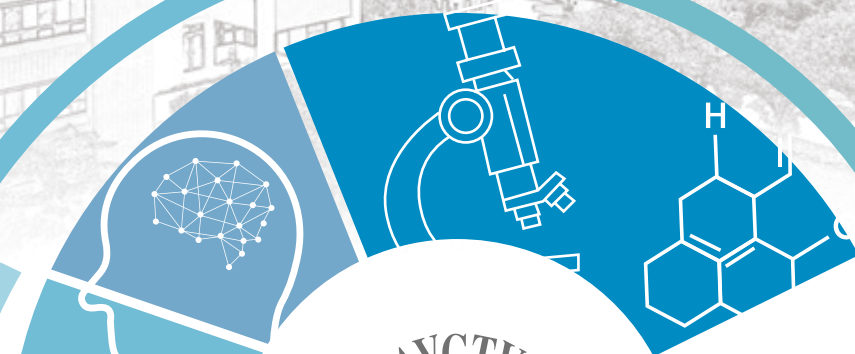




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研發工業  
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**FIRDI**

# 2020 Annual Report

Food Industry Research and Development Institute



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# Preface

The global outbreak and rapid spread of COVID-19 pandemic in 2020 has posed uncertain challenges to the supply chain and logistics of the food industry. Nevertheless, the pandemic has also brought in business opportunities for which the society needs to respond and adapt. Taiwan has been successful in fighting against the pandemic, resulting in its rather limited impacts on the food industry. In 2020, the output value of Taiwan's food industry (excluding tobacco manufacturing industry) was 642.1 billion NTD, increased by 1.87% from the previous year and accounted for 5.1% of the total manufacturing output value (ranked 7th). It could be said that the key tasks for our food industry in 2020 were to get hold of the environmental changes in raw material sourcing in the global supply chain, processing process, product circulation and consumer demands, and to strengthen the agility and resilience to changes. In response to the COVID-19 pandemics, the Food Industry Research and Development Institute (FIRDI) has flexibly adjusted its R&D, training, inspection, certification, and services, while continuing to cultivate key technologies in crucial areas to lead industrial innovation and transformation constantly.

In terms of food technology innovation and R&D, FIRDI has not only developed four major platforms, including food texture design & construction platform, special strains application platform, sterilization equipment process data collection and quality prediction, and smart reheating system and quality prediction technology, but has also created software and hardware technologies as well as products that combined low additions. With most efforts, FIRDI has refined and integrated upstream and downstream energy of the supply chain in the industry. Plant-based meat, instant rice and baked rice / noodles have been introduced successfully to the related industries and promoted innovation in the food industry. In terms of plant-based meat processing technology, a continuous process technology with software and hardware for milder, adjustable shear force have been created for the production of the plant-based meat with multi-dimensional protein fiber structures. The technique for plant-based meat is in line with international standards. The restriction on the amount of non-wheat ingredients added to noodles were demolished, FIRDI has not only developed Chinese-style noodles that required relatively small amount of additives and still retained its tasty, moldable, chewy, nutritious, and were convenient to eat with chopsticks, but also assisted the manufacturers on the developments of multi-functional noodle forming equipment and innovation of Chinese cold-water noodles, which has led the noodle products an innovative and diverse aspects.

The smart reheating system, which could be used to reheat fried and grilled frozen/refrigerated prepared foods with restored crispy tastes. as well as be used in traditional Chinese dim sums such as steamed buns, dumplings, and meatballs, was developed by FIRDI. After reheating, the food maintained its humidity and was neither dry nor hard. This technology has already been used in medical institutions, care institutions and other fields.

For the promotion of the canning industry in terms of technological upgrades, FIRDI has developed a sterilization equipment process data collection and quality prediction system at the Chiayi Industry Innovation and Research Center, of which

a high-efficiency central axis rotating sterilization kettle was built to provide customized equipment design and trial mass production services to solve the problem of quality deterioration in canned products caused by excessive sterilization. FIRDI also proposed an advanced plan for the "Canning School", including talent training, talent matching, and innovative research and developments. At the same time, FIRDI has invested in equipment for construction and renovation of the canned food pilot plant. The "Canning School" and the canned food pilot plant have been officially opened since July 2020, aiming to provide high-quality research and development services, and to create new opportunities for the canning industry.

In terms of preservation and research of biological resources, FIRDI has not only established cultivation techniques for those microorganisms, which are difficult to cultivate but has also conducted research topics related to human microorganisms with many medical research units. Among them, FIRDI signed a memorandum of cooperation with the Linkou Chang-Geng Memorial Hospital in 2020, through which both parties would jointly develop precision microbial treatment by utilizing the FIRDI's analysis and research in bacterial identification, cultivation and bioinformatics of intestinal bacteria. Moreover, the benefits of photosynthetic bacteria in the fields of agriculture, livestock, aquaculture and the environment were thoroughly studied. FIRDI, who owned crucial technologies in the strain cultivation, preservation and fermentations of photosynthetic bacteria, has steadily conducting a series of training courses for applications of photosynthetic bacteria in recent years. In 2020, FIRDI expanded its scale to assist farmers in counties such as Yunlin, Chiayi, Tainan, Kaohsiung and Pingtung as well as outlying islands for the development of products and feed additives with fertilizer, whose efficiency and stability are compatible with chemical fertilizers. This, as a result, has effectively improved the efficiency of the farming, poultry, livestock and aquaculture industries, while also protecting the environmental sustainability.

As for inspection services, FIRDI has constructed and launched an Online Contract Services Application Platform that provided

# FIRDI DIRECTOR GEN

multiple contract service channels for customers, in 2020. The inspection services also had established an adulteration identification model and index components of soybean soy sauce products, which could be used as the basis for the soy sauce industry for product quality monitoring. Furthermore, FIRDI has offered inspection services in the analysis of multiple residues of beta receptors, including 21 items for ractopamine, and inspections of heavy metals, pesticide residues, xanthotoxin and sulfur dioxide for traditional Chinese medicines, in rapid responds to market demands.

Regarding certification service, FIRDI is an FSSC22000 and GFSI international food safety and quality certification agency and will continue to uphold a professional and fair attitude to provide high-quality certification services. FIRDI Certification Service Center has provided professional and fair certification services that comply with ISO and TAF standards for the domestic food industry. FIRDI would continue to refine and strengthen its energy and service scope of food safety and quality assurance counseling, in order to assist manufacturers in establishing a complete food protection plan, and effectively remove obstacles of exportation, as well as strengthen the competitiveness of Taiwan's food industry.

With regard to professional training, FIRDI Academy has continued to strengthen the quality of its online video courses, completed a digital learning platform, and would keep actively in development of multiple digital courses in the future. In 2020, free advanced trainings were provided to those food companies affected by the COVID-19 pandemic, which helped their trainees obtained qualifications to act as sanitation control personnel and joined the food safety control team. Additionally, FIRDI has cooperated with the education platform of National Formosa University to cultivate seed teachers for iPAS food quality assurance engineers to spread the energy of professionals in food quality assurance.

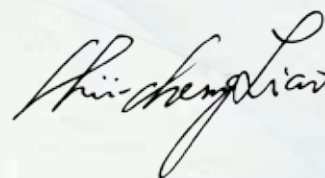


Being awared of the impact of future cross-field technology, especially the digital technology, on the food industry, FIRDI has launched the exploration and agitation of AI applications in the food industry since 2019. The theme of "AI Applications in the Food Industry" was selected again in 2020 and the winners groups have been included in the research topics of the annual Technology Foresight Research Programs. It was expected that AI will be used in the fields of quality management and process optimization for the food industry in the future.

FIRDI has started the promotion in Taiwan the first-of-its-kind "Eatender Logo", which stands for "Elderly, Affordable, Thoughtful, Easy, Nutritious, Delicious, Enjoyable, and Reliable", in 2019. FIRDI has participated in the quality classification of packaged foods and launched the "Texture-friendly Labeling" in response to specific elderly dietary needs, in 2020, demonstrating a fully support in the development of Taiwan's elder-friendly food industry. Moreover, FIRDI has held the "FUN FOOD TAIWAN" product selection and exhibition activities with the support from the government in 2020, which focused on the value of international food trends, such as "clean and high value", "design experience" and "convenience and sustainability", aiming to guide the industrial innovation and enhance product value to a higher level.

Looking forward to the future advanced technology and services in the fields of food and biological resources, FIRDI will focus on smart technology and digital transformation under the trend of digitization. It is hoped that all our colleagues in the FIRDI can uphold an efficient working attitude, strive to expand new horizons, and actively achieve their own goals at work. It is also hoped that all sponsors and customers will continue to encourage and support FIRDI and work together to contribute to the innovative development of Taiwan's food industry jointly.

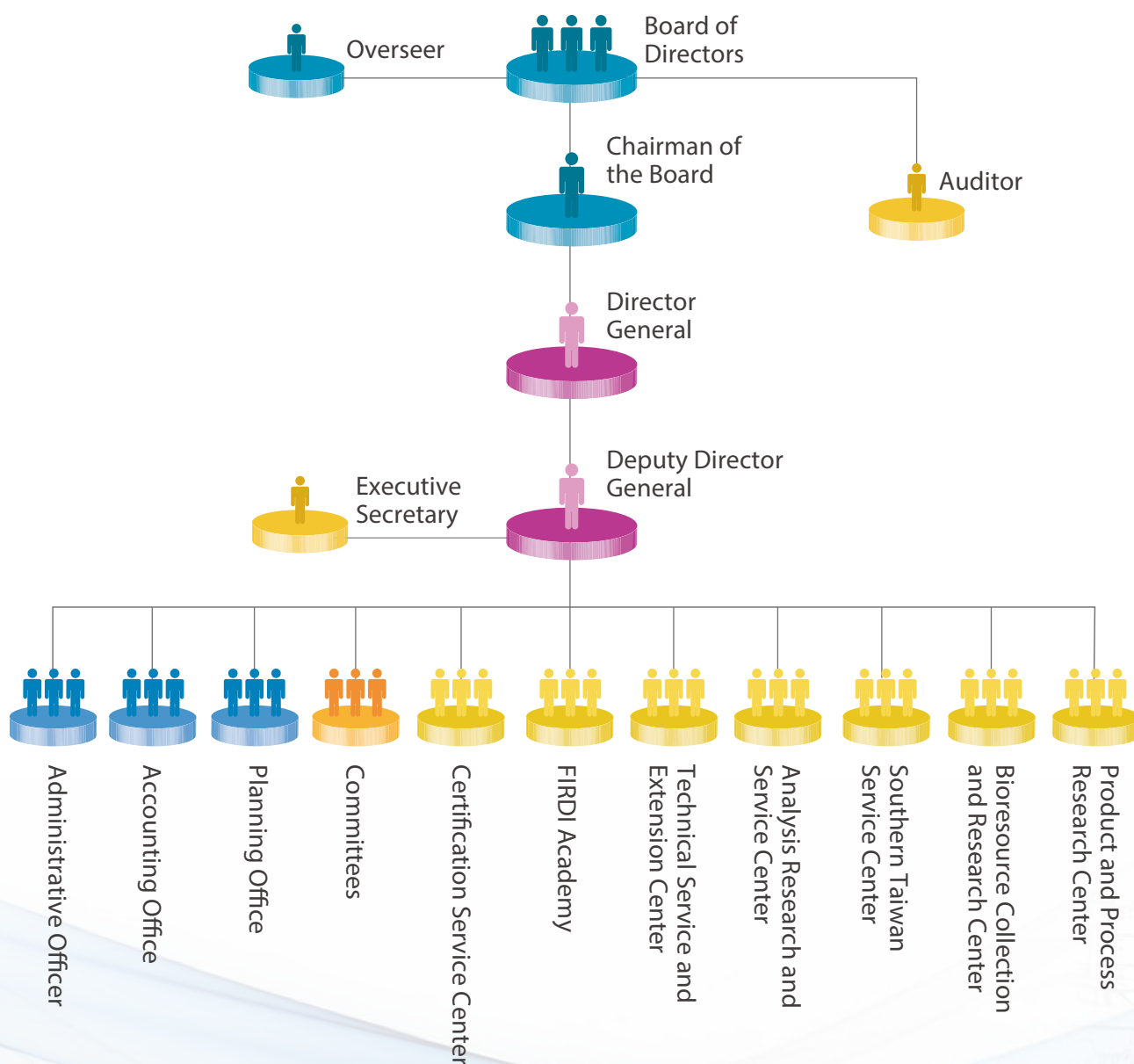
Director General



Dr. Chii-Cherng Liao  
May 2021

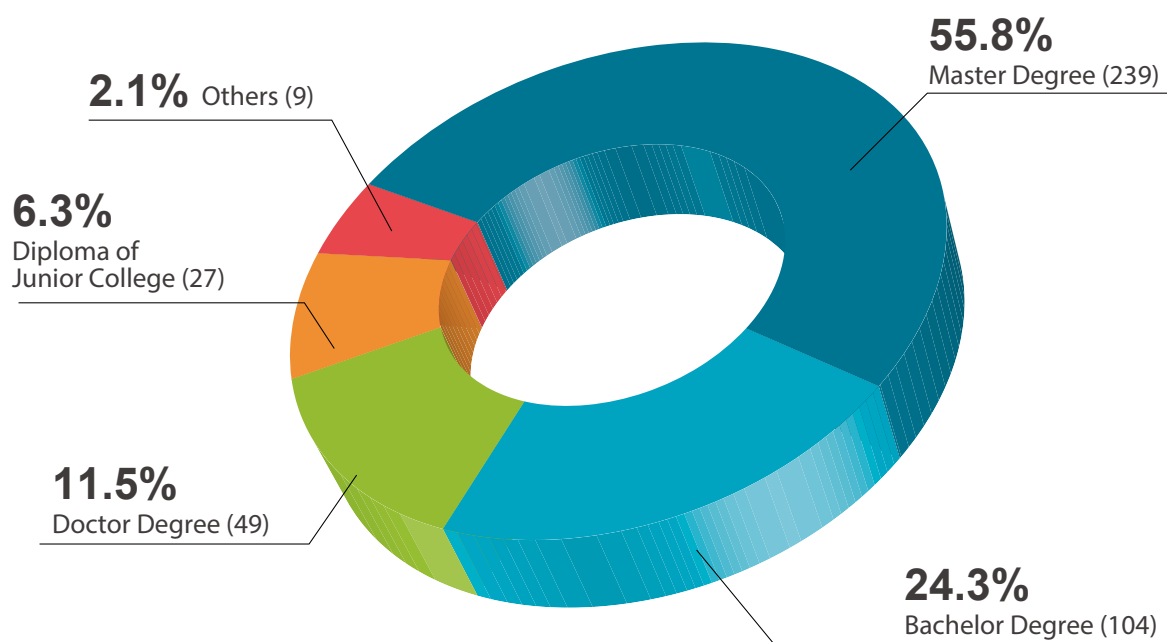
# Organization and Human Resources

## ● Organization

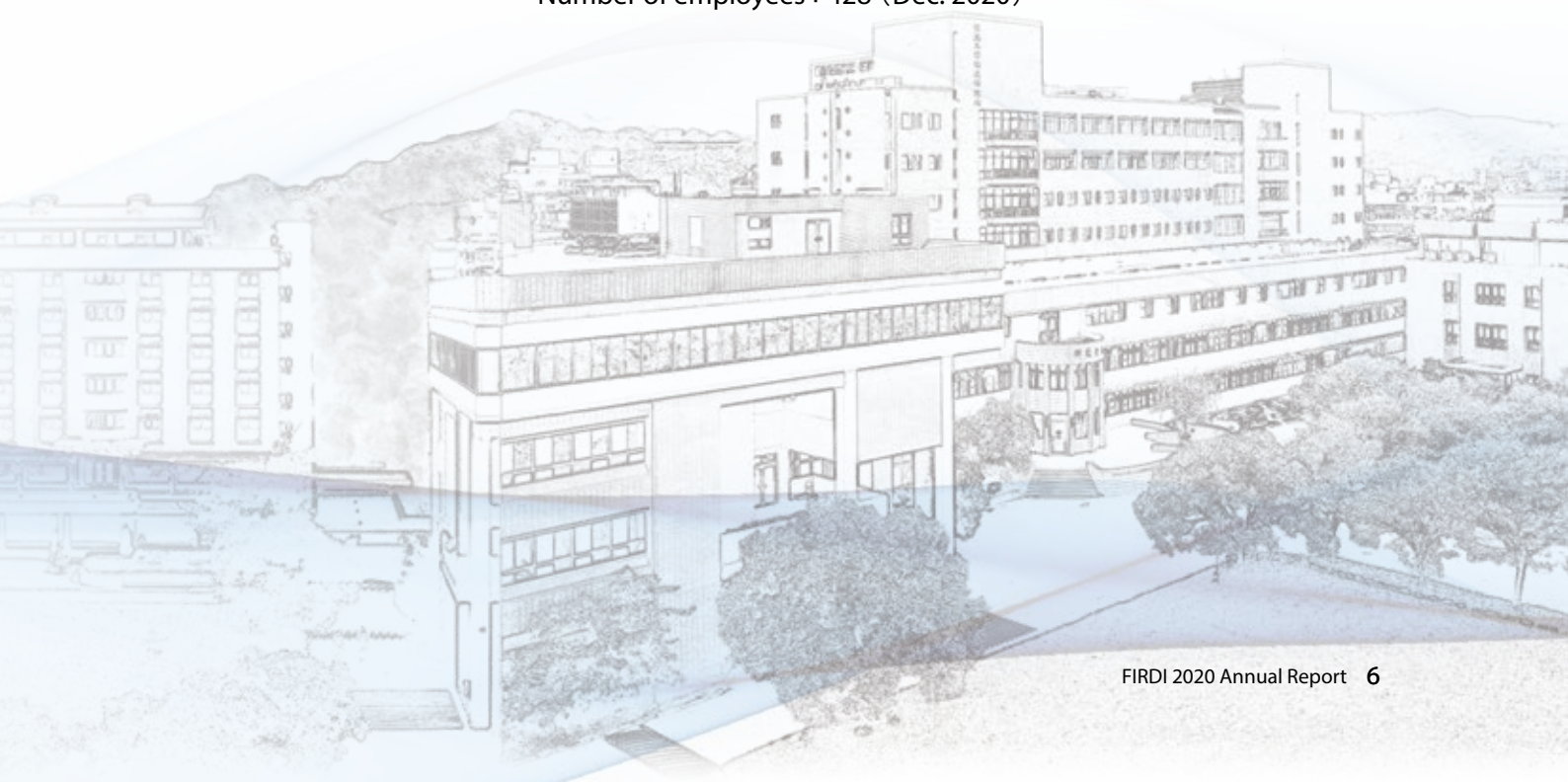




## ● Human Resources



Number of employees : 428 (Dec. 2020)



# Research & Development in Food Technology

## Design, Development and Application of the Textures of Food Materials

In response to the trend of clean labeling, for high-growth ready-to-eat meal products, FIRDI developed commonality software and hardware controlled technologies for food structures, such as plant-based meats, noodles, and rice products. Innovated food materials were produced with delicate and less additives. Functional ingredients developed using byproducts from domestic agricultural food process were also studied and found to be able to substitute artificial additives, which were used for food quality stability.



### A combined technology of twin-screw extrusion and simple shear devices

A combination of twin-screw extruder and simple shear devices were used for the development of a continuous plant-based meats production system, which led to a breakthrough of the current batch-type production of plant-based meats using shear device in the world. Secondary processes using binders and water-holding agents were not needed anymore with this technique and meat-like products with animal fiber bundles still could be continuously produced. This technology has been transferred to many local companies. The taste of these plant-based meats products developed via this technology was much similar to real animal meats. In comparison with plant-based meats made from the current raw materials and methods, in terms of its taste, texture and flavor, the products produced from this new technology have a better chance to meet the needs of the market as well as industry, and tool hold of more business opportunities of clean label and diversified preparations in the future.



1



2

› 1&2.The 3rd generation plant-based meats



3



4

› 3&4.Products of the 3rd generation plant-based meats



### Formulation design and processing technology for multi-configuration & -ingredient noodles:

This technology was based on human oral processing, using dynamic food texture measurement and food structure design, for developments on Asian noodles characteristics that have taste, shape, chewing texture, nutrition, and easy to eat with chopsticks. So far, 12 kinds of structures had been developed designed, triangle-shaped, heart-shaped, and cherry blossom-shaped, etc. were all included. 6 types of texture features were enhanced, including increased sauce adsorption, boosted bite, elasticity, soft taste, smooth taste, and reduced adhesion. In

addition, adding different ingredients to the noodle processes, the combination could also develop novel noodle products.



›Based on texture perception data analysis and mold design, the noodle products with different mouth feel and nutrient requirements were developed.

### Vacuum cooling assisted infrared drying technology:

Vacuum cooling assisted infrared drying equipment was developed for rapid cooling the pre-cooked food materials to room temperature and together with the programmable infrared direct heating system in vacuum condition could retain better flavor and color of the food

materials. Food materials processed by the combined technology not only retained more flavor and color, but also shorten the time by more than 20%, compared with traditional cold air cooling and drying methods. The adzuki bean soup made by this combine technology has shown well tasty and retained the original flavor and color.



›Vacuum cooling assisted infrared drying equipment

## Value-addition of Agricultural and Livestock Raw Materials Commercialization

Using Taiwan's high-quality grains, beans, poultry and livestock meats as raw materials, with the application of modern food technologies, product formulations, processing conditions and quality variation were studied, and introduce mass production processing technology, develop several kinds agricultural products that conform to the concept of whole-food utilization or clean labeling. Production of processed products using these technologies enhanced their additional values and expended the scopes of use, of which, promoted the sustainable development.

**Clean label spam products:** Most of the domestically sold Luncheon meat products (most well-known brand name as "Spam") are imported from Denmark, the United States or South Korea. Luncheon meat is a canned food that uses pork as the main raw material, adds color retention agents or antioxidants and other food additives, and sterilized by high temperature. FIRDI used domestic pork, by introducing the concept of clean label, established product process for development of luncheon meats that meet the tastes of local and foreign consumers. It has promising market potentials and could assist domestic pork to expand its export markets to new areas, such as Japan, Australia, New Zealand, and Singapore, of which further promoted the development of the pork industry.

**Bone softening poultry and livestock prepared foods:** Pork feet and chicken feet are rich in gelatin and nutrients, and are popular among the elderly. However, how to soften the bones without affecting the texture of meat has always been a problem in the food industry. The shelf-stable, ready-to-eat bone-in poultry and livestock prepared foods treated with organic acid, 121°C high temperature and high pressure cooking have been developed. These products are easy to consume for elderly, and the hardness of bones below  $5 \times 10^6 \text{ N/m}^2$ .



› Braised pork feet and chicken feet with softened bones



› New type chicken jerky products

**New type of chicken jerky products:** Using the bouncy characteristics of layers' meat as raw materials, high-temperature sterilization technology was introduced, and with the addition of natural pigment and antioxidant, high-water activity chicken jerky products were developed using this formula. The product is different from traditional jerky using food additives for preservation. It has the concept of clean labeling, which significantly increases the additional value of layers.



## Development of chicken products for the elderly:

The composition characteristics and quality evaluation data of various unutilized by-products in the chicken essence industry showed that chicken fat and refined chicken meat still have rich nutritional value after processing and had the potential for further development in protein-rich foods. Emulsification and quality stability technologies were established for the usage of cooked chicken meat as raw materials for derivative application developments. The product developed was chicken meat jelly, which meets the protein content of 8.1 g/100 g or more, and calorie of 100 kcal/100 g or more. It was an elder-friendly product with a uniform texture and high nutrient density.



›Elder-friendly product: chicken meat jelly

## Promotion of AI Applications in the Food Industry

In line with the government's smart machinery and digital economy policies, the application of AI in the food industry, such as precise and efficient processes, accelerated research and development, and smart and labor-saving supervision, are the main axis of Technology Foresight Research Program (TFRP). Colleagues are encouraged to propose innovative plans for TFRP to evaluate and to establish the strategy and foundation to assist Taiwan's food industry incorporating AI in the future. Researches for this year were concentrated in infrastructure constructions, focusing on basic food manufacturing processes, such as fermentation, drying and cleaning, sensors and visual imaging technology applications for the establishment of a test field. In the future, it could link sensor data with cleaning/production processes, and use AI to construct predictive models to assist manufacturers achieving the purpose of intelligence.

**Sensing technology:** In 2020, infrared spectroscopy was used to establish a fatty acid value characteristic spectrum analysis model for the evaluation of the possibility of real-time sampling detection, feedback control and simultaneous correction of oil refining process parameters in the production line to stabilize the process. At the same time, the fermentation process data was analyzed through the data visualization platform and machine learning to solve the technical gap that traditional fermentation is time-consuming and the process cannot be adjusted quickly. In addition, online system such as fiber optic temperature, sample weight, and induced electric field etc., these off-line thermal imaging analysis systems were combined to construct a smart radio frequency drying system. The establishment of drying prediction curves for jerky meats with different

thicknesses and fat contents could solve the problem regarding traditional drying process relies on manual adjustment of the production process and the determination of the end point, which may cause inconsistent product quality.



›Smart RF drying test system

**Visual images:** In 2020, the integration of visual components and image processing software, for the analysis of the relationships between the color difference and shrinkage rate difference during the drying process and the relative moisture and water activity, the dried fruit drying quality prediction model was established. In addition, through image processing software, the pipeline surface characteristics were converted into quantitative pictures, and the mobile smart control CIP cleaning module was developed.



›Computer visualization system

## Integrations of Processes and Equipments

The professional food engineering expertise and technology integration ability of FIRDI lead the researches and developments of food processing process and mechanical equipment in the field. Establishments of core technical capabilities and efficiency verification platform, as well as developments of equipments that are user-friendly, simple to operate, and had intellectual property protections, allowed the industries have stronger competitive strength in terms of equipments and quality products.

### Smart Reheating System with reheating process for prepared foods

The steam function of Smart Reheating System which comprised with microwave, infrared and hot air heating module by incorporation with water atomization module was developed. The Smart Reheating System allowed the Chinese

tradition foods, such as buns, dumpling, and Taiwanese meatballs, to keep soft and moist texture after reheating, and restore the crispy texture of the fried and baked frozen foods at the same time. This system could automatically execute the heating process of prepared food by a barcode reading device and a database of reheating process for different types of prepared foods, which could standardize the qualities of prepared food and prevent problems of insufficient heating or overheating. The idea of this system has been invention patented in Taiwan, Japan and China.

“Smart Reheating System for prepared food press conference” was held by FIRDI and Han Dian Food Co. in Food Taipei Mega Shows on



›Field tests of Smart Reheating System



December 17<sup>th</sup>, 2020. The live demonstration showed the Smart Reheating System developed by FIRDI and how to use this system with vending machine to save manpower and reduce operating costs. This system could be used in medical institutions and medical care institutions, as well as unmanned stores, trade fairs, commercial buildings, and school dormitories in the future. A cross-domain solution for prepared food industry was developed by promoting the commercial application of the Smart Reheating System and the development of new business models. Thus, the industry chain of prepared food could

be optimized, and the software and hardware capabilities of domestic players could be enhanced.



› Smart Reheating System participated in the Discovering Technology Treasures Show held in Taipei on August 12<sup>th</sup>, 2020.



› “Smart Reheating System for prepared food press conference” was held by FIRDI and Han Dian Food Co. on December 17<sup>th</sup>, 2020.

## Establishment of new retort and quality prediction system

Most retort system in Taiwan lacks of monitoring and controlling modules that can precisely predict critical process parameters in real-time. For the safety reasons, most food manufacturers tend to over-cook, which caused waste of energy and quality deterioration. FIRDI integrated smart sensors, IOT, mechanical design as well as multi-platform data processing/visualization

techniques to finalize this new retort system in CIIC. These techniques not only enhanced the design of retort engineering for equipment suppliers but also provide customized processes and trial production services for food manufacturers to shorten the development timeline and localization of high-end equipments.

## Special Services and Value-addition of Bioresources

### Core technologies to the development of local yeast starters

Along with the growth of BCRC, the bio-platforms for isolation, preservation, identification, as well as gene and metabolite engineering have already been established. In addition, with the development of microorganism cultivation, fermentation, downstream processing and formulation designs, a systematic service for value addition and a special cell bank were provided, particularly in the local yeast library and the related applications.

Based on the evaluation of sugar tolerance, fermentation power, purine reduction, and the characteristics of special flavors, some potential yeast strains were selected to meet the requirement of baking and brewing industries from the yeast bank. After further scaled up in fermentation control, refined separation, and formula designs, a few core technologies were established and some valuable starters of yeasts were also developed.



›Diverse products derived from local flavor yeasts



Up to the present time, BCRC has helped over 10 domestic food enterprises to make use of these flavor yeast strains, focusing on brewing, baking, cocoa and tea residue re-utilization. These efforts not only assist local factories in improving the

fermentation processes and exploring unique flavor-derived products, but also overcome the challenges of starter deficiency for baking and brewing industries.

## Development and application of photosynthetic bacteria

Photosynthetic bacteria (PSB) are a group of phototrophic microorganisms, in which the purple non-sulfur bacteria are widely used in agriculture, aquaculture, animal husbandry as well as environmental protection. Over the past years, BCRC has separated, purified, identified and preserved more than 300 PSB from various breeding ponds and soil environments. In recent years, the group has been more active in promoting the applications of PSB, including in agriculture and aquaculture, etc., which assisted the governmental policies of rational fertilization and reducing the use of pesticides.

In 2020, the group has held 10 PSB training courses, including 5 in agriculture and 5 in

aquaculture. There were 680 trainees from all counties in Taiwan. After training, they could cultivate PSB by themselves, which not only reduced the burden of purchasing microbial agent, but also increased the willingness to engage in friendly farming and breeding. According to the feedback from the trainees, the use of PSB could significantly increase crop yield and quality, at the same time reduce the use of other chemical fertilizers and pesticides. In addition, it could purify water in aquaculture ponds by reducing the concentration of hydrogen sulfide and ammonia nitrogen, which not only reduced the mortality rates of fish, shrimps and shellfish, but also helped in feeding and grow.



1. The photosynthetic bacteria counseling team visited the production of photosynthetic bacteria at the trainees' farms in Tainan.
2. At the "Inauguration Press Conference of the Microbial Materials Cultivation and Promotion Center" in Dong-pian Community, Nei-pu Township, Ping-tung County, Dr. Li-Ling Liaw (1st from the left) instructed the Mayor of Ping-tung County Mr. Men-An Pan about the cultivation of photosynthetic bacteria. 5<sup>th</sup> of November, 2020.

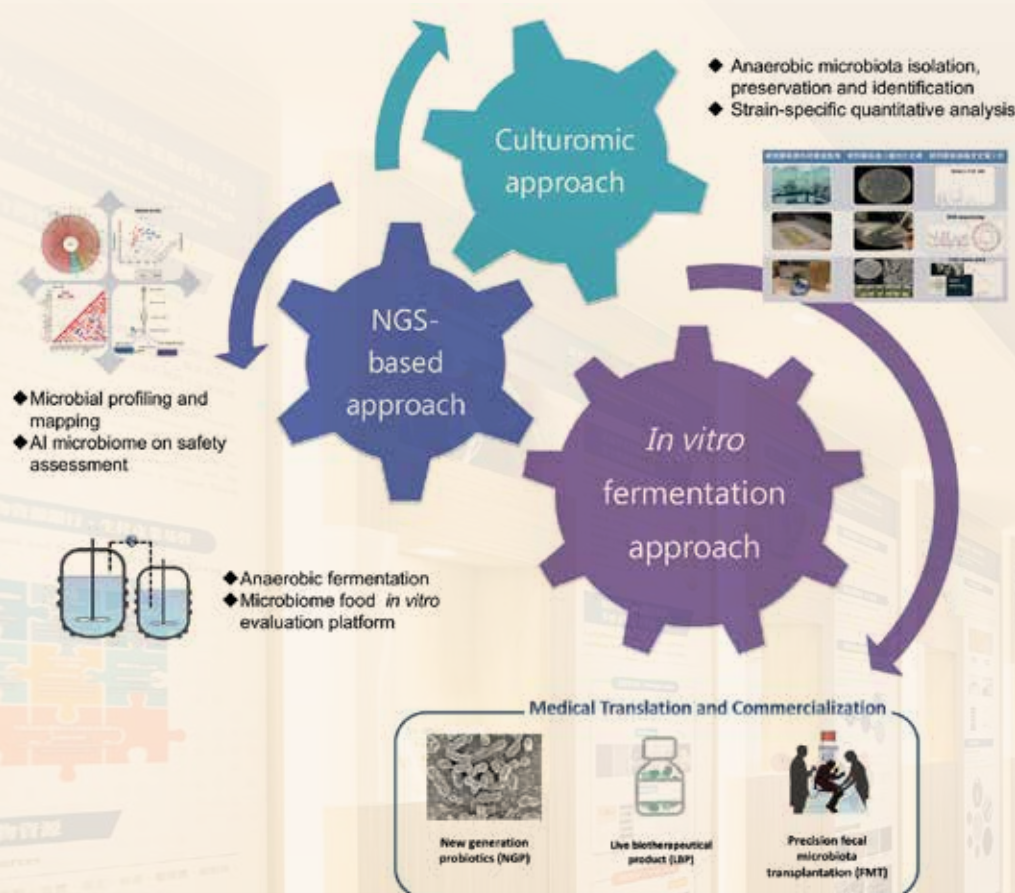
## Construction of microbiome technology platform for industry

Microbiome analysis technology, culturomics technology and *in vitro* culture technology were integrated for setting off the Microbiome Technology Platform for Industry, of which, became the key technology on microbiomic products developments and fermentation starter designs. This platform could take parts in novel functional and biomedical industries as well as traditional fermentation food industries.

Microbiome analysis technology developed by BCRC team could fish out the crucial and specific microorganism targets. Together with the big data from public resources, assessment

protocols on microbial safety issues upon usage was set up, the screening process of microflora strains, which speed up the further productization were also improved. FIRDI has also isolated and purified over 120 types of gut microbiota, including *Clostridium butyricum* and *Akkermansia muciniphila* (the Akk), from local healthy volunteers and set up gut microbiota bank. Functional assessment of intestinal mucosal integrity was also completed.

Critical medical treatments, i.e., the precise-therapy, has been researched and developed together with Linkou Chang Gung Memorial



› Microbiome Technology Platform: Novel healthy foods research and developments



Hospital using Fecal Microbiota Transplantation (FMT). Cooperation took place actively between FIRDI and medical centers as well as other research units, including National Taiwan University Hospital, National Cheng Kung University Hospital, National Institutes of Health, National Tsing-hua University and National Cheng Kung University. The research groups have applied for Human microbiome project sponsored by the Ministry of Science and Technology, for the development of gut and oral microbiota banks and for the research development on new era probiotic products. Technology on the cultivation of anaerobes was

also transferred to several food and biotech companies, in terms of research environment set up and technical training etc., which aimed to improve the biotech industries in handling and process techniques.

Microbiome technology platform could also apply to traditional fermentation foods, such as fermented vinegars, old dough in bakery, matured meats in husbandry, tea, coffee and cocoa etc.. Food ingredients together with different composition of microbiota create different flavours, and tastes, providing consumers more options on safe and special flavoured foods.

### **New era on digital services of bioresources: Zero contact and zero distance, but completed information and rapid digital services**

Bioresource E-commerce system provides not only detailed information of bioresources, but also incorporates the Material Transfer Agreement (MTA) automatically according to the bioresources that has been placed ordered. The system also includes the multi-ways of online payments, such as credit cards, supermarket barcodes payment systems, as well as traditional postal remittance etc.. Customers who placed orders and completed payments successfully could trace the order status and related information on another co-related Customer service system. Thematic strain catalog database was constructed for the further usage on bioresources in industry. Open reference database was analyzed using

Web semantic technology for the establishment of a research and development application references resources on biomaterials integrated to the BCRC E-commerce, Customer service system and Thematic strain catalog database.

In 2020, Responsive web development technology (RWD) was applied to the webpages, so that web browsers used by each individual could be identified and exhibited the most compatible displays accordingly. Such modification on top of the remarkable information and services provided from the Bioresource E-commerce system, Customer Service system and Thematic Strain Catalog database allowed users a tremendous experience on the safe and informative digital services that BCRC provided.

# Industrial Services

## Operation of the Chiayi Industry Innovation and Research Center (CIIC), MOEA

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

### Integration of service capacity to assist local industry in innovative research :

In 2020, total of 121 firms were visited, 201 times, for R&D problem-solving services. 37 conferences and training courses were held, of which a total number of 1,145 attendees were participated in sharing as well as further training sessions in professional knowledge. Since the establishment of the Food Safety Inspection

Center in 2011, 352 firms have been served, furthermore, an even more convenient and faster testing services for the local food industry were provided. Moreover, in 2020, the 9 research communities set up by the research institutes stationed in CIIC have held 17 forums on specific topics, expecting to stimulate innovative ideas and cooperative opportunities within these knowledge-sharing platforms.

### Integration of institutional resources and promotion on innovation of industrial technology :

The "Demand-planning of Local Specialty Industries" program, has integrated the capabilities of CIIC's four research legal parties, provided technology service models regarding pilot production implementation, real-life experiences, and product commercialization to assist technology-

upgrading of local industry. In 2020, 9 firms had worked as business tenants with research institutes in CIIC and 42 pilot plant services were provided correspondingly. CIIC, in 2020, has assisted 11 cases/ firms obtaining central/local government sponsorships in R&D subsidies with 7,210,000 NTD in total.

### Facilitate the cooperation between academic and research institutes for local industry services :

CIIC has

›The EHEDG Food Machinery Advanced Hygienic Design Engineering Technology Training Course held on Nov. 10<sup>th</sup>, 2020.





constructed and operated the Research Resource Integration and Service Network (RRISN) website by integrating resources of the academia and research institutes in Chiayi/Yunlin. To date, 4 research institutes and 8 colleges in Chiayi/Yunlin have uploaded their service information and R&D outcomes to this website. Registered

website members of RRISN platform would receive monthly newsletters with updated information, which hopefully could lead to wider knowledge sharing rate and higher page view counts. There are already 133,000 views accumulated since the website had launched.

## Supervision on Food Industry Upgrading

### Development of offshore-island industries:

In 2020, the group guided the local traders in Kin-men on addition of dietary fiber and probiotics to their peanut candy. The traditional production method was upgraded with this new process to meet the modern

consumption consciousness and still maintained the edible value of the products. Moreover, the group also assisted traders in Penghu to develop a number of deep-packed products with Penghu elements to enhance the flavor of the products and extend their shelf life up to 6 months.

**Rural industry assistance:** In 2020, the group helped youth returning to Taitung to devote themselves for development of the Taitung local souvenir e.g. Honey-Scented Oolong Tea. This special product involves processes of steam brewing using Oolong tea leaves. This project hooked up with Taitung tourism activities for spotlight promotion of local developments. Furthermore, the

group also assisted Taitung indigenous tribes to establish their own microbial preservation technology for traditional glutinous rice wine fermentation, and to develop products derived from glutinous rice wine dregs and vinegar. This, the brewing of glutinous rice wine, at the same time, also combines with the local tourism business for better rural business development.

### Value-addition of processed food quality:

In 2020, not only did the group assisted more than 10 food companies to refine their processing flows, products quality optimization and speedup commercialization, but also developed products such as minced pork balls with less additives, high-quality sea bass

essence, pineapple cake with longer shelf life, meat products supplied at room temperature and new-styled green algae, etc.. In addition, the group has also solved problems such as the yield of cubilose (bird's nest) products, improvement, the stability of Sacha inchi oil and the uniformity of powdered nuts.

**Smart food manufacturing:** FIRDI provides specific automation processing techniques combined with intelligent equipment and cross-field expertise consultations for 20 companies. Three companies were promoted to smart production via this project. FIRDI also

held conference on Robot application in food industry and hygiene design of open equipment and related management training courses that promote over 0.2 billion investment on smart machinery industry.



## Food Industry Analysis and Knowledge Services

With the support of relevant governmental projects, FIRDI collected and analyzed global and Taiwan food market dynamics, tracked and analyzed changes in the local industry chains and food lifestyle, conducted market research in new Southbound countries in real-time. The group expanded the scope and influence of information services via continuing to publish and communicate with the public through various digital publications and seminars, setting up the food industry knowledge database, thematic social media membership system, as well as the ITIS Intelligence Network, providing members or social media users with direct access to first-hand information and trends.

### Leading industrial development with proper information:

From perspectives of consumption, technology, regulations, and markets, the group conducted in-depth analyses on key issues in domestic and foreign food developments, clarified problems, and offered guidance on future directions of development. A global food industry trend observation seminar was held in the fourth year to assist in the strategic layout of the domestic food industry.

### Assisting industry responds to the pandemics of COVID-19 situation :

Due to the impact of pandemic of COVID-19 in 2020, the group utilized the capabilities in industrial analysis to engage in related policy research and industrial development cooperation during each stages of the epidemics. Industry supply chain issues, surveys, regular tracking of demand for masks at production sites, supply gaps and

Under the global plant-based trends, the group assisted the local livestock industry in product innovation, value communication and market positioning, to lead the domestic vegetarian meat industry upgrading and transforming into international cooperation at the same time. And from the perspective of industry analysis and planning, the group guided the development of elderly-friendly food and food innovation projects.

volume price assessment of instant noodles and other epidemic prevention resources, dynamic information on the global food industry supply chain and consumer demand, and other recommendations on industry development were focused real-time. Information provided to the industries helped them to quickly adapt to changes of the environment and responded accordingly.

### Publishing the *Journal of Food Industries*:

*Journal of Food Industries* is a monthly journal published by FIRDI and is an important platform for knowledge exchanges between the Institute and members of the industry. Scientist Researchers in FIRDI analyses and compiled industrial trends in columns and technical albums each month. Important reports published in 2020 include the application of “omics” technology in the food industry, the application of radio frequency and microwave heating technologies in the food industry, the hygienic design of dry particulate materials

food machinery and equipment, the industrial utilization of fungi, the upgrading and utilization of grain by-products, stepping into Eatender V2.0 in Taiwan, R&D trends of plant-based beverages, application and management of inspection technology in food safety, application of sensing technology in food processing, data and application of food protection technology, application of smart manufacturing technology in the fermentation industry, and outlook of food certification programs, coming to a total of 12 issues per annual.



# Promotion on Innovation of the Food Industry

Industrial Services ●

## Influence and visibility for elder-friendly foods

The fact that Taiwan is about to enter an aging society, FIRDI decided to lead all walks of life to pay close attention to the dietary needs of the elderly. FIRDI has assisted the Council of Agriculture to promote elder-friendly food selection and evaluation activities since 2016. So far, FIRDI has set up the “Eatender” Labeling System for the elder-friendly foods and kept on establishing numbers of technologies and research service platforms accordingly. After five years of diligence and hard work, the efforts in coaching the elder-friendly food industry has gain powerful experiences and indepth knowhow, and has gradually expanded the visibility and influence in leading the formation of the elder-friendly food industry in Taiwan.



›Photo of the elder-friendly food award ceremony was held on December 20<sup>th</sup>, 2020, Dr. Junne-Jih Chen, Deputy Chairman of the Council of Agriculture (front row, middle), Dr. Chii-Cherng Liao, Director General of FIRDI (front row, 4<sup>th</sup> from left), and representatives of the food industry who won the Eatender Award.

### Driving the industry with the selection and evaluation of elder-friendly foods :

Selection and evaluation of elder-friendly foods were based on key items such as production quality, nutritional function, texture characteristics, packaging design, and meal preparation. In 2020, 150 products were selected from 60 companies, and there were 283 products (from 93 companies) had been selected so far. Moreover, 42 companies

started to use the “Eatender” logo on their packaging across the range of 110 products. It was estimated that the output value would exceed NTD 300 million in 2020, and some products have already been exported to Japan and Hong Kong. Among them, 30 products have used texture-friendly labeling, an estimated output value of NTD 46 million was made.

### Establishment of the texture-grading and guidance platform for elder-friendly foods :

With reference to the international texture standards, FIRDI has adjusted the food classification standards to formulate four texture classification specifications for Taiwanese elder-friendly foods, ranging from “easy-to-chew”, “gum-chewable” “tongue crushing” to “no chewing”. FIRDI has also set up pre-processing procedures, instrumental analyses, and detection and sensory differentiation procedures for the industry to develop texture-adjusted products. In 2020, the group trained the producers for productions of steamed soybeans, Ten Treasure Mixed Congee,

meat mousse and other products, which had achieved the “easy-to-chew” texture grades. Moreover, the groups assisted 31 products applications in texture grade labeling, of which 6 products from 3 companies have completed their packaging labels. In addition, the group assisted manufactures in adjusting their production lines to establish key technologies and production processes for specific designs in aging-adaptive and texture-adjusted products, including prepared easy-to-chew nut and bean foods, gum-crushable vegetable ready-to-eat foods, viscosity-designed nutrition drinks and functional gel foods that can be sucked by the elderly, etc.

### Expansion on marketing and awareness in multiple ways :

FIRDI conducted a number of activities for the promotion of elder-friendly foods and raise the brand awareness for “Eatender” logo and texture-friendly labeling in 2020. The group also clarified the characteristics of texture-adjusted foods demanded by medical institutions and established the communication windows for supply and demands. In addition,

FIRDI also cooperated with elderly groups, provided real life experience of products; by collecting feedbacks the product developments could have better improvements. Meanwhile, FIRDI also carried out marketing campaigns with a number of retail channels and promoted awareness through a variety of audio and video media, with a click view number of more than 6 million.



›The elder-friendly food with texture-friendly labeling



### Guiding the development of new products with standards and technologies :

In 2020, FIRDI has used domestic agricultural ingredients for the development of 5 texture-adjusted poultry products and products with high-nutrient density, including the development of prepared skin-on chicken products (to meet the texture grade for easy chewing) with physical treatment and enzyme softening technology. Among them, the technology to produce prepared elder-friendly meal products that are phosphate-free and

gum-chewable has been transferred to related industries. In the future, such ready-to-use poultry meat ingredients can not only be used for catering and RTH prepared foods for meat tenderization, but they can also be used to provide medical care and prepare easy-to-chew and gum-chewable food ingredients for seniors at home. FIRDI would continue to improve the interactive and convenient senior meal service toolset design 2.0 versions, which will not only incorporate research on the needs of parental care but also help the traders master the needs of the elderly.



› Photo of the launching ceremony for the use of the elder-friendly food with texture-friendly labeling on November 25<sup>th</sup>, 2020, section chief Dr. Chun-lung Cheng of the Council of Agriculture (back row, 5<sup>th</sup> from left), Director General Dr. Chii-Cherng Liao of FIRDI (back row, 6<sup>th</sup> from left), and representatives of the food industry who won the Eatender elder friendly texture-label.

## FUN FOOD TAIWAN - Revitalizing the new value and new trends of Taiwan's food industry



›On December 17<sup>th</sup>, 2020, Director-General Jang-hwa Leu of the Industrial Development Bureau (left 6), Director-General Dr. Chii-Cherng Liao of FIRDI (right 5), and the 2020 Fun Food Taiwan bakery winners took a photo together.

FIRDI has assisted the Industrial Development Bureau, Ministry of Economic Affairs to promote the "FUN FOOD TAIWAN" campaign since 2020. Through the selection and evaluation process of the "FUN FOOD Award", FIRDI integrated the phased innovation, transformation, and post-pandemic revitalization of the food industry, leading the industry to create directions and goals for innovation. Subsequently, FIRDI would put in more efforts in marketing and coaching so as to jointly create a new image and new trends for Taiwanese foods.

In 2020, two major industries, namely the bakery products, which were hit hard by the pandemic, and the brewed foods, which have benefitted from the stay-at-home economy, were selected as examples to emphasize the

three major trends of the global food industry – "clean and high value," "design experience," and "convenience and sustainability" for value enhancement and innovation. At the same time, FIRDI also invited cross-industry experts to jointly create a fair professional evaluation mechanism based on the aforementioned three major values. Within a short period of time after online registration was opened for contestants, 77 products entered the competition. After the qualification review and the two-stage selection of the preliminary round and semi-finals, relevant awards were awarded to a total of 31 second-category products, whose exhibition and award ceremony were held in the "FOOD TAIPEI Mega Shows" in December 2020.



## Food Quality Assurance Services

### Introducing food protection technology for food factory for international food safety management system compliance :

"Food Protection Plan Builder" is the first online digital tool to assist Taiwan food industry in line with international food safety management system. It contains more than 1,000 pieces of data with information such as food recalls and food fraud events. In 2020, the group had reach-out to 53 factories, completed 267 on-site supports. In accordance with the technical information requested by the industry, 5 technical

reports had been prepared and incorporated into the builder for manufactures to learn from, so as to prevent repeating the same mistake or shorten the downtime.

Overall, from 2016 to 2020, the group had assisted 254 factories implemented Food Protection Plan successfully, with 54 and 93 factories passed US FDA and overseas customer on-site inspections respectively, 201 businesses successfully obtained the latest international food safety management system certifications and 3 companies secured NSF certificates.

### Hygiene management and counseling for canned foods

**Improvement on contract services efficiency:** Various measures have been taken to improve the efficiency of canned foods service activities. Time to be on site (< 40 calendar days)

had been improved from 50% in 2018, 70% in 2019 and 80% in 2020. Nowadays, final testing report could be ready to deliver in one week.

**Construction of the canned foods database system homepage :** Database system of sterilization parameters for canned foods been consolidated from annually filing data, which

includes production plants, equipment used and various product characteristics. Manufacturers from canned food industry have started to submit service requests electronically since Nov. 2020.

### Project to assist industry to establish own expertise in thermal processing :

Total of 13 technicians from canned foods industry had been trained and qualified by FIRDI. And a total of 4 companies had completed all qualifications and started the self-conducting thermal processing studies. By Nov. 2020, total 7 heat distribution studies of retort processing and 78 product heat penetration studies have been accomplished by their own expertise.



›Schematic Diagram of Food Protection Plan Builder

# Food Inspection and Safety Evaluation



›High-performance ion chromatography

The Analysis Research and Service Center (ARSC) of FIRDI was an ISO 17025:2017 accredited food testing laboratory that provides inspection services which complies with the requirements of international standard.

To expand product exportation, FIRDI has actively strived to become an accredited testing laboratory registered in several countries. The Institute currently holds accreditations from various countries and regions: the Export Public Inspection System certificate by Japan's Ministry of Health, Labor and Welfare; fishery product inspection certificate by the European Union; drink, vinegar, and wine inspection certificate by Brazil; fresh crop import inspection certificate 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.

## Launching of the Online Contract Services Application Platform

In 2020, an "Online Contract Services Application Platform" was established to provide a convenient mechanism for human mobility and distance constraints during the pandemic. Customers could use their computers or mobile phones to

conduct online consultation, application, payment, progress query, report preview remotely, effectively strive for timeliness and master analysis data, effectively provide more convenient and diversified entrusted processing channels.





## Expansion in Scopes of Inspection Services

In 2020, ARSC has added new testing service items, include  $\beta$ -Agonists in food, heavy metals, pesticide residues, aflatoxin in Traditional Chinese medicine. In addition, complete the adulteration identification model and index components of soy sauce products, it can also be used as the basis for the quality monitoring

platform and quality standards promotion. At the same time, we are also develop and verify testing methods of food additives, confirm the applicability and specifications of food additive, and comply food additive specifications and to inspect on food additives, to speed up inspection performance.

## Database Construction and Optimization

The "Taiwan Food Composition Database" established has so far released a total of 2,121 pieces of data, and online database system has provided a real-time connection for consumers. In addition, FIRID has assisted the Ministry of Health and Welfare for the construction of the database of "food adulteration information platform". During 2016~2020, there were more than 5,000 international data on frauds and hazards related to food, medicine, and

cosmetics, had been collected, among which helped the authorities have the knowledge to respond in advance. In addition, examinations of VBN and total Enterobacteriaceae counts have been established as quality indicators for raw chicken materials this year, which significantly assisted the industry in improving quality control efficiency and reducing waste.



›Inductively coupled plasma atomic emission spectroscopy (ICP-AES)

›Real-time PCR inspection (Real-time polymerase chain reaction)

## Certification Services

FIRDI has provided several types of certification services including CAS Taiwan Premium Agricultural Products Certification, Second-level Quality Management Certification, TQF Taiwan Quality Food Certification, FSSC 22000 Certification, and SQF Certification. Except for the CAS certification issued by the Council of Agriculture and the secondary quality control certification by the Ministry of Health and Welfare, respectively, the other certification services have been complied with the requirements of ISO 17021, ISO 17065 and ISO 22003, and have obtained accreditation by TAF. In recent years, FIRDI has been actively striving to become a certification body for international scheme. FIRDI has obtained global accreditation by JAS-ANZ for SQF scheme and FSSC 22000 scheme, which make FIRDI not only a domestic, but also internationally recognized certification body.

### Continuation on the Promotion of Multiple Governmental Certification Management Systems

This year, FIRDI certification service center has promoted the seafood industry to implement GHP, CAS, HACCP, and ISO systems by encouraging factories to upgrade self-quality control abilities. Achievements in 2020 had included assisting 11 food sector categories including frozen food and others. A total of 118 manufacturers have obtained the CAS Taiwan Premium Agricultural Products Certification Label, 45 production lines and 249 alcoholic beverage products have obtained the alcohol quality certification and 401 facilities that have passed the second-level quality management certification of Food and Drug Administration. In addition, this project also contained a risk monitoring mechanism for “from raw material to final products” and producers were requested to complete the seafood product traceability system on this basis. Finally, FIRDI kept providing practical training courses, which included food safety essential knowledge, regulation understanding, to assist the producers having abilities to ensure their products in compliance with relevant law and regulation.

### Promoting the Management System of Agricultural Primary Production Farm and Primary Processing Plant for Aquatic Products

This year, in response to the amendments published on “Agricultural Production and Certification Act” and “Administrative Measures for Primary Production Farms of Agricultural Products”, FIRDI assisted on the publication of the code of hygienic practice, policy promotion, and guidelines on agricultural primary production practices. In addition, FIRDI also held various education and training courses, assisted potential and willing aquaculture operators for usages and legality of the land, and

› Voluntary establishment of HACCP assessment seminar for the catering industry







› Field visits of agricultural primary production farm management studies

strengthen site sanitation management along with supervising the safety of final product at the same time, as well as stabilize the market supply and demands.

## Keep Promoting the Voluntary Establishment of HACCP Assessment in the Catering Industry

Since 2009, in order to encourage the catering industry, the government has introduced the concept of Hazard Analysis Critical Control Point (HACCP) in the cooking process. In 2020, FIRDI has continuously devoted itself in promoting the sanitation evaluation system, which was originally served as consultation service provider at the early years, and evolved to a second-level quality control certification body. Moreover, relevant policies were also drafted through the analysis of on-site evaluation results to meet up the real needs and situation of industry. In 2020, the group has assisted 141 catering industries voluntary imply to HACCP assessment voluntary.

## Expansion of the Second-party Audit Service

FIRDI has been professionally recognized by the industry for years based on our experiences and capabilities in certification and auditing. In 2020, the group accepted the commission of the industry to conduct the audit of their co-manufacturing factories. It was expected that this second-party auditing business would give a promising approach in the future. FIRDI will always maintain a professional and impartial attitude to provide high quality services.





## Industrial Personnel Training



› Group Photo of Qualification Assessment of Food Industry Talents Symposium

FIRDI is the largest food industry professional training institution in Taiwan. In 2015, FIRDI Academy was established aiming on the development of cross-disciplinary innovative courses; cultivate diverse talents, and qualification assessments. In order to enhance the quality of training services, FIRDI Academy implemented Taiwan Talent Quality-management System (TTQS), and was awarded the Silver Medal for TTQS Training Organization Version. FIRDI Academy has also become an international SQF training center and provided internationalized training courses. Meanwhile, FIRDI integrated the curriculum with occupational competency and offered iCAP (Integrated Competency and Application) courses accredited by the Workforce Development Agency, Ministry of Labor.

FIRDI held two types of qualification assessment for food industry talents— "Food Quality Assurance Engineer" and "Health Food Engineers". The former certification was issued by the Ministry of Economic Affairs (MOEA) directly, and the latter was issued jointly by FIRDI and the Health Food Society of Taiwan, which was recognized by Industry Professional Assessment System (iPAS) of MOEA.

### Providing Professional Training and Education

These include HACCP and food quality assurance, product development, smart manufacturing, canning, biotechnology, food analysis, food safety inspection, continuing education, and primary agricultural product processing training for farmers and fishermen. A total of 191 classes were organized and trained 5,059 people in 2020.

### Expansion on Training Courses of International Regulations

In order to meet the demand of export industry, FIRDI offered international food regulation courses including FSMA practices, Halal certification and quality assurance, ASEAN health food regulations, and management of biotechnology product development and application. FIRDI and Halal



Industry Development Corporation (HDC) co-organized “Halal Science & Halal Lab Assurance Management” online course to familiarize the

industry with international regulations and market trends, and to expand business opportunities in 2020.

### Optimization of Training Environment

In order to provide a comfortable and safety learning environment, the biological operation laboratory was refurbished to meet the requirement of a Biosafety Level 2 Laboratory in 2020, and 6 Class II BSCs were newly purchased to provide a compliant operational environment. The Canning School with pilot plant was established and

provided a professional high-quality training environment. In response to the pandemic of COVID-19, internet has been relied heavily, which subsequently facilitates the digital learning platform. FIRDI would continuously being active in developing digital courses in the future to provide more diversified learning courses.

### Qualification Assessment for Food Industry Talents

In 2020, 6 assessments were carried out on 48 examination sites in 97 test rooms across the country with 5,018 applicants. Overall, 375 “MOEA Certified Food Quality Assurance Associate”, 4 “MOEA Certified Food Quality Assurance Specialist”, 312 Professional Health Food Engineer–Entry Level”, and 3 “Professional Health Food Engineer–Intermediate Level” were certified, reaching 594 in total. FIRDI also promoted the recognition agreement with corporates, which gave the certified applicants priority of interview and employment. Twenty-one new agreements were signed in 2020, reaching a number of 297 in total.



› The new BSL Class II practice microbiology training laboratory



› MOU Signing Ceremony for Talent Cultivation between FIRDI and National Chung Hsing University

## Special Reports

### Response and Adjustment of FIRDI's Businesses During the COVID-19 Pandemic

Since the pandemic of COVID-19, FIRDI, in late February, 2020, has required employees to imply split operations, 24/7 card access control of each building, as well as closed connection channels between buildings. Employees were not permitted to make physical contact with each other unless necessary and were required to use phone, internet, or video chat to communicate instead. Public areas were disinfected daily, and elevators, handrails, door handles, etc. were wiped with bleach. For external visitor management, apart from taking forehead temperature, the meeting area was restricted to the reception room of the service building. Contact windows for trainee registration, entrusted analysis, delivery, etc. were all set up outdoors. In addition, other related businesses such as R&D, services and promotion also coordinated with governmental policies to adjust practices or introduce new operating models.

#### Taiwan agricultural food for epidemic prevention

In order to expand the applications of Taiwan's agricultural materials, FIRDI had organized "Taiwan agricultural food for epidemic prevention" competition. 9 products including staple foods, non-staple foods, soups, desserts and beverages were selected and listed on chain stores. The characteristics of epidemic prevention foods were to be focused on the foods could be stored at room temperature, i.e. easy storage, conveniences in usage, and functional ingredients, i.e. nutritional balances, etc. These foods could not only be used as home storage food, but also encourage the exploitation rate of Taiwan agricultural materials.



▷ Taiwan agricultural foods for epidemic prevention

#### R&D achievement promotion platform

On April 10<sup>th</sup>, 2020, the "2020 R&D Achievements Presentation Conference" was held and published on FIRDI's website as well as an online platform site. A total of 54 technologies for

early participation in 2020 and transferable R&D results in 2019 were announced. Display platform link: [https://www.firdi.org.tw/Bulletins\\_Detail.aspx?BulletinID=30005380](https://www.firdi.org.tw/Bulletins_Detail.aspx?BulletinID=30005380)



## Guidance for farmers in imbalance of production and sales due to the outbreak of COVID-19

Farmers in the Taoyuan area provided a nutritious lunch for school children with organically cultivated komatsuna (Japanese mustard spinach). However, due to the delay of a new semester for the COVID-19 pandemics, the production and demand of komatsuna were unbalanced. The young agricultural society in Taoyuan had applied the "low temperature drying technology" to dry komatsuna under the guidance of FIRDI. Dried komatsuna powder was then made via milling and sieving technology furtherly. This combinational technology retained the original color and aroma of komatsuna. Komatsuna's powder had been

used in various processed foods, for example, noodles, egg rolls and bread, which had become a variety of local value-added featured products.



› A variety of value-added specialty products from Komatsuna powder were developed.

## Striving for the R&D project from the government for the food industries

The government promoted the "Research and Development Project Plan" for industries affected by the pandemics that have operational difficulties through relief subsidies. BCRC counselled detergent manufacturers to develop antibacterial and epidemic prevention sanitary

products using microbial-derived lipopeptides. In addition, the group also counseled beverage manufacturers for the development on functional beverages based on plant raw materials to help manufacturers adapt to the industrial impact caused by the pandemics effectively.

## Distance learning with FIRDI Academy

To ensure smooth delivery of training courses under COVID-19 pandemics, FIRDI Academy had expanded software and hardware facilities to improve the quality of online video courses. FIRDI Academy had established a digital learning platform, and would actively invest in digital curriculum development in the future to provide more diverse learning courses. By using subsidies distance learning, in response to the impact of COVID-19, offered 5 free HACCP training courses to assist 83 trainees to obtain the qualifications of health inspectors and HACCP team member.



› Video conference with Dr. David Acheson, former associate commissioner of U.S. FDA

## I nauguration of FIRDI Canning School and Pilot Plant

The opening ceremony of “FIRDI Canning School and Pilot Plant” was held on July 22<sup>nd</sup>, 2020. Chairman of FIRDI, Mr. Mark Hsieh led the first-level supervisors and invited representatives, such as the Chairman of the Taiwan Canner’s Association etc., to participate.

FIRDI Canning School planned to provide practical trainings on innovative R&D and process improvement, conducted the “Canning R&D Technology-Sterilization Condition and Quality Practices” course for the R&D personnel to help nurture canned food professionals enhancing the core capabilities of product research and development to create diversified products.



› The Opening Ceremony of FIRDI Canning School and Pilot Plant

### Establishing FIRDI “Canning School”

FIRDI has proposed a “Canning School” improvement plan to cooperate with Taiwan Canner’s Association and other sectors for the promotion on upgrading the domestic canned food industry. The School served as three functions—personnel training, talent matching, and innovative R&D. FIRDI renovated

the intermediate factory as a special pilot plant for canned food in 2020, and designed a learning map for professionals in the canning industry, reorganized training courses, and compiled standard textbooks to promote talent development in the canning industry.

### Reconstruction of the canning pilot plant

The pilot plant consisted with a conditioning room, a filling and packaging room, and a sterilization room. Tests could be done consistently—from raw material to finished products. The hardware of the factory complied with the current hygiene regulation on canned food. A class 100,000 cleanroom air-conditioning, ventilation facilities, and polyurethane industrial floor were installed in the filling area, which can help adjusting the processing environment parameters and

simulate the environmental requirements of canning conditioning tests and packaging. Additional heat distribution/heat penetration measuring instruments and new sterilizer were also installed. In addition, FIRDI provided trial production of small batch cans of prepared foods, simplified unit operation equipment and process. Practical applications combined with sterilization theory were achieved for the improvement on process safety and quality evaluation.



## Researches and Cooperation with Medical Centers on Precise-therapy in Terms of Fecal Microbiome Transplantation (FMT)

MOU on precise-therapy using Fecal Microbiome Transplantation (FMT) were signed between FIRDI and Linkou Chang Gung Memorial Hospital on 20<sup>th</sup> of January, 2020. This MOU was signed by the Chairman of the committee of Chang Gung Memorial Hospital, Dr. Wen-Jin Cherng and Director General of FIRDI, Dr. Chii-Cherng Liao.

Through the research and development of human microbiome, many novel industrial applications on microorganisms had arisen. Scientific researches and innovative applications need multidisciplinary cooperation. Microbiome Technology platform together with the Fecal Microbiome Transplantation performed by Chang Gung Medical System were used as

precise-therapy on patients with severe or recurrent or refractory *Clostridium difficile* infection. Both parties are looking forward for combinations of microbiome technology platform for industry from FIRDI and clinical and translational research from Chang Gung Medical System, leading to future development on microbiomic biologics or probiotic products.

This would lead to further developments on precision medication, such as therapy for patients suffered from imbalance of gut microbiome that led to other related diseases, as well as developments in food and bioresources that could validate and verify the clinical evidences for prevention or nutritional healthy food products.



›MOU of on precise-therapy using Fecal Microbiome Transplantation (FMT) was signed by the Chairman of the committee of Chang Gung Memorial Hospital, Dr. Wen-Jin Cherng (6<sup>th</sup> on front line from the right) and Director General of FIRDI, Dr. Chii-Cherng Liao (5<sup>th</sup> on front line from the left) on the 20<sup>th</sup> of January, 2020.

## Promotion of Overseas Cooperation and Exchanges

### Thailand-Taiwan Industrial Collaboration Summit

Led by the national federation of industries on both sides, the “4<sup>th</sup> Thailand-Taiwan Industrial Collaboration Summit” was jointly held by FIRDI and the National Food Institute (NFI) of Thailand through video conferencing and online negotiation from September 22<sup>nd</sup> to September 24<sup>th</sup> for the first time, 2020. In line with the development trends of business opportunities during the COVID-19 pandemics and the new global daily life orders, the four major aspects of interests to both parties, that is, food biotechnology, textile, smart city, and automation. Through the exchange and cooperation of the industrial chains, both parties enjoyed new directions and potential for collaboration at the summit. The two parties also signed two letters of intent for cooperation and built two cooperative relationships, bringing the existing cooperative relationship to the next level. In line with the COVID-19 pandemics in 2020, lactic acid bacteria with future influence and business opportunities

for cooperation emerged from “the food biotechnology” aspect during the summit. The two parties enthusiastically discussed the key health ingredients of lactic acid bacteria as a new business opportunity for future cooperation in the Taiwan-Thailand industrial chain and market.



› From September 22<sup>nd</sup> to 24<sup>th</sup>, 2020, the Food Industry Research and Development Institute planned and organized the “4<sup>th</sup> Thailand-Taiwan Industrial Collaboration Summit” between Taipei and Bangkok through video conferencing.

### Indonesia-Taiwan Industrial Collaboration Forum and Taiwan-Malaysia Industrial Collaboration Summit

The “4<sup>th</sup> Taiwan-Malaysia Industrial Collaboration Summit,” the business conference--food, drug, and cosmetic sub-forum that was co-organized by the Institute, took place online for two consecutive days starting on September 17<sup>th</sup>, 2020. The “4<sup>th</sup> Indonesia-Taiwan Industrial Collaborative Forum,” whose food biotechnology

sub-forum was co-organized by the Institute, was also held online in October of the same year. Through video conferencing, Taiwan and Indonesia discussed seaweed technology and industrial developmental strategies. In the future, FIRDI will continue to exchange views on high-value development and diversified



applications of seaweed raw materials for the promotion of a closer industrial partnership between Taiwan and Indonesia. In order to enhance the connections between the domestic

food industry and the Indonesian industrial ecosystem, two cooperation agreements with Indonesian partners was signed.



› Organizing the “2020 Indonesia-Taiwan Industrial Collaboration Forum-sub forum of food biotechnology”

### Business services website for Taiwanese overseas

FIRDI has set up a website as information provider regarding food technologies and services to Taiwanese overseas in Sept. 2020. Every opportunity is welcomed to jointly enhance the international competitiveness and value-added of Taiwan's food industry to achieve a win-win situation.



全球僑臺商  
食品技術服務平臺



加入好友

› Line of food technology service for Taiwanese overseas

## Promotion of Popular Science Education

### Railways of Popular Science - Hsinchu Station Event

In cooperation with "2020 Taiwan Railways of Popular Science" event promoted by the Ministry of Science and Technology, the Institute set up a booth for popular science experiments on canned foods at Hsinchu Railway Station. The booth offered hand-on practices, hoping to stimulate students' curiosity in scientific exploration and gave them knowledge about how traditional cans and aseptic packaged beverages were made. This activity attracted more than 500 elementary school pupils from Taoyuan and Hsinchu areas.



› FIRDI was invited to the pre-event press conference of "2020 Taiwan Railways of Popular Science" hosted by the Ministry of Science and Technology.

### Training seed teachers

FIRDI had been working with the Ministry of Economic Affairs and the Ministry of Education for the promotion of cross-sector collaborations in Qualification Assessment. FIRDI and National Formosa University jointly organized the

"Training Course for Seed Teachers of Food Quality Assurance Engineer" in end of August, 2020, 23 trainees and cultivate the talents of food quality assurance professionals were trained during the course.

### Love-sending to rural area

FIRDI and SIG Combibloc Co., Ltd jointly organized a love-sending to rural area activity. FIRDI had sent 2,000 cans of aseptic nutritious soymilk beverages produced in FIRDI pilot plant to five elementary schools in Penghu and Tainan, respectively. FIRDI also shared knowledge about aseptic beverage processing technology and soymilk nutrition concepts at Yushan and DongYuan elementary school in Tainan, respectively with a total number of 110 students participated.



›The group photo of the nutrition education activity at Yushan elementary school in Tainan (photo taken at Sept. 30<sup>th</sup>, 2020).



## Awards Obtained in 2020

Special Reports ●

Director-General of the Food Industry Research and Development Institute (FIRDI), Dr. Chii-Cherng Liao was awarded the Fellow of the 2020 International Academy of Food Science and Technology (IAFoST).

Director-General of FIRDI, Dr. Chii-Cherng Liao and Deputy Director-General of FIRDI, Dr. Tony J. Fang were awarded the Mr. Hsieh Cheng-Yuan Special Contribution Awards by the Mr. Hsieh Cheng-Yuan Food Technology Development Foundation. The R&D team of plant-based meat technology was also awarded the Mr. Hsieh Chung-Pi Innovation Award.



›Director-General of FIRDI, Dr. Chii-Cherng Liao (left) and Deputy Director-General of FIRDI, Dr. Tony J. Fang (right) were both awarded the Mr. Hsieh Cheng-Yuan Special Contribution Awards.



›Senior researcher of FIRDI, Dr. B. Barry Yang was awarded the 50<sup>th</sup> Professor Stephen S. Chang's Outstanding Achievement in Food Science and Technology Award by the Taiwan Association for Food Science and Technology.

Senior researcher of the Food Industry Research and Development Institute, Dr. B. Barry Yang was awarded the 50<sup>th</sup> Professor Stephen S. Chang's Outstanding Achievement in Food Science and Technology Award by the Taiwan Association for Food Science and Technology. Furthermore, the awards won by other members of FIRDI in 2020 were as follows: Researcher Mr. Chih-Hong Tung was awarded the Food Science and Technology R&D Achievement Award; Researcher Dr. Sam-Long Hwang was awarded the Mr. Zhang Tong Commemorative Patent Invention Award; Technician Ms. Linng-Yir Yeh, Associate Researcher Ms. Tzu-Wen Chen and Associate Technician Ms. Yu-Hsin Chen were awarded the Extension and Service Achievement Award. Awards and recognitions were given at the Annual General Meeting held in Pingtung on December 4<sup>th</sup>, 2020.

FIRDI executed the "DIGI+ Talent Accelerator & Jumpstart Program" funded by the Industrial Development Bureau, Ministry of Economic Affairs was to promote cross-disciplinary digital talent practical project researches. Research scientist of FIRDI, Dr. Zhong-Huang Wang and Professor Zhen-Jie Hsieh from the Institute of Electro-Optical Technology of National Taiwan Normal University had been jointly advised students to conduct researches on the topic of "Application of Real-Time Detection Spectrum System in the Food Industry", of which has won the "Excellence Award" in the special contest.



›FIRDI not only had won the DIGI+ Talent "Quality Training Institute" award in 2019, students' research topic supervised by the group has won the "Excellence Award" in 2020.

# Major Events in 2020

01/02

Senior Scientist Researcher Dr. Meng-Jen Tsai was assigned as the Acting Director of the Product and Process Research Center, whereas Researcher Dr. Yi-Hong Chen was assigned as the Acting Director of the Certification Service Center. At the same time, Ms. Yan-Hwa Chu retired from her positions.

01/20

A memorandum of cooperation between FIRDI and Linkou Chang Gung Memorial Hospital was signed by Director-General of the Food Industry Research and Development Institute, Dr. Chii-Cherng Liao and Superintendent of Linkou Chang Gung Memorial Hospital, Dr. Wen-Jin Cherng for carry out microbiome in precision medicine research jointly.



## Feb.

02/18

The Product and Process Research Center was reorganized into 3 main sectors, 10 groups: (1)the product design sector: includes agricultural and aquatic products, meat and prepared foods, food texture design, nutritional enhancement products groups, etc. (2) the process development sector: includes novel processing technology, edible oil and functional food, plant-based protein products, grain and legume processing groups, etc. and (3)the technical supporting sector: includes food packaging and sensory evaluation, and animal experiments groups.

## Mar.

03/02

The "Online Contract Services Application Platform" were officially launched, FIRDI providing online/offsite applications for analysis, payment, progress inquiry, and preview reports.

## Apr.

04/10

Research achievements of FIRDI in 2020 conference and the initiation of cooperation projects between industries and FIRDI were organized on FIRDI's official website.

## Jan.

01/06

Dr. Buddhi P. Lamsal, Associate Professor of the Department of Food Science and Human Nutrition, Iowa State University, visited FIRDI.



01/21

Mr. Hideaki Sato and Mr. Mamoru Ishii from the Stem Cell Research Institute of Japan visited FIRDI.



02/25

The Dean of the National Academy of Marine Research, Dr. Yung-Fang Chiu, and a group of 5 delegates visited FIRDI.



## Jun.

06/03

The Analysis Research and Service Center of FIRDI was reorganized into the following four groups: Nutritional and Functional Analysis, Trace Elements and Food Additives Analysis, Microbiological and Biotechnological Analysis, and Entrustment Analysis and Service.



**06/23**

The Institute held a tea party in honor of the retirement of the director of the Technical Service and Extension Center, Dr. Chin-Cheng Huang.

**Jul.****07/01**

Senior Scientist Researcher, Dr. Meng-Jen Tsai was assigned to be the Director of the Product and Process Research Center of FIRD.

**07/07**

The signing ceremony of the cooperation project between FIRD and Sophie's Bionutrients Pte. Ltd. was co-hosted by Chief Executive Officer of Sophie's Bionutrients Pte. Ltd., Dr. Yao-Hsin Wang and Director-General of FIRD, Dr. Chii-Cherng Liao.

**07/23**

FIRD participated in the "2020 BIO Asia-Taiwan" in Taipei (23<sup>rd</sup>-26<sup>th</sup> of July).

**06/19**

Five people, including Sino Cell Technologies Former Chairman Mei-Ching Ho and Dr. Ming-Sai Chien, visited FIRD.

**06/29**

The director of the Technical Service and Extension Center, Dr. Chin-Cheng Huang, retired at the end of the year, and the position of center director was acting by former deputy director Dr. Jui-Sen Peng. The Acting Director of the Certification Service Center, Dr. Yi-Hong Chen, also retired, and the position of center director was taken over by former Director of Analysis Research and Service Center, Dr. Wei-Guang Fu. Furthermore, from July 1, the position of center director of the Analysis Research and Service Center was acting by Ms. Hui-Shu Chang, the former Deputy Director.

**07/22**

FIRD held the Inauguration of FIRD Canning School and Pilot Plants and, including the directors and supervisors of the Taiwan Canners Association, total of 36 delegates were invited to attend the ceremony.



**07/27**

Chairman of the National Animal Industry Foundation, Mr. Tsung-Hsien Lin and other 4 delegates, visited FIRD.



**08/26**

FIRD organized workshops and lectures for "the 2020 Discovering Technology Treasures - Architecture in the Mouth".



**Sep.**

**09/03**

Deputy Branch Director from the Kaohsiung Branch of American Institute in Taiwan, Mr. Ming-Lei Li and another delegate, visited the Chiayi Industry Innovation and Research Center of FIRD.



**Aug.**

**08/12**

FIRD participated in the "Discovering Technology Treasures Show" held at the Pavilion of New Fashion, Taipei International Flora Exposition (13<sup>th</sup>-30<sup>th</sup> of August).



**08/27**

A total of 29 members from the 2020 Agriculture and Health Industry Delegation, Asia Taiwanese Chambers of Commerce visited FIRD.



**09/09**

Sector Chief of the Food Processing Sector, Council of Agriculture, Dr. Chun-Lung Chen visited FIRD to guide and verify the COA Elder Friendly Project implemented by FIRD.





**09/17**

A total of 22 members from the Taiwan Vegetable Oil Manufacturers Association visited FIRD.

**09/23**

FIRDI held "the 2020 Thailand-Taiwan Industrial Collaboration Summit-Food Biotechnology and Automation Sub-project" in Taipei.

**09/24**

FIRDI participated in the "2020 Taiwan Innotech Expo" held in Taipei. (24<sup>th</sup>-26<sup>th</sup> of September)

**09/30**

A technology transfer signing ceremony between the Institute and Taiwan Chlorella Manufacturing Company (TCMC) was co-hosted by Chairman of Taiwan Chlorella Manufacturing Company (TCMC) Mr. Chin-Hsi Yeh and Director-General of FIRDI, Dr. Chii-Cherng Liao, in Hsinchu.

**Oct.****10/14**

The Certification Service Center of FIRDI was reorganized into the following two groups: Agricultural Products Certification, and Verification groups.

**10/26**

In cooperation with "The 2020 Taiwan Railways of Popular Science" event promoted by the Ministry of Science and Technology, the group had set up a booth for popular science experiments on canned foods at Hsinchu Railway Station, in which elementary school students from Hsinchu and Taoyuan were participated.

**10/28**

A total of 10 members, including Chairman of Chung Hua Biomedical Industry Association (CBIA), Mr. Chien-Chou Chen, visited FIRDI.

**10/31**

Celebrated the 53<sup>rd</sup> anniversary events of FIRDI.



# Nov.

## 11/10

Ceremony for the signing of a letter of intent between FIRDI and National Chung Hsing University was held. This letter of intent was signed jointly by Vice President of National Chung Hsing University, Dr. Chang-Hsien Yang and Director-General of FIRDI, Dr. Chii-Cherng Liao,



## 11/18

A delegation of 29 members from "2020 Chinese and Taiwanese Overseas Businessmen on Food Technology and Smart Agriculture" visited FIRDI.



## 11/27

The Administrative Office of FIRDI was reorganized into 4 different groups: Administrative Office, General Affairs group, Maintenance group, and Environmental Health and Safety group.

# Dec.

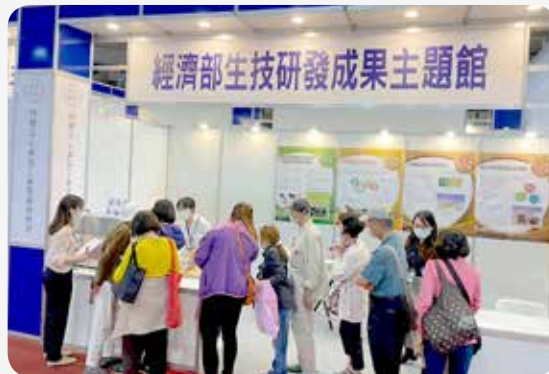
## 12/17

FIRDI and Han Dian Food Co. held a joint press conference on the release of "smart food reheating & cooking equipment and the technology standardizing the product reheating program" at Food Taipei Mega Shows. The group also held "the Fun Food Taiwan awards ceremony" at Food Taipei Mega Shows.



## 11/06

Participated in the "Southern Taiwan Biotechnology Exhibition" held in Kaohsiung. (6<sup>th</sup>-9<sup>th</sup> of November)



## 11/12

A total of 7 members, including Chairman from TCI Co., LTD. Mr. Yung-Hsiang Lin, visited FIRDI.



## 11/25

FIRDI held a "2020 launching ceremony on the usage of the Eatender elder-friendly food with texture-friendly label" in Hsinchu.





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# FIRDI 2020



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