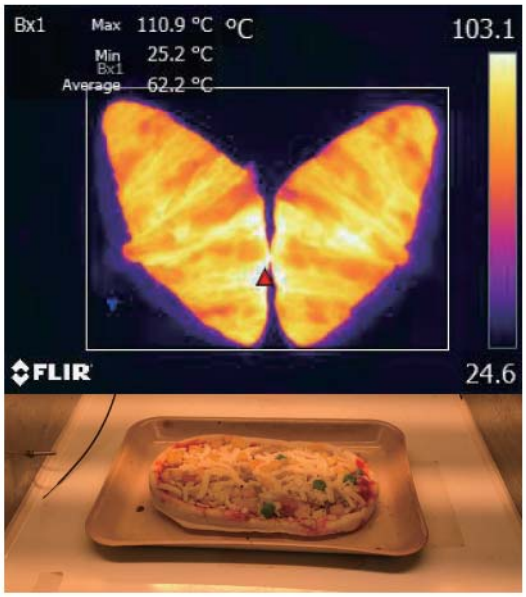
Smart cooking system and quality predication technology for prepared foods

The integration of cooking machine and smart components : A microwave heating system with commodity barcode coding technology was established. Using information technology and programming skills, product information with respect of reheating conditions were recorded in the barcode. By scanning the barcodes, this smart cooking system could automatically read the cooking process information stored in the barcode and judge which energy sources to be used, such as hot air and infrared, as well as adjusting ambient temperature changes with "auto ambient temperature sensing feedback control module" for reheating to get the ideal food quality and texture.

Hybrid Energy Smart Cooking System

Development of materials for ovenable containers for prepared foods : The materials used in this container were selected by chemical migration, deformation test and packaging surface analysis to ensure food packaging safety. The ovenable containers were developed by combination of wave shape design and skin lamination, which could be heated to a maximum temperature of 200℃ for 30 min.. Moreover, food in the containers could be heated more uniform. This container could be used for all type of foods and sealed by conventional sealing machine. This package is suitable for microwave, oven and microwave combination heating systems for convenient stores, restaurants or office bars.

Microwave hybrid reheating techniques and quality assessments for prepared food : An evaluation platform that consisted of hybrid energy for heating (microwave, infrared and hot air) and quality assessments technologies was developed. This platform could rapidly produce reliable information, which allowed reheating condition database to be setup for the smart cooking machine for reheating pre-baked prepared food precisely. All results acquired from this platform in respects of temperature, color, texture feedbacks and sensory evaluations for reheating processing could be used for information database setup, which acted as a basis of this smart cooking system.



Establishment of correlation in energy reheating and quality assessments parameters

【Services and Value Addition of Bioresources】

Operation quality improvement of BCRC

BCRC received multiple quality management certifications : BCRC of FIRDI is the only bioresource repository in Taiwan. It aims to continuously improve and maintain a world-class bioresource bank and provide diversified services to the industry, and actively participate in the development of the bio-economic industry. In 2018, BCRC acquired the updated ISO 9001:2015 and ISO 17034 certifications and also passed ISO 17025 annual evaluation to ensure continuous delivery of high quality services. In this year, BCRC received a total of 106 deposit requests of biomaterials, and assisted over 30 local companies and 5 overseas universities (from Japan, Italy, Bahrain and China) to preserve a total of 586 important biomaterials. This shows that the preservation and management quality of BCRC has been recognized by the scientific communities all over the world.

BCRC provided a total of 5,270 batches of biological resources, and completed 1,157 cases of commissioned testing and identification services during the year, actively assisting the development of the bio-industry.

Lobby and show room of BCRC

GTP lab. for cell and tissue processing

Expanding diverse cellular resources and research for supporting cell therapy industry development : BCRC has continued to expand the diverse aspects of cell bank resource conservation. One continuously works on the collection and preservation of the various special cells from domestic research units, and also participates in the "Human Disease Induced Pluripotent Stem Cell (iPSC) Service Alliance" to collect the iPSC of the healthy and of the disease donors. Till now, BCRC has collected more than 600 cell lines in the cell bank, and provided more than 1,600 batches each year. Hence, a reputed international cell bank one has become.

In view of the fact that the Ministry of Health and Welfare has specialized open six kinds of cell therapy programs for related indications. BCRC has independently developed various stem cell resources close to clinical needs and can provide GTP level operational laboratory for human cell tissue processing and with cell culture, storage, assays, and etc. technical services in response to the high demand for the development of the cell therapy industry.

Exploration and development of diversified fungal resources of Taiwan : BCRC newly collected 450 local fungal resources of Taiwan this year, consists of more than 150 species of 105 genera, including new species of Taiwan, endophytic fungi from agarwood, entomopathogenic fungi, Trichoderma and plant pathogenic fungi. They can be used in the development of agricultural products. Combining the resources with plant pathogen testing and product verification technologies, BCRC not only further improve the green agricultural development but also maintain food safety. At present, there are 471 strains of Cordyceps resources preserved in BCRC, including over 30 medicinal and health beneficial

BCRC Liquid nitrogen storage room

Cordyceps species such as *Cordyceps sinensis*, *Cordyceps militaris*, *Cordyceps sobolifera* and native Cordyceps species of Taiwan. BCRC is currently exploring their health benefits and further developing potential strains.

Industrial applications of biological resources

Establishment of a microbiome service platform to promote the development of biotechnology : Microbiome is the emerging technology trend and an important direction of the biotech industry development. BCRC pioneers in the research of microbiome and is establishing the first microbiome service platform in Taiwan. This year we continue to develop three core technologies including culture, preservation and detection of key indicator bacteria, culture and screening of intestinal microorganisms, and microbial bioinformatics. Currently, BCRC provides related services to assist researchers and bio-industry development.

Mushroom products development and mushroom industry expansion : BCRC continues the effort to preserve edible mushroom resources and introduce new varieties of commercial mushroom species, such as *Morchella* (morel), *Hericium erinaceus* (Lion's Mane Mushroom), *Tremella fuciformis* and *Ganoderma lucidum* to enrich the domestic mushroom resources for industrial applications. In addition, mononuclear strain libraries of four mating types of 921 shiitake mushroom varieties were established to prevent cultivated strains from deterioration. Besides, BCRC establishes fermentation, enzyme conversion, extraction, composition analysis and formulation technologies for edible and medicinal fungi to assist the industry in products processing.

BCRC held technical workshops to assist the development of the mushroom industry in rural areas. Through the mushroom industry alliance, BCRC was able to connect upstream and downstream operators and promote the export

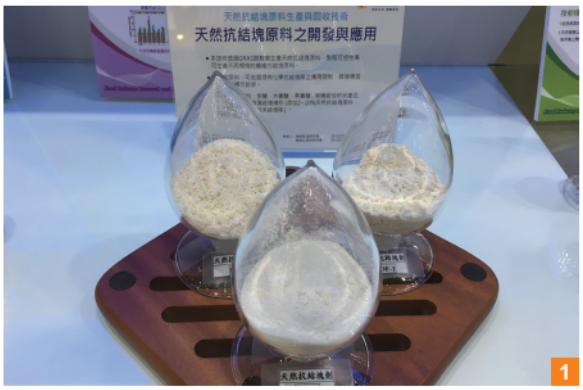
of mushroom products. Also, spent mushroom compost was used to develop a variety of applications such as plant pathogen inhibitors, soil amendments and animal feeds to facilitate creating a green recycling agricultural system for the mushroom industry.

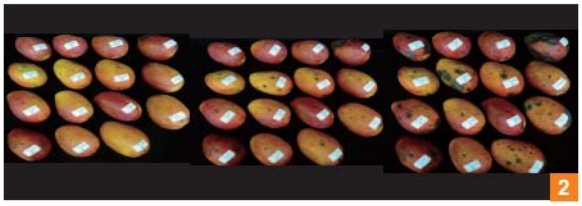
Mushroom product exploitation and industrial development results exhibition took place in Hsinchu on Nov. 11th, 2018.

Establishment of yeast strain library and its application development : To benefit the innovation and development of food industry, BCRC has been establishing the specialized commercial yeast bank by collecting the potential strains, investigating their characteristics, and analyzing the results of the fermentation process in baking, brewing or special flavor producing. Related techniques in yeast application have being developed for constructing the whole supplied chain of commercial use. In 2018, the optimization of yeast production, starter preparation, extraction, enzymatic hydrolysis, conversion, and fermentation technology were also investigated. The research in natural flavor ingredients from yeast was also developed to respond to the global clean label trend.

Screening and evaluation platform of biological control for fruit decay and product design diversify : Along with the establishment of the developing platform of the natural antagonists, BCRC had explored a fruit preservative with higher efficiency and met the clean label requirement. Moreover, the target compound combined with the hurdle techniques could perform a much better result in both dosage and target claims. By the aid of formulation design, this natural preservative exhibits an effective antagonistic outcome for fruit preservation, simply with spraying or soaking handling.

Additionally, BCRC had also proposed a new technique concerned with the bacterial cellulose as an alternative to protect the food ingredient from caking/agglomeration during the processing or end use. After the modification of the fermentation process and transformation, the titer of bacterial cellulose production from Acetobacter has been improved significantly. Now, this technique could provide a rather shining opportunity to replace the anti-caking chemical in food processing.





1.Development of natural anticaking agent with *Gluconacetobacter xylinus*

2.Screening of potential microorganisms as biological antagonists for protection of fresh fruit from damage of postharvest distribution, e.g. Mango treatment with *Aureobasidium pullulans* broth

Industrial Services

Mei-Yueh Ho, National Policy Advisors to the President, visited CIIC on October 31st, 2018.

【Operating Chiayi Industry Innovation and Research Center (CIIC), MOEA】

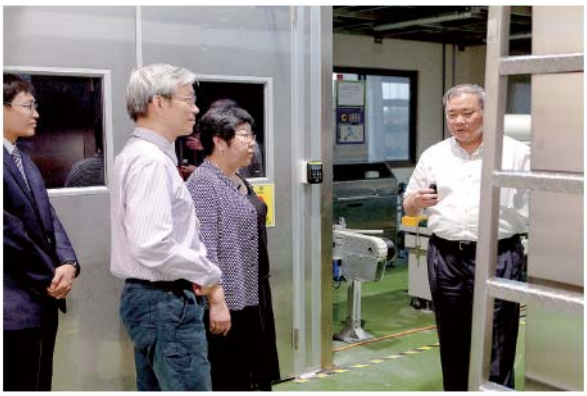
The Ministry of Economic Affairs (MOEA) has assigned FIRDI to operate the administration and research functions of the CIIC since 2011. FIRDI has been expected to promote CIIC as the benchmark for innovation and as a health-oriented technology transfer and application center by integrating resources of industries, government, academia and research institutes in Southern Taiwan.

Integrating service capacity to assist local industry in innovative research： In 2018, CIIC had visited 120 firms for R&D problem-solving services. Moreover, 45 conferences and training courses were held, providing 1,675 attendees with professional knowledge. Furthermore, the Food Safety Inspection Center established in 2011 has served 269 firms, providing a more convenient and faster testing service for the local food industry. Additionally, the 9 research communities formed by the research institutes stationed in CIIC have held 19 forums on specific subjects, expecting to stimulate innovative ideas and cooperative opportunities within these knowledge-sharing platforms.

Integrating institute resources to promote innovation of industrial technology： To promote the "Demand-planning of Local Specialty Industries", one has integrated the capacities of the four research institutes stationed in CIIC, which provides technology service model for

the implementation of pilot production, real-life experience, and the commercialization to assist technology upgrading of local industry. In 2018, there were 13 firms working with research institutes in CIIC as business tenants and 47 times pilot plant services were provided correspondingly. Meanwhile, in 2018, CIIC has assisted 10 cases of firms to obtain central/local government R&D subsidies with 9,350,000 NTD in total.

Promoting cooperation of academia and research institutes to serve local industry : CIIC constructed and operated the Research Resource Integration and Service Network (RRISN) website by integrating resources of the academia and research institutes in Chiayi/Yunlin. Thus far, CIIC has 4 research institutes and 8 colleges in Chiayi/Yunlin already uploaded their service information and R&D outcomes to this website. Registered website members of RRISN platform would receive updated information in varies forms, such as weekly newsletters, which hopefully could lead to a higher page view counts for the websites. There are 100,000 views accumulated since the website launched in 2013. Moreover, CIIC signed the "Cooperative Strategic Alliance Agreement of Douliu Industrial Park", looking forward to help local industries become more prosperous with a firming interaction and training cooperation.



Hsiao-Hung Chen, member of the Control Yuan, visited FIRDI's pilot plant in CIIC on September 10th, 2018.

CIIC has won the Excellent Intelligent Building in 2018 while FIRDI also received the Intelligent Building Contribution Prize.

【Offshore Islands Food Industry Innovation and Upgrading Promotion】

Establishment of offshore island industrial development consulting service platform: In 2018, FIRDI's work has continued in collaboration with National Quemoy University, National Penghu University of Science and Technology and Matsu Souvenir Development Association to establish the "Food Industry Development Consulting Service Platform" in Kinmen, Matsu and Penghu. The purpose for setting up this platform was to offer immediate and comprehensive counseling/consulting and assistance for local industries. A total of 45 cases of industrial consulting service have been successfully completed this year.

Consultation and diagnosis of offshore island specialty food industry upgrading : Targeting the three offshore island counties, Kinmen,

Matsu and Penghu, a consulting/counseling group organized by food technology experts has been formed. The purpose was to assist companies and manufacturers in implementing autonomous administration of the food industry through visits paid to the factories. A total of 80 health management inspections and technical consultations have been successfully completed this year, together with 4 forums held. In addition, through seminar activities, promotion of food hygiene and safety management and raw material control, as well as upgrading production process technology, a total of 7 sessions have been conducted.

Industry advancement and promotion of offshore island specialty food industry: Prospective manufacturers and companies with business opportunity potential were appraised and selected based on local characteristic resources. The assistance of key process technology introduction was given to enhance the connection between the local industries with outstanding characters of offshore islands and the requirements of safety, peace of mind and health as demanded by consumers. A total of 18 promotion projects have been successfully completed this year.

For Kinmen County, commercialization of aged beef, instant Kaoliang sour Chinese cabbage with beef, distillers' grains with free-range chicken concentrated chicken essence, dried dragon fruit, honey vinegar and seaweed floss has been accomplished. For Matsu County, apart from the development of a number of specialty gifts and products including Kaoliang chocolate liqueur, Daqiu senbei deer crackers, roselle jam and Blue Tears facial masks, assistance in strengthening winemaking ability has also been provided to the wineries in Matsu. As for Penghu County, the following achievements had been done, the upgrading of black sugar cake, the development of ready-to-eat seafood products and lactic acid cabbage packaging at room temperature, the improvement of XO sauce filling equipment and seafood sauce pack quality control technology. Furthermore, the expansion of marketing channels for offshore island specialties has been accomplished. A total of 6 exhibitions have been held.

1. DIY chocolate liqueur with fruit filling
2. Souvenir chocolates with battlefield slogans

【Guidance on Upgrading of Food Industry】

Innovation technology integration and development of specialty food ingredients for export expansion : Through the consultation service of the food industry by the experts, the core technical needs and instant assistance for the potential manufacturers who were doing innovative research in development stage for the

special foods of new southbound export were given. In 2018, the team had visited 18 factories including baked foods, prepared foods, meat products, condiments, health drinks and dairy products to assist in the improvement of process of fish floss, the introduction of enzyme beverage sterilization equipment, the improvement of the texture of stuffing baking products, and the establishment of bug eggs and microbial sterilization techniques of spices, respectively.

To coach prepared foods industry process innovation and upgrades : A core technology platform had been established, which assisted not only product improvements but also speed up commercialization, as well as coached industrial upgrading and transformation. In 2018, the team had coached 15 factories, including high stability oil powder, extruded instant grain powder, multi grain fermented drink, shelf-stable and aseptic packaged Corbicula fluminea soup, shelf-stable packaged Thai style sauce, less artificial additive meat products, functional chlorella products and other products. The development of high barrier packaging materials using deposition film technology was also achieved.

Promotion of smart food manufacturing: The team had gathered the requirements from food manufacturers and equipment suppliers, together with the team's expertise, for the purpose of further establishment in consultancy services, promoting smart processing machine, information communication platform and the other integration services. The team had developed new ways to increase the flexibility of the production lines, open-up visibility into the supply chain and increase transparency into processes to meet required all related standards and regulations. In 2018, consultancies and solutions to 33 companies and 40 employees trainings were provided. Moreover, 5 companies were also assisted for the introduction of process visualization platform, digitalization of machine status and real-time quality monitoring as well as the control module to increase productivity and efficiency.

[Food Quality Assurance Services]

Food factory Good Hygienic Practice guidance : In response to globalization and promotion of exports, efforts were made to plan and promote international verification systems. This year, services in food factory Good Hygienic Practice (GHP) guidance, raw material supplier counseling and technology consultation & diagnosis were offered to 340 factories. In addition, assistance was provided to 34 factories to carry out industrial upgrade and transformation, which includes raw material supplier management, process optimization & automation and labor reduction. Furthermore, seminars and training courses on related topics as well as on market dynamics and key industrial event analysis were provided to help the establishment and implementation of GHP regulations and process management, improving the quality assurance capabilities for the industry.

Establish Food Protection Systems for food factory to fulfill global new food safety trend : To strengthen and expand food industry's export capability plus to connect with the international market, FIRDI developed "Food Protection System". This System was based on risk preventions and incorporates aspects of Food Safety (FS), Food Defense (FD), Food Fraud (FF) and Food Quality (FQ).

In 2018, FRIDI provided assistance service to 50 factories for the implementation of Food Protection Plan by using Food Protection Plan Builder (FPPB). Not only established technical

Sensory technique on determination of food decomposition workshop on Oct. 4th, 2018

information for each risk criteria of FD and FF, but also an English version were incorporate into FPPB. In order to optimize business management environment and regarding the common export issues, two guidance documents about export issues were composed.

Promote catering providers to implement food safety self-control system: In 2018, FIRDI had conducted HACCP inspections on 105 hotels, schools, medical institutions, sales stores, central kitchens, and restaurants, and offered 2 audit consensus camps and 1 hygiene seminar. In addition, refer to foreign government guidance, FIRDI also incorporated modularization for Dishes preparation into 3 types. This will be more practical for catering to perform the HACCP system.

Promoting Food Hygienic Management System for manufacturers of thermally processed foods packed in hermetically sealed containers : FIRDI had accomplished surveys for manufacturers of thermally processed foods packed in hermetically sealed containers, build up electronic data bases with all information feedbacks for future references and searching, and list of FAQs for food canning industry. 15 canning companies were counseled for the setup of food safety management system and were integrated into daily production system successfully. 20 companies that produced food sauces with low water activity were counseled for their improvement in hygienic control system. Last but not the least, to introduce and promote Food Hygienic Management System, conferences with producers, officers and technical experts were held and SOP for food sauces manufacturers were published.

At the same time, other activities, such as researches and questionnaires a total of 208 companies in the market for the sale of condiments in closed containers, a consensus meeting of the health unit, a briefing session for the establishment of the industry, and examples of standard operating procedures for the preparation of seasoning food manufacturers

were carried out. These activities were all to assist the industry to meet Act Governing Food Safety and Sanitation and other relevant regulations.

Food supply chain management and counseling: In 2018, we have aided 202 manufacturers with registered factories to establish their own traceability systems. Moreover, we held meetings with experts and scholars, offered consensus camps for health authorities, and hosted explanation sessions and tutorial classes of electronic upload operation (including practice) for the industry in a hope to help them establish their own food traceability systems.

【Food Industry Analysis and Knowledge Services】

Provide food industry dynamic analysis and industrial knowledge services： Information was collected on policies and regulations that affect domestic and export sales of local food products, new products and new technologies, as well as food product consumption and market development trends. News on market trends were updated monthly, and the number of entries amounted to over 1,000 throughout the year. The food industry knowledge base and the theme community's information on market development trends and analyses were also continuously updated. All information was disseminated and shared to external parties via publications, online articles, emails, seminars, sharing sessions, and conferences. Food industry knowledge bases, theme community membership system, and the ITIS Intelligence Network are also continuously promoted to provide members and communities with first-hand information and trends. Over 15 sessions of keynote addresses or consultancy services regarding industry trend analyses for food associations and manufacturers, including the 2018 International Elder-Friendly Food Development Forum and 6 market analyses and industry innovation seminars held across Northern and Eastern Taiwan.

Publishing the Food Industry Annual and Food Industry Survey Reports： Publication of the 2018 Food Industry Annual which provides a comprehensive overview of the industry in various regions including the United States, Europe, Japan, China, and Southeast Asia. It also analyzes Taiwan's food and related industries and global trending topics of the year such as industrial ecology reforms and big data exploration. It is presented chiefly through graphs and tables, and allowed readers read easily and grasp the key points quickly. Broadening the scope of the Annual, new topics covered in the 2018 edition included analyses of baked goods, alcoholic beverages and dairy products.

The local industry research topics that were conducted and published in 2018 include dairy products, beverages, pork, poultry, and processed fruits and vegetables industries. In promoting innovative products and emergent industries, research and development in the industrial production chain for elderly-friendly foods was incentivized to respond to the aging of society. Taiwanese consumers' food choices were analyzed, and surveys on food demands within Southbound Policy countries and also promoting industry cooperation with countries such as Thailand, Indonesia and Malaysia. Strengthening prospective trend studies and emerging research topics across domain this year, such as the application of emerging technologies such as artificial intelligence (AI), blockchain, and sensor technologies in the food industry. Other topics covered included the circular economy, smart retail, smart precision health care and etc..

Food Analysis

GC IsoLink IRMS System – Food adulteration identification technology

【Optimization of Service Scopes and Quality】

Dual accreditations of the Analysis Research and Service Center : The Analysis Research and Service Center (ARSC) of FIRDI is an ISO 17025 accredited food testing laboratory that provides inspection services which complies with the requirements of international standard. ARSC has been granted 603 accredited testing items from the Taiwan Food and Drug Administration (TFDA) and 651 accreditations from the Taiwan Accreditation Foundation (TAF). The newly accredited items acquired in 2018 include methyl mercury, pesticide residues in foods (373 items), pesticide residues in foods (423 items), *Coliform*, *Pseudomonas aeruginosa*, *Fecal Streptococci* in bottled and packaged drinking water.

TFDA accredited testing laboratory for medicals and cosmetics : To expand consignment services, ARCS passed the accreditation to become the TFDA testing laboratory for medicals and cosmetics. The accredited testing items include aerobic plate counts, *Escherichia coli*, *Staphylococcus aureus*, and *Pseudomonas aeruginosa* in cosmetics.

International accredited and registered testing laboratory : To enhance product export, FIRDI has actively strived to become an accredited testing laboratory registered in many countries. The Institute currently holds accreditations from various countries and

regions: the Export Public Inspection System certificate for 492 items issued by Japan's Ministry of Health, Labour and Welfare; fishery product inspection certificate for 17 items issued by the European Union; drink, vinegar, and wine inspection certificate for 21 items issued by Brazil; fresh crop import (including fruits, vegetables, grains, nuts, and tea) inspection certificate for 184 items issued by the Indonesian Agency for Agriculture Research and Development; maleic acid (anhydride) inspection certificate issued by Singapore; and the National Treasury Agency certificate on plasticizers inspection in alcohol exports for 9 items.

Consultation on laboratory accreditation : To serve and assist the industry in adhering to the Act Governing Food Safety and Sanitation and the Three-tier Quality Assurance System for Food Safety. FIRDI provided consultation services such as hardware planning and personnel training for companies interested in establishing their self-management laboratories of the first-tier quality assurance that meet international standards. FIRDI assist companies hard and strive for becoming a contract laboratory of the industry.

【Deepening Inspection Capacity】

New testing service items : FIRDI continued to add new testing service items. The announce of newly launched testing service this year covers tryptophan in foods, quantitative tests of swine ingredient and golden threadfin bream ingredient, qualitative tests of *Gadus* spp., *Thunnus* spp. and shrimp ingredient, and microbiological analyses of *Clostridium perfringens* and *Bacillus subtilis* in foods. In addition, one also provided full testing service for additive specifications in accordance with the Act Governing Test Methods in Food Additives announced by TFDA. Moreover, in response to the policy "Measures for the Administration of the Registration of Formula Food for Special Medical Use" issued by China, the Institute has established a standard testing method conforming to the national food safety inspection requirements of China to facilitates the export of formula products intended for special medical use in China.

Establishments in adulteration identification techniques : Food adulteration identification and rice grade inspection services of FIRDI are unique in Taiwan. By integrating equipment such as Elemental Analysis-Isotope Ratio Mass Spectrometry (EA-IRMS) and Gas Chromatograph-Ion Mobility Spectrometer (GC-IMS), novel high-value food testing services regarding adulteration can be conducted by examining differences in spectral profiles regarding the ratios of stable isotopes and volatile components in food products. By combining the established databases of volatile flavor compounds, inorganic elements, and free amino acids with multiple eigenvectors, an adulteration detection model for dripped chicken essence products have been constructed. This model can be used for the identification of commercial chicken essence products with substantial accuracy.

Evaluation on product quality and specifications : This evaluation technique can monitor the quality specifications of the specific products. By using statistical analysis techniques, the main component database was established to identify the differences between samples. This procedure could help the industries quickly assess product qualities and enhance the production efficiency. In addition, the quality assessment service of

UPLC (ultra performance liquid chromatography) – Multiple analysis method

food product has been continuously deepened. This evaluation system combines with the gas chromatograph-ion mobility spectrometer (GC-IMS), the chemical analysis technique and the sensory evaluation to establish the database of product quality. Manufacturers could identify the factors affecting product deterioration as product development quality improvement basis and help reduce production time and cost.

Food additive specifications inspection service : FIRDI was supporting the Ministry of Health and Welfare for setting up the development and validation testing protocols for food additives. These protocols can serve as a reference for manufacturers and government inspectors to ensure the safe use and management of food additives. Currently, 41 food additive inspection methods have been developed and verified, 38 inspection methods for specifications were compiled, 36 inspection methods for specifications were revised, and 89 inspection method involving 886 items were established and verified. FIRDI has started full

range of testing services for food additives in order to assist the industry to meet the food additive specifications and to implement independent inspection.

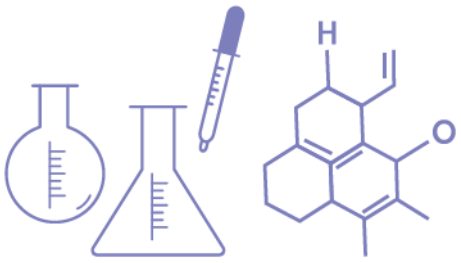
【Expanding Technical Research】

Developing and maintaining the Food Nutrition Database and the Edible Oil Database in Taiwan： The establishment of the "Taiwan Food Composition Database" would not only help to facilitate the study of the dietary habits and dietary characteristics of Taiwan people, but also provide consumers with appropriate food nutrition information and serves as the basis for the establishment of a food nutrition labeling system. In 2018, one continued to accumulate the contents of the database, and assisted in the maintenance and revision of the TFDA network database, as well as replying and handling the public opinions. In addition, the edible oils and fats database were continuously maintained with the needs of food nutrition and hygiene management policy, and hoped to act as the reference for government agencies in terms of management and legislation-wise.

Compiling food adulteration data and constructing the database： An information platform of food adulteration was created. In 2018, collation of non-conformance data of Taiwan border inspection has been increased. In the future, this database will be released to the public to enable their understanding of the possible fraudulent situation of food, thus alerting the food manufacturers.

Evaluation of the application of genetic identification methods to traceability of raw materials of dripped chicken essence products： Single nucleotide polymorphisms (SNPs) are variations of one single nucleotide at a specific position in the genome. SNPs can play an important role in species evolution. In this research, suitable SNP markers for native chickens, commercial white broiler and White Leghorn were selected for the identification of DNA sequence and the confirmation of species specificity. In addition, discrimination of different chicken essence (single high heat high pressure autoclave manufacturing process) extracted from native chickens, commercial white broiler and White Leghorn could also be made by analyzing skin color related gene BCDO2 using high resolution melting (HRM).

Managing new generation biotechnology foods and monitoring transport spillage of GM soybean and corn： For the management of new biotech food, FIRDI has drafted the "Management principle of biotechnology foods derived from genome editing technique", "Management principle of biotechnology foods derived from reverse breeding technique" and "Management principle of biotechnology foods derived from agro-infiltration technique" for the Ministry of Health and Welfare. Furthermore, FIRDI assisted the Council of Agriculture in investigating the GM grain spillage during transportation for GM feed management.



Certification Services

Several types of certification services FIRDI provided includes CAS Taiwan Premium Agricultural Products Certification, Second-level Quality Management Certification, Taiwan Quality Food Certification, FSSC 22000 Certification, and SQF Certification. CAS is recognized by Council of Agriculture, GHP is recognized by Ministry of Health, while other certification services are in compliance with the requirements of ISO 17021, ISO 17065, ISO 22003 and which are accredited by TAF. In order to expand the range of services, FIRDI has also eagerly obtained accreditation for international schemes, including accreditation by JAS-ANZ for SQF scheme and FSSC 22000 scheme.

【Promotion of Government Certification Program】

CAS Taiwan Premium Agricultural Products certification : The key projects of this year were summarized and stated as follows: implementation on surveillance audits and sample testing for CAS certified products, products and processes improvement assistance, on-site inspections, projects meeting, industry symposium, promotion on relevant government regulations, and discussion on the industry development requirements and future direction of CAS.

The seafood quality certification system: For the accreditation of premium seafood product FIRDI has conducted surveillance factory inspections and sample testing. Moreover, one also contributed in the supervision of food safety monitoring plan establishment along with facilities and manufacturing process analysis and improvement. At the same time, FIRDI also held the food safety regulation seminar for seafood industries.

The expansion of accreditation and certification system regulation for agricultural products : As referring to the international agriculture management system and relevant certification scheme requirements, TGAP drafted 7 new categories of brewed food (vinegar), brewed food (soy sauce), miso, ambient temperature products, snacks, and frozen foods (glutinous rice balls) and fillings. The draft for management method of primary processing farm was established. This project was also supported by conducting policy research, educational training, normative review, opinion exchanges meeting, and calibration meeting to provide insights for the government authority. Furthermore, main points for Halal certification implementation are also discussed. This project has extended TGAP further requirements by establishing standard operational procedure and assisting agriculture related industry by giving a clear explanation regarding the potential market requirements and trends in food safety and hygiene management.

Seminar and educational training for the seafood quality certification system

Second-level quality management certification : FIRDI has gained the recognition as an eligible certification body for second-level quality management certification since June 2016. It is a mandatory certification scheme based on the Act Governing Food Safety and Sanitation which is established by the Ministry of Health.

The alcohol quality certification system : In 2018, on behalf of National Treasury Administration, FIRDI has conducted on-site assessment, factories consultation, and new products review for a total of 219 alcoholic beverage products. Additionally, one also took part in revising the alcohol quality certification assessment standard for public regulation and 3 standards for sorghum liquor and beer, and training classes were held regarding technology and process for wine inspection and other related issues.

【Private Certification Schemes】

FSSC 22000 Certification : FSSC 22000 scheme was developed for the food manufacturing companies, managed according to ISO 22000 and ISO 22002-1 standard and now covered up to all food manufacturing related industry. FIRDI has applied for the recognition of FSSC certification body in 2018, and at the end of year, one had successfully achieved the accreditation from Australian accreditation body JAS-ANZ.

SQF Certification : FIRDI has gained the international licensed as the SQF certification body. In this globalization era, SQF as one of the GFSI recognized scheme, is an important option for the local food industry to expand their business range to the international market as well as ensuring their quality assurance system in track with the international standard.

Office assessment is performed by JAS-ANZ assessor in FIRDI.

Taiwan Quality Food Certification (TQF) : FIRDI has gained Taiwan Accreditation Foundation accreditation for the ISO 17065 standard and Taiwan Quality Food certification scheme. The certification service for this scheme was classified to several food sector categories based on the scheme requirements. Moreover, this scheme has aligned with the international standard and FIRDI will actively cooperate with TQF for better integration with the international certification in order to assist local food industry to reduce any barriers for exporting.

ISO 22000 certification : Since 2010, FIRDI has obtained accreditation from TAF as food safety management system certification body. Currently, the certification scope covers a large portion of food manufacturers and will continually expand to those manufacturing and processing enterprises in the food supply chain. In 2018, ISO 22000 has published its new version and FIRDI have held a seminar regarding this topic in order to make the local industry understand the key differences in the updated version.

Industrial Personnel Training

Simulated HACCP audit training for Hotel Food Services

Since its establishment, FIRDI has devoted itself to food-related professional training and has grown to be the largest food industry professional training institution in Taiwan. In 2015, FIRDI Academy was established to develop cross-disciplinary innovative courses and cultivate diverse talents. In order to improve the quality of training services, FIRDI Academy introduced Taiwan Talent Quality-management System (TTQS), and was awarded the Silver Medal for TTQS Training Organization Version in 2017. FIRDI Academy has also become an international SQF training center and provided internationalized training courses. In addition, FIRDI is committed to the combination of curriculum and occupational competency development. The "Basic Principles of HACCP" and "Principles of HACCP (Advanced)" courses had been accredited the iCAP (Integrated Competency and Application) logo by the Workforce Development Agency, Ministry of Labor in 2018. Overall, a total of 221 classes were offered this year and 6,400 people were trained.

【Professional Training and Education】

Training for industry self-management and food protection : FIRDI offered 17 training courses of source management/self-management system of the food industry and trained 484 trainees in 2018. It produced digital micro-courses and a mobile app to create a hybrid interactive learning environment to facilitate the training of industry professionals of micro-enterprise in outlying islands and rural areas. This year, FIRDI also offered 13 classes of food protection and food safety program series and trained 264 trainees; hosted 4 international conferences to enhance the company's ability to respond to international trends in food safety management and expand the global market.

Food hygiene auditing training: Training courses of food regulations, HACCP, food poisoning investigation, and field simulation inspection were offered to train hygiene inspectors from local health bureaus across the country to strengthen the capability of the inspectors. In 2018, 28 classes were offered with 1,169 trainees.

Internationalized training program : The lecturers of FIRDI obtained the qualifications of professional trainers accredited by the Safe Quality Food Institute (SQFI) and the Food Safety Preventive Controls Alliance (FSPCA). In 2018, 2 "Introduction of SQF System "courses, 3 "Preventive Controls Qualified Individual (PCQI)" courses, and 1 "Better Process Control School" course were offered to assist the food industry to be in line with global management systems.

Food safety and regulation training: FIRDI continued offering HACCP courses, and started offering new courses on cross-contamination prevention practices, application and management of food additives, crisis management and risk communication, allergen management practices, and environmental

Training course of the" Spoilage and Decomposition Evaluation Using Sensory Technique"

Training for analysis of alcoholic products

microorganisms monitoring technologies. In addition, it organized a series of international regulations and market trends related courses for the export industry, including FSMA practice, ASEAN food safety regulations and export practices, and Muslim product designing strategies. In addition, for micro-entrepreneurs, FIRDI provided the braised-dishes production course, which combined processing, marketing, packaging design and hygiene regulations. Through practical training sessions and case studies, the course made the road to entrepreneurship more effective.

【Qualification Assessment for Food Industry Talents】

In 2017, FIRDI held qualification assessment of "Food Quality Assurance Engineer" and "Health Food Engineers" for food industry talents. The former certification was issued by the Ministry of Economic Affairs (MOEA), and the latter was issued jointly by FIRDI and the Health Food Society of Taiwan. The assessment was approved by the iPAS program of the Industrial Development Bureau of MOEA. In 2017, 6 assessments were held on 50 examination sites in 118 test rooms with

"Qualification Assessment of Food Industry Talents Symposium "in Taipei on Jan. 10th, 2018

7,229 applicants. In total, 515 "MOEA Certified Food Quality Assurance Associate", 16 "MOEA Certified Food Quality Assurance Specialist", 590 "Professional Health Food Engineer–Entry Level", and 5 "Professional Health Food Engineer-Intermediate Level" were certified. Throughout the year, 1,087 certifications were issued.

In order to promote the qualification assessment, FIRDI hosted two sessions of "Qualification Assessment of Food Industry Talents Symposium" for academics, industry and certified applicants. In addition, cooperation program was promoted to 8 Taiwanese colleges and universities, to encourage group application of the assessment, listing the assessment as one of the graduation requirements; or conducting related workshops and occupational-competency-oriented courses to incorporate the subject matter of the assessment into the teaching plan.

Follow-up surveys were conducted on certified applicants. According to the survey of 1,174 certified applicants, 30% of the certified employees got pay raise or received praise and higher performance rating. Also, 90% of the certified graduates were successfully employed when seeking for the first job, with a median salary of 28,908 NTD for bachelor's degree holders and 36,395 NTD for master's degree holders.

Publication of the "Introduction to Food Quality Assurance" and "Introduction to Food Science and Technology" reference guides

Group photo of 2018 FIRDI Prospective Advanced Consensus Camp

【2018 FIRDI Prospective Advanced Consensus Camp】

To urge future advancement of the institute and to build consensus, the "2018 FIRDI Prospective Advanced Consensus Camp" was held on November 9th and 10th at the North Coast Pacific Hot Spring Hotel Green Bay. In addition to the senior research fellows from each center of FIRDI, many external specialists and professionals including Mr. Bi-Tang Zhang, Chairman of Heysong Corporation, Mr. Rui-Bi Wu, Emeritus Professor of Institute of Food Science and Technology, National Taiwan University, Mr. Zhao-Yi Chen, Chairman of Automotive Research & Testing Center, and Mr. Xin-Hong Chen, Director of Chung-Hua Institution for Economic Research were also invited to partake in the event and offer their valuable suggestions.

First of all, the leaders of each center presented brief reports on prospective advanced planning, aimed at FIRDI's 5 major business areas including overall business development, manpower analysis and cultivation mechanism and 3 major strategies of technological development including artificial intelligence application, interdisciplinary cooperation and Microbiome platform technology. Afterwards, advice and reflections were provided by the experts on the future development of FIRDI, together with exchanges and interactions with participated colleagues. On the second day, the business development forum was held, which was led by the Chairman and Director General to probe into the future direction and strategies from the viewpoint of financial analysis and key business practices.

At the end of the conference, Director General Liao concluded that by proposing a specific direction for future implementation based on the 4 aspects of "positioning, R&D, talent, and financial affairs". With regard to positioning, since the technology service industry was the target to be focused of

the FIRDI, it has been provided with the function of resembling "The Academia Sinica of Taiwan's Food Industry" in practice. However, it requires the practice of not only appropriate segmentation and strategic planning but also rolling scheme reviews to focus on major fields while teaming up with large, SME enterprises and micro-businesses. In respect to R&D, it was essential that FIRDI inverted the perspective from industrial demand to R&D planning and items; one should develop original R&D and an outlook for diverse topics targeting block chain and AI smart technology and combine multiple school resources at the same time for the introduction of innovative ecosystem concepts and mechanisms, activate spatial function and effectiveness by way of "outside-in" methodology. As for talent cultivation, it was recommended that the earmarked system for talent training to be mapped out and established to foster competent persons specialized in cross-domain interface communication. Fourthly, financial affairs, FIRDI should carry out assessments based on the index of overall income, self-help fundraisings and per capita income to increase R&D and service value.

Finally, Chairman Hsieh gave his encouragement and expectation for the food industry colleagues at FIRDI that would continuously push the business focus of FIRDI forward to prospect and progression by the philosophy and attitude of "tomorrow will be better than today, and next year shall be better than this year".

【Officially Become a Qualified FSSC 22000 Certification Body】

After becoming the first independent institution to achieve recognition as "SQF the Safe Quality Food" certification body and training center, in 2018 FIRDI also has officially become the accredited FSSC 22000 certification body. FSSC 22000 is also a recognized Global Food Safety Initiative (GFSI) certification program and a widely accepted food safety certification program for the global food industry. This scheme was established based on the ISO 22000 food safety management system, ISO/TS 22002 prerequisite program and FSSC 22000 additional requirements to ensure the integration with international standard as well as local and international market requirements.


JAS-ANZ
JAS-ANZ ACCREDITED BODY
Food Industry Research and Development Institute
Management Systems Certification

The Certification Service Center officially became a FSSC 22000 certification body in November, 2018.

【The First Institute Granted the Full Range Certifications for Food Additive Specification Inspection by TFDA】

Due to the frequent occurrences of food safety incidents, the government was committed to implement food additives regulation for food safety control by integrating all test methods of food additive specifications. Though the analyses of some food additives were extremely difficult, the ARSC of FIRDI has actively set up a full inspection scheme for food additive specifications. In 2018, FIRDI was the first agency in Taiwan granted the full range certifications for testing method and specification of food additive preservative - benzoic acid by the Ministry of Health and

Welfare. On the basis, FIRDI would be expected to offer food industrials the professional and full inspection services of food additive specification in the future, which would contribute to the regulation of food safety in the country.

【Obtained iCAP Accreditation for the HACCP Training Courses】

FIRDI was committed to the training of food industry talents and the improvement of the quality of training services. FIRDI Academy has been actively introducing occupational-competency-oriented courses ever since it was awarded Silver Medal for TTQS Corporate Training Version in 2017. Additionally, the "Basic Principles of HACCP" and "Principles of HACCP (Advanced)" courses had both been accredited the iCAP (Integrated Competency and Application) logo by the Workforce Development Agency, Ministry of Labor this year. FIRDI will continue to develop the iCAP training courses required by the food industry, provide customized training services to meet the needs of specific enterprises, and to enhance capabilities and competitiveness of food industry talents.

FIRDI Academy obtained iCAP accreditation for the HACCP training courses (basic and advanced level) in 2018.

【Prospective Microbial Identification Technology Development and Industrial R&D Services are Highly Recognized】

BCRC stood at international leading position for the establishment of a microbial protein fingerprint database for food and biotechnology industries application. BCRC team has developed a microbial rapid identification platform by MALDI-TOF MS technology. Moreover, multi-locus sequence typing (MLST) technology for most common probiotic LAB species was developed for commercial strain typing. The platform also applied genomic technology for safety assessments of microbial strains. The systematic integration of polyphasic microbial identification and genomic risk assessment gave contribution to improve food safety. Due to the unique technological innovation and remarkable industrial benefits, BCRC has won the R&D Service Excellence Award in 2018 from the Ministry of Economic Affairs. This innovative technology has been recognized by scientific journals and obtained international patents. Using this prospective identification R&D service, BCRC has specifically assisted 15 probiotic products to obtain national health food certification, and assisted 22 biotechnology companies with more than 1,400 environmental microbial identifications, for their compliance with international PIC/S GMP standard. To meet the increasingly strict domestic and international relevant regulations, BCRC could provide a one-stop customized service project to assist the commercialization of microbial products, which could solve the problem of raw material exports, promote product value enhancement and expand international marketing in one project.

Microbial prospective identification technology R&D service team of BCRC

BCRC microbial prospective identification technology won the R&D Service Excellence Award in 2018 from the Ministry of Economic Affairs.

【Promotion of Overseas Cooperation and Exchanges】

2018 Taiwan-Thailand Industrial Collaboration Summit Forum : FIRDI has been the implementer of the Taiwan-Thailand Industrial Collaboration Summit Forum since 2017. The 2018 Taiwan-Thailand Industrial Collaboration Summit Forum was held on June 28th, 2018, attended by nearly 600 representatives from Taiwan and Thailand. During the meeting, both sides conducted interactive discussions on future collaboration models and held business matching events in the target areas of Food and Biotechnology, Textiles, Smart City and Automation. A total of 9 MOU had been signed to extend the substantive cooperation between the both sides.

FIRDI planned and implemented the "2018 Taiwan-Thailand Industrial Collaboration Summit Forum "held in Taipei on June 28th.

2018 UMFCCI-CNFI Industrial Collaboration Summit : FIRDI organized the "UMFCCI-CNFI Food Industrial Collaboration Workshop: Improvement of Food Processing Technology and Overall Process " in Yangon, Myanmar as a part of the summit program to promote Taiwan's food processing technology and explore cooperation opportunities, as well as establish a communication channel with international groups and enterprises between both sides.

2018 Indonesia-Taiwan Industrial Collaboration Forum (ITICF) and 2018 Taiwan-Malaysia Industrial Collaboration Summit : Led by Chairman Mark Hsieh and Director General Dr. Chii-Cherng Liao, FIRDI organized "Food Biotechnology Sub-forum" during ITICF in August, 2018. In September of the same year, the "2018 Taiwan-Malaysia Industrial Collaboration Summit" was held in Kuala Lumpur, Malaysia, and FIRDI co-organized the "Food/ Pharmaceutical/Cosmetics Industries Sub-forum".

FIRDI co-organized the "Food/ Pharmaceutical/ Cosmetics Industries Sub-forum" during the "2018 Taiwan-Malaysia Industrial Collaboration Summit" held in Kuala Lumpur, Malaysia in September 2018.

FIRDI organized the " UMFCCI-CNFI Food Industrial Collaboration Workshop " in Yangon, Myanmar in July 2018.

FIRDI organized" Food Biotechnology Sub-forum" during ITICF in Jakarta in August 2018.

【Awards and Certifications Obtained in 2018】

- The course of "Food Safety Management System Practice Program (advanced/Basic)" initiated by the FIRDI Academy has passed quality certification for the iCAP Competency-Based Program conducted by the Workforce Development Agency, Ministry of Labor. It was expected that both optimization of course quality and market differentiation could be achieved and sought by the obtainment of the iCAP quality authentication.
- The "Prospective Microbial Identification Technology Development and Industrial R&D Services" team at the Bioresource Collection and Research Center has honorably achieved the "2018 R&D Service Excellence Award" granted by Ministry of Economic Affairs. The recognition award was presented during the " Technology Development Programs (TDPs) Chief Strategic Meeting" held on August 31, 2018 in New Taipei City.
- The Certification Service Center was certified by Australian JAS-ANZ and officially became the certification body of FSSC 22000 in November, 2018.
- The list of winners of awards had been granted by the Taiwan Association for Food Science and Technology in 2018 include: Technologist Feng-Qi Liu was honored with the "Food Science and Technology R&D Achievement Award", Research Scientist Qin-Hong Zhang was honored with the "Mr. Zhang Tong Commemorative Patent Invention Award", and Research Scientist Zi-Hong Dong, Shu-Fang Lu and Associate Technologist De-Quan Liu were honored with the "Extension and Service Achievement Award". The recognition award was presented during the annual general meeting held on November 30, 2018 in Taipei City.
- Dr. Gwo-Fang Yuan, Director of Bioresource Collection and Research Center and Ms. Yan-Hwa Chu, Director of Product and Process Research Center, were awarded the "Mr. Cheng-Yuan Hsieh Special Contribution Award" by Mr. Hsieh Cheng-Yuan Food Technology Development Foundation and FIRDI's New Southbound Promotion Team won the "Mr. Chung-Pi Hsieh Innovation Award".

The "Prospective Microbial Identification Technology Development and Industrial R&D Services " team has won the "2018 R&D Service Excellence Award" granted by TDP for Nonprofit Research Organization, Ministry of Economic Affairs and was presented on August 31, 2018 in New Taipei City.

Major Events

January

Jan. 9

Held the 19th and 1st board of directors meeting in Taipei and Mr. Mark Hsieh, Honorary President of Taiwan Canners Association and Chairman of Synmax Biochemical Co., Ltd. was elected to serve as the chairman of FIRDI.

Jan. 15

Visited by Mr. Ming-Xin Gong, Deputy Minister of Ministry of Economic Affairs, R.O.C.

February

Feb. 1

Visited by Mr. Qi-Gong He, Deputy Minister of Ministry of Health and Welfare, Ms. Ching-Yi Lin and Mr. Chia-Pin Chung, members of the Legislative Yuan.

Feb. 2

Visited by Mr. Mark Petry, Agricultural Section Chief at the American Institute in Taiwan.

March

Mar. 15

Visited by Professor Li Ni, Vice President and Secretary-general of Fuchien Province Association for Food Science and Technology, along with 5 other delegates.

Mar. 28

Organized "The Conference to Announce FIRDI's Research Achievements of 2018 and Initiation of Cooperation Projects Between Industries and FIRDI" in Hsinchu and Chiayi. (March the 27th in Chiayi and March the 28th in Hsinchu).

Mar. 29

Visited by Bin-Tang Zhang, Executive Supervisor of FIRDI and Hui-Jin Ceng, Zi-Qing Lin, Supervisor of FIRDI.

April

Apr. 12

Visited by Mr. Mohammad Firdaus, Director of Investment Dept., Indonesian Economic and Trade Office to Taipei.

Apr. 13

Visited by Mr. Panuwat Triyangkulsri, Deputy Director General of Department of Industrial Promotion (DIP), Ministry of Industry in Thailand, along with 4 other delegates.

Apr. 18

Visited by Mr. Jia-Sheng Xu, Managing Director of Taiwan Fermenting Food Association, along with 5 other delegates.

Apr. 27

Visited by Mr. Cong-Xian Lin, Commissioner of Council of Agriculture, along with 8 other delegates.

May

May 15

Visited by Mr. Song-Shi Wang, Deputy Mayer of Jiangsu Province of the People's Republic of China, along with 5 other delegates.

June

Jun. 15

Visited by Mr. Jang-Hwa Leu, Director General of Industrial Development Bureau, MOEA, along with 2 other delegates.

Jun. 26

Visited by Mr. Somkiat Tangkitvanich, Dean of Thailand Development Research Institute (TDRI) and Ms. Saowaruj Rattanakhamfu, senior research fellow, along with 2 other delegates.

Jun. 28

Participated in the "2018 Discovering Technology Treasures: Tech Formula" held in Taichung. (From June the 28th to July the 22nd).

Jun. 29

Visited by Mr. Ahmad Khairuddin Abdul Rahim, Executive Director of Manufacturing Development Resource at Malaysian Investment Development Authority, MIDA Kuala Lumpur Headquarters, along with 3 other delegates.

July

Jul. 13

Visited by Dr. Ngakan Timur Antara, Head of the Agency for Research and Development of Industry (BPPI), MOI of Indonesia, along with 5 other delegates.

Jul. 17

Jointly held the "Indigenous Vegetable Clean Label Product Launch" with Taifu Agri-biotechnology Co., Ltd., in Hsinchu.

Jul. 19

Participated in the "Taiwan Biotechnology Exhibition 2018" held in Taipei City. (From July the 19th to July the 22nd)

Jul. 31

Visited by Mr. Yuan-Zhi Lin, Dean of the School of Ocean Science and Biochemistry Engineering, Fuqing Branch of Fujian Normal University, along with 2 other delegates.

August

Aug. 7

Visited by Dr. Hwey-Kang Sytwu, Vice President of National Health Research Institutes, along with 3 other delegates.

Aug. 27

Visited by Mr. Jing-Chun Qui, Magistrate of Hsinchu County, along with14 other delegates.

Aug. 28

Visited by Mr. Hua Yu, Section Chief of Intellectual Property Office, MOEA, along with other 16 patent and trademark examiners.

September

Sep. 12

Visited by Mr. Hidetaka Sato, Board Director of Food Analysis Center, Japan, along with 3 other delegates.

Sep. 27

Participated in the "2018 Taiwan Innotech Expo" held in Taipei City. (September the 27th to September the 29th).

October

Oct. 18

Visited by Mr. Pramode Vidtayasuk, Chairman of National Food Institute, Thailand, along with 7 other delegates.

Oct. 27

Held the 51st anniversary celebrations and events of FIRDI.

November

Nov. 9

Held the "2018 FIRDI Prospective Advanced Consensus Camp" in New Taipei City. (November the 9th to November the10th).

Nov. 13

Organize a review conference for "2018 FIRDI Innovative Proposal Competition" in Hsinchu.

Nov. 15

Visited by Dr. Pramod Gopal, Department of Food Nutrition and Health, The New Zealand Institute for Plant and Food Research Limited and Dr. Koichi Watanabe, Visiting Professor of Department of Animal Science and Technology, National Taiwan University.

Nov 19

Visited by Mr. Philip Loveder, Manager Stakeholder Engagement & Director International, National Centre for Vocational Education Research (NCVER), Australia for discussions.

December

Dec. 20

Organized a "ISO 22000 and TQF Version Transfer Highlights Explanation Session". (December the 20th in Hsinchu and December the 21st in Chiayi).

FIRDI 2018

財團法人
食品工業發展研究所
Food Industry Research and Development Institute

Food Industry Research and Development Institute

331 Shipin Road , Hsinchu, 30062 Taiwan, R.O.C.

Tel：886-3-5223191 Fax：886-3-5214016 http：//www.firdi.org.tw

Southern Taiwan Service Center

No. 569, Sec.2, Bo-Ai Road, Chiayi, 60060 Taiwan

(Chiayi Industry Innovation and Research Center, MOEA)

Tel：886-5-2918899 Fax：886-5-2861590 http：//www.ciic.org.tw

5F, R3 Bldg., No.31 Gongye 2nd Rd., Annan District, Tainan, 70955 Taiwan

(Southern Taiwan Innovation & Research Park, MOEA)

Tel：886-6-3847300 Fax：886-6-3847329