Asia-Pacific Economic Cooperation

Advancing Free Trade
for Asia-Pacific **Prosperity**

Final Report of the Leverage Digital Twin Technology to Enhance Supply Chain Productivity for Resilient Economy project

APEC Policy Partnership for Science, Technology and Innovation

June 2023

Leverage Digital Twin Technology to Enhance Supply Chain Productivity for Resilient Economy

Final Report

Policy Partnership for Science, Technology and Innovation (PPSTI)

June 2023

APEC Project: PPSTI 03 2021A

Produced by

Chinese Taipei

For

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PROJECT PROFILE

Project number & title	PPSTI 03 2021A – Leverage Digital Twin Technology to Enhance Supply Chain Productivity for Resilient Economy
Committee / WG / Fora	PPSTI
Project Overseer Name	Mr. Jose Cheng
Organization / Economy	Chinese Taipei

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INTRODUCTION

1. Backgroud

The COVID-19 (Coronavirus disease 2019) crisis has plunged the global economy into recession and caused not only significant changes in the way people live and work, but severe challenges on disruption of industrial chains. According to the Global Economic Outlook report published by OECD (Economic Cooperation and Development), global GDP (Gross Domestic Product) dropped by 4.2% in 2020 due to the COVID-19 pandemic. It also unveils the inflexible circumstances caused by insufficiency of talents, new technology input and innovation in conventional industries. Therefore, integration of digital technologies for supply chains to achieve industry 4.0 will be the pivotal issue for SMEs (Small and Medium Enterprises) and conventional industries to recover the economic activities and avoid the middle-income trap. This project can help them to gradually introduce intelligent production mode and not be limited by short resources and insufficient self-improvement capability of digitization.

The project aims to share best practices on how digital transformation can help the aquaculture industry as a demonstration to develop new marketing and trend by employing digital twin. A digital twin is a digital representation of a real-world entity or system. The implementation of a digital twin is an encapsulated software object or model that mirrors a unique physical object, process, organization, person or other abstraction. The first practical definition of digital twin originated from NASA (National Aeronautics and Space Administration) in an attempt to improve physical model simulation of spacecraft in 2010. Gartner has included the top 10 strategic technology trends for three consecutive years from 2017 to 2019, and companies such as the U.S. General Electric Company and Germany's SIEMENS have introduced digital twin technology for manufacturing. The spirit of digital twin is that human-machine cooperation is not a replacement for human labor. Through processing big data, it allows teams to adjust their work models and improve efficiency through collaboration and real-time feedback.

Digitized knowledge can be taught remotely through various display technologies, allowing for contactless experience transfer in the post-pandemic era. Through workshops, site visits and case studies, stakeholders from APEC (Asia-Pacific Economic Cooperation) member economies will share their experiences in drafting policies that support digital transformation and extend the application of this technology to other industries, which has been proven to help boost capacity in a short period of time. To pave the way for resilient supply chain in APEC member economies, a report of policy recommendations collecting best practices from member economies will be presented as an important reference to prepare for future supply chain regionalization challenges.

2. Purpose

In order to ensure that representatives of APEC economies, in particular developing economies, are able to fully exchange ideas, experiences concerning their economies, and give feedback, an International Conference (hybrid format) was held in November 2023 with the purpose of demonstrating how to implement digital twin

technology in agriculture and fisheries, and discuss the current status of digital transformation in the APEC region. Subjects are included but not limited to: Introduction of flexible production solutions through digital farmers, targeting the most suitable crops and the lowest hardware and software equipment requirements, and demonstration of establishing the S.A.F.E (Sustainable Agri-Food cross-border Exchange platform) Platform, which is the operation mechanism of the Sustainable Agri-Food & Eating Platform. The international conference will invite speakers and experts from APEC member economies to share their knowledge, perspectives and involvement on leveraging digital twin technology to enhance supply chain productivity for resilient economy to all event participants and establish a sustainable food production supply chain in APEC economies. Digital content from the virtual field trip will be played throughout the conference. The best practices of smart agriculture solutions will be discussed to show the best practice model for the development and dissemination of smart solutions in the APEC region.

The conference is a 2-day event covering below topics:
(1) How to Build a Sustainable and Resilient Supply Chain for APEC Economies in the Post-Epidemic Era
(2) Digital Transformation of Production Technology: Experience Sharing of Digital Twin Technology in Agriculture and Fisheries
(3) Smart Agriculture Greenhouse Production Technology and Application
(4) Fishery and Electricity Aquaculture Technology and Application
(5) From farm to restaurant, agriculture and fishery products traceability and flexible supply chain operation sharing

This project plans to hold events includes international conferences, online consultations and other activities. In order to achieve gender equality, female participants from APEC economies will be invited, including experts and speakers of APEC delegations, policy makers, economic representatives, regional development agencies, SME participants, academia, research institutions, and private company representatives to share information and provide opinions. Nominations for participants are being sought from APEC's Policy Partnership for Science, Technology and Innovation (PPSTI), the Telecommunications and Information Working Group (TELWG) and the Small and Medium Enterprises Working Group (SMEWG) representatives.

3. Date & Venue

The **"APEC International Conference on Leveraging Digital Twin Technology to Enhance Supply Chain Productivity for Resilient Economy"** was held on November 3-4, 2022 in Taipei. Participants were invited to participate physically in the event at **Azalea Hall, Courtyard by Marriott Taipei Downtown** (No.6, Sec.3, Minsheng East Road, Taipei). We invited 4 speakers from other economies (Peru, Philippines, and Thailand) flying to Taipei and joined the physical event with APEC funding for per diem and air fare (one round-trip ticket to Taipei).

SUMMARY OF PRESENTATIONS

1. **Keynote Speech - Experience of promoting Digital Twin technology solutions in Chinese Taipei**

The first speaker is Dr. Neng-Kai Chang. He is the Section Chief from the Department of Industrial Technology of Ministry of Economic Affairs (MOEA). First, he briefly introduced the digital twin technology and how it can solve the pain points which both farming and fishery industries are facing. Then, he shared real case and results of applying digital twins in aquaculture. Lastly, he shared the success factors based on our experience as policy recommendations. Hope it can help to build resilient supply chains.

Introduction to Digital Twin
A Digital Twin is the virtual representation of a physical asset, process and system. Taking a medical case as an example, we all know that doctors cannot randomly test treatments among patients. But through digital twin technology, a virtual patient can be built for monitoring, supervising, testing and managing the best solution before applying them to human beings. It can not only raise the accuracy, lower the risks of decisions, but also result in better R&D and greater efficiency. Digital twin technology can be used in a wide range of applications. Besides medical care, it is also frequently used in manufacturing, transportation planning, as well as agriculture and aquaculture. My presentation today will mainly focus on farming and fishery, so let's see what pain points these industries are facing. According to the Food and Agriculture Organization of the United Nations, people engaging in the primary industry, also known as agriculture, forestry, fishery and animal husbandry, have been gradually decreasing around the world. However, with the increasing population, the demand for food is raising daily; what's more, the lockdown during the pandemic in the past few years has worsened the situation, and the shortage of labor may result in supply chain disruption or even a food crisis.

His presentation mainly focused on farming and fishery. According to the Food and Agriculture Organization of the United Nations, people engaging in the primary industry, also known as agriculture, forestry, fishery and animal husbandry, have been gradually decreasing around the world. However, with the increasing population, the demand for food is raising daily; what's more, the lockdown during the pandemic in the past few years has worsened the situation, and the shortage of labor may result in supply chain disruption or even a food crisis. Besides the labor shortage, according to Chinese Taipei's analysis, the four major pain points of agriculture and fishery industry includes: the apprenticeship system makes it inefficient to pass on experience, because it requires long periods of face-to-face instruction, and only few apprentices can be trained at a time. The decision-making risk is relatively high because it relies on old farmers' experience, and there is a knowledge gap. The experience of old farmers hasn't been transformed into objective data, making it difficult for beginners to enter the industry. Moreover, the agriculture and fishery industry require on-site operations, but the pandemic and lockdown may lead to supply chain disruption and worsen the negative impact of

labor shortages. With the introduction of digital twin technology based on AI (Artificial Intelligence), IoT (Internet of Things) and BIG Data, knowledge digitalization can solve the problem of inefficient learning and limited recipient caused by apprenticeship; AI integrates objective data into the experience-oriented decision-making model, so it can improve the accuracy of decision making; big data provides reliable recommendations to beginners and help them get started easily; the automation of fish farm systems and functions integration in mobile apps, allow fishermen to work remotely without worrying about disruption due to lockdown.

How the digital twin technology is adopted in farming and fishery:
(1) First, deploy IoT sensors on the farm or in the pool.
(2) Second, build a virtual farm or pool with the data collected by the IoT sensors, and then test solutions within it.
(3) Finally, AI will offer the best operation recommendation from its predictions.

Aquaculture Case
In Chinese Taipei's aquaculture case, we integrated the digital twin technology with human intelligence, and created the "Digital Twin Aqua-Solution." The IoT devices, such as water quality sensors and underwater cameras will be installed in the fish farm, for collecting fishermen's onsite operations and decision-making behaviors, and built a knowledge model for the virtual fish farm. And then, the AI system will generate a breeding schedule for the next 3-5 days through data analysis. Finally, the best recommendations are simulated and predicted for the fishermen's reference, and eventually enabling AI and human collaboration for decision optimization, and double farming value.

One of the key functions of the digital twin is "dynamic optimization". First, the digital twin virtual fish farm will generate original AI suggestions for the fishermen's reference through simulating the real fish farm conditions. After the fishermen executes, the system will compare the performances between the real fish farm and the virtual one, and evaluate the parameter differences. Then, it will iterate the model with the updated parameter, to ensure better breeding recommendations dynamically, and it works repeatedly for optimization. Moreover, this model can also be broadened to other aquatic species, which ideally facilitates the digital transformation of aquaculture.

Based on the statistics, the introduction of digital twin technology in aquaculture has effectively improved the fishermen's capability of "precision production", including a 50% enhancement in efficiency of the fishermen's operations, the improvement on survival rate of white leg shrimp from the original 10% to 54%, and of giant groupers from 40% to 82%. It also created a 30% increase in the aquatic yield. To sum up, digital twin can enhance the productivity and value of traditional agriculture and fishery products, and encourage the younger generation to sustainably participate in the industries.

However, other than the technology itself, the success of the case is actually based on the support of a comprehensive smart aquaculture ecosystem. On the production

side, integration and digitalization of the service chain of fishermen, fishery enterprises, and processors, could drive the transformation and innovation of the aquaculture ecosystem. Meanwhile, gathering the efforts of collaborators, such as the Ministry of Economic Affairs, research institutes, info and hardware suppliers, as well as domain experts, could create a total solution for turnkey transfer. Lastly, on the consumption side, consumers can trace the source of aquatic products for improving food safety, while feedback and demand could also be automatically provided to the production sides for enhancing the brand value of the smart aquatic products and achieving sustainable consumption goal.

Summary
First, cross-field integration is very important, and we suggest that different sectors, such as fisheries and technology, software and hardware, government and private sectors, should be encouraged to collaborate for stimulating more innovative solutions.

Secondly, the establishment of a demonstration site allows farmers to see how it works with their own eyes, and improve their confidence in new technologies, thereby enhancing their willingness to adopt them.

Lastly, replicating successful experiences with total solutions led to the development of the whole smart aquaculture ecosystem.

2. Keynote Speech - Applications of AI in Aquaculture

Artificial Intelligence Combined with Professional Skills to Transform the Breeding Industry
In the past, factory managers had their office overlooking the factory so that they could get a feel for what was happening on the factory floor. With the digital twin, not only the factory manager, but everyone associated with factory production could have that same virtual window to not only a single factory, but to all the factories across the globe.

AI Calendar
The database analysis will generate a feedback mechanism, provide breeding suggestions, and establish an intelligent breeding system. AI Calendar integrate environmental parameters, feeding records and growth status of fish farms. Environmental parameters include water temperature, dissolved oxygen, pH, salinity, redox potential, etc. Feeding records include feeding amount, changing of water, oxygenation, provision of probiotics, etc. Growth status including growth video recording, fish screening, body length, body weight, feed conversion rate, etc. The database analysis will generate a feedback mechanism, provide breeding suggestions, and establish an intelligent breeding system. Build expert knowledge base and provide consulting services. Breeding technology and experience have scientific basis and records, and can be effectively passed down.

The sensing data collection project includes connecting to the common application programming interface (API) of the Central Weather Bureau to obtain information such as temperature and tide, and using a screening machine to calculate the number of fish and store images, which can be used as the basis for body length analysis. Connect the water quality sensor IoT in series to obtain the sensing data (water temperature, dissolved oxygen, pH, Oxidation-Reduction Potential, salinity, etc.), store the data through the cloud server, and the data is analysed using by machine learning model training.

Smart Farming
Smart farming production chain can reduce damage caused by supply disruptions and avoid production interrupted due to labor shortage and technology succession gap.

Fishery & Electricity Symbiosis
Using fishery & electricity symbiosis can prevent energy shortages and increased prices and produce clean energy. It is a win-win situation.

3. Building a Sustainable and Resilient Supply Chain, NOW

In the post-pandemic era, we found these important impacts:
(1) Transportation for products/food/fertilizers/any materials
(2) Climate change and challenge
(3) Unstable production
(4) Food shortage, nutrient insufficient, food self-sufficient rate

We know we need to prioritize these:
Local/regional supply chain is priority
Regional supported cultivation
Technology implements and application
Climate change strategy: facilities and cultivation plan

Alliance is a suggested strategy.
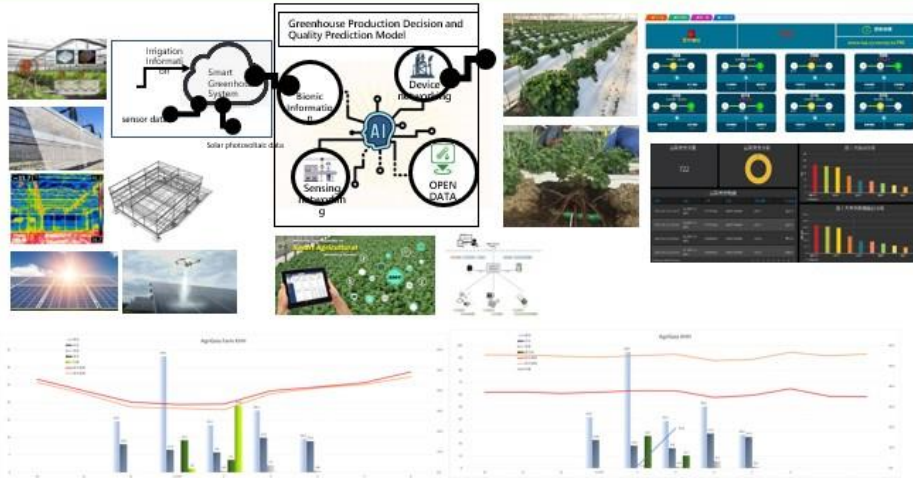
Human resources development is also an important part of a resilient and sustainable supply chain.

We suggest farms manage network with big data platform, IoT/AIoT (The Artificial Intelligence of Things) system, and solar power applications.

# LOCATION, DISTRIBUTION, TRANSPORTATION, MAMAGEMENT

Farm Managing Network with

Big Data Platform, IoT/AIoT System, Solar Power Applications.

4. How to Build a Sustainable and Resilient Supply Chain for APEC Economies in the Post- Epidemic Era (Peru)

Ubiquitous data, unlimited connectivity and massive processing power make new customer value propositions. Innovation and digital transformation is now the key word to all, on people/mindset, processes, and technology.
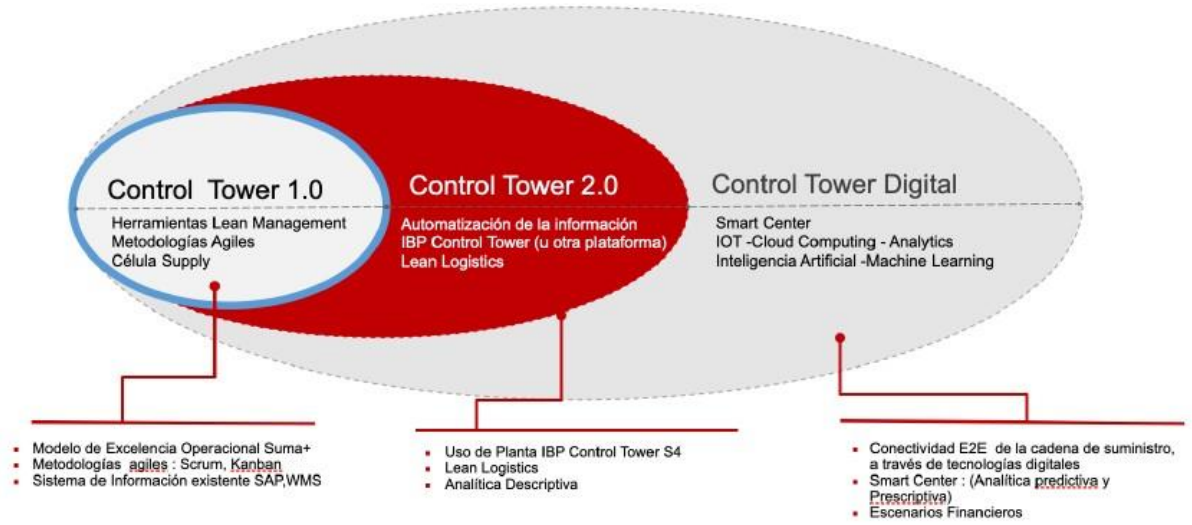
Framework: Organization design for digital transformation

https://www.dhl.com/global-en/home/insights-and-innovation/insights/logistics-trend-radar.html#
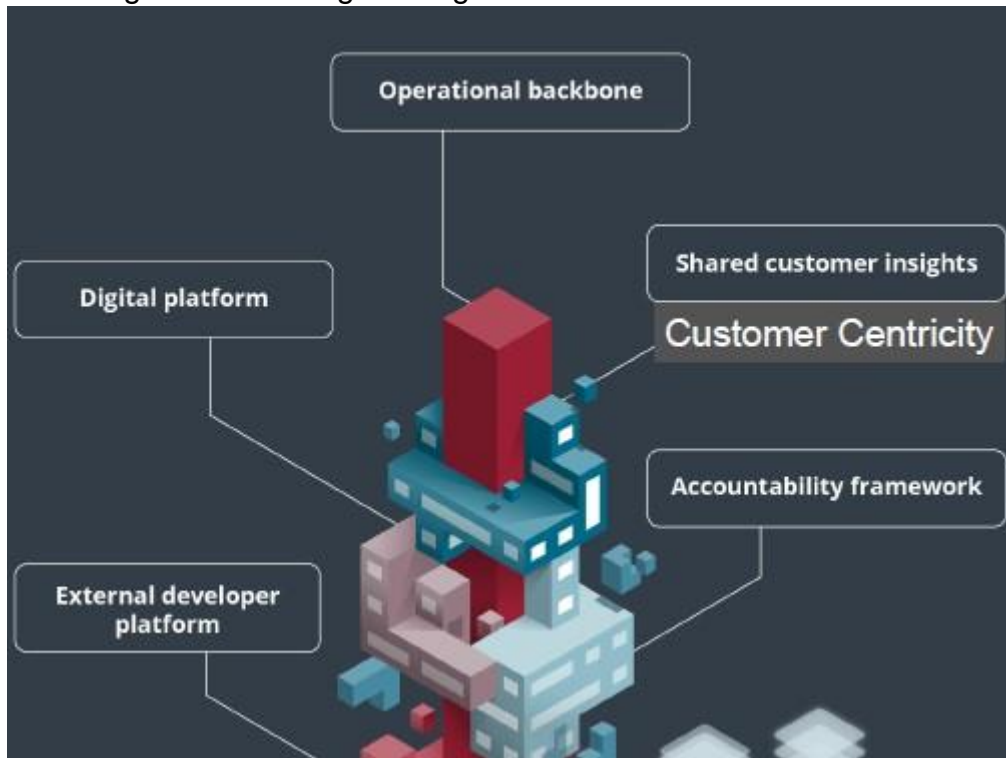
GS1 Peru proposed a control tower system:

Control Tower

Key skills in supply chain
(1) Ability to operate at the pace of a fully digital environment
(2) Development of cognitive skills for redesign and innovation
(3) Strengthen social and emotional skills
(4) Adaptability and Resilience

5. Q-yo Biotechnology Co., Ltd.

Q-Yo Biotechnology Corp. is a well-known mushroom producer in Chinese Taipei. To enhance the competitiveness internationally, it makes huge investment introducing automated equipment and installing intelligent production modules, and uses big data to analyze the biological resources and production data of mushrooms to build a real-time monitoring and big data early warning system. The management receives visible data, trend analysis and special analysis for reference in the decision-making. The ideal of standardized, scientific and precision agricultural management is achieved. Through the integrated big data system, the operation status of the equipment in the plant is constantly monitored, and the management of Q-Yo Biotechnology Corp. can make quick decisions and judgment in case of abnormalities. This reduces the chance of human errors, improves the accuracy of productivity forecast, reduces inventory costs, and increases overall revenue.

Managing Concept
Q-Yo is based on "people", conforms to nature and respects life. And committed to the strict control of food safety. Introducing nature into technology, then returning to nature with technology, by promoting organic life, Let all consumers have peace of mind and have fun. And enjoy the five senses provided by the Magic Mushroom Tribe. In the end, they sincerely take the concept of "Nature", "Health", "Live" and "Health". Share to everyone who also cherishes the land!

IPCC: Intergovernmental Panel Climate Change

Climate change, agriculture bears the brunt
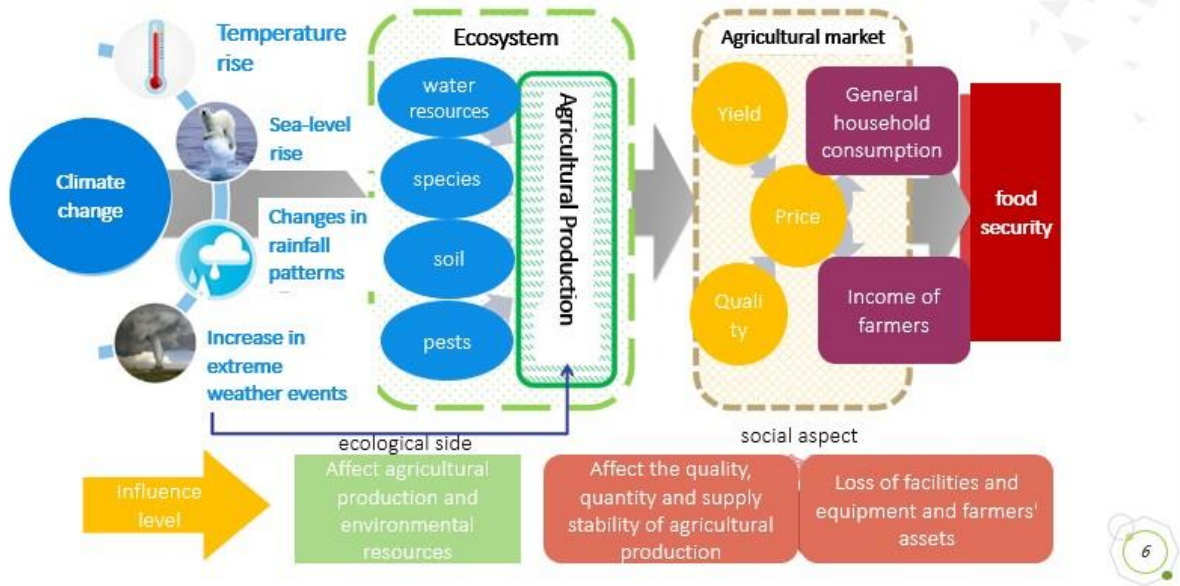
Evaluation Report of the 6th UN IPCC (The United Nations Intergovernmental Panel on Climate Change) Meeting pointed out that global warming continues, and the temperature may exceed 1.5 degrees in the next 20 years. From 1991 to 2020, the annual average temperature in my economy has risen by 1.6 degree Celsius, and there is an accelerating trend of temperature increase.

Challenges Facing Chinese Taipei's Agriculture
The rate of sea level rise is increasing. At the beginning of the 21st century, summer increased to 120-150 days, and winter shortened to approx.70 days, shortened to 20-40 days in winter in recent years is twice the global average.
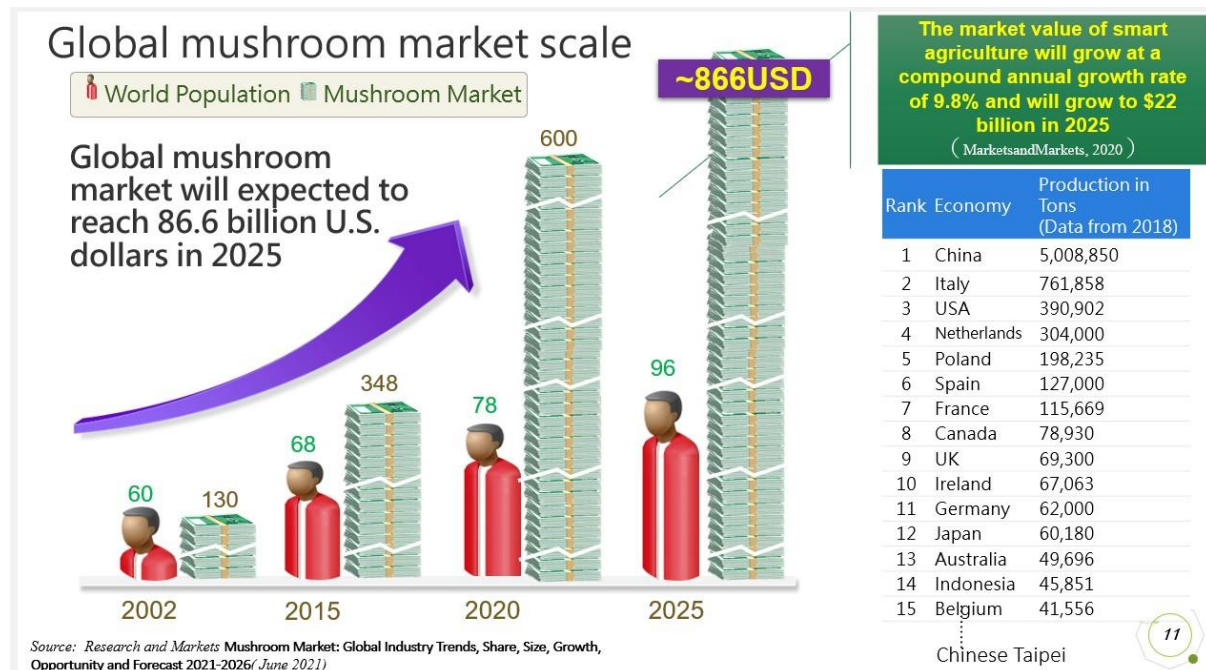
Carbon Neutrality
Carbon neutrality refers to the total amount of carbon dioxide or greenhouse gas emissions directly or indirectly generated by an economy, enterprise, product, activity or individual within a certain period of time. Offset the carbon dioxide or greenhouse gas emissions generated by itself, achieve positive and negative offsets, and achieve relatively "``zero emissions". There are generally two approaches to achieving carbon neutrality: Carbon offset mechanism and Low-carbon or zero-carbon technologies.

The carbon emissions produced by a business or economy are equal to the carbon emissions reduced elsewhere. For example: planting trees, purchasing renewable energy certificates. Use renewable energy sources (such as wind and solar) to avoid carbon dioxide emissions into the atmosphere from burning fossil fuels. The ultimate goal is to use only low-carbon energy sources, not fossil fuels, so that the amount of carbon released and absorbed back into the earth does not increase.

Status and Evolution of Mushroom Industry:

intelligent and innovative mushroom industry production module

Global mushroom market scale

🧍 World Population 🟩 Mushroom Market

~866USD

Global mushroom market will expected to reach 86.6 billion U.S. dollars in 2025

600

348

68   78   96

60   130

2002   2015   2020   2025

Source: Research and Markets **Mushroom Market: Global Industry Trends, Share, Size, Growth, Opportunity and Forecast 2021-2026** (June 2021)

The market value of smart agriculture will grow at a compound annual growth rate of 9.8% and will grow to $22 billion in 2025
(MarketsandMarkets, 2020)

Rank	Economy	Production in Tons (Data from 2018)
1	China	5,008,850
2	Italy	761,858
3	USA	390,902
4	Netherlands	304,000
5	Poland	198,235
6	Spain	127,000
7	France	115,669
8	Canada	78,930
9	UK	69,300
10	Ireland	67,063
11	Germany	62,000
12	Japan	60,180
13	Australia	49,696
14	Indonesia	45,851
15	Belgium	41,556

Chinese Taipei

11

The average consumption of edible fungus in the world

2010-2017 Global Edible Fungi Production statistics

6000
5000
4000
3000
2000
1000
0

Unit: 10,000 tons

2010 2011 2012 2013 2014 2015 2016 2017

978-2012 Global Population and Global Edible Fungi Production

World population (billions) and the total number of edible fungi in the world production (billions of kilograms)

30
25
20
15
10
5
0

1978 1983 1986 1990 1994 1997 2002 2008 2012

—— 世界人口 —— 世界食用菌產量

Statistics from FAO shows that the global production of edible fungi increased from 30.256 million tons in 2010 to 47.956 million tons in 2016, with a compound annual growth rate of 8%.

The per capita amount of edible fungi is estimated that it will reach more than 7 kilograms in 2021.

Source: Proceedings of the 8th International Conference on Mushroom Biology and Mushroom Products (ICMBMP8) 2014

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Mushroom Industry 2.0 to 4.0

Current Situation and Difficulties

- Pleurotus eryngii and Flammulina velutipes have been produced with full environmental control equipment system
- Lack of automated packaging, inoculation, handling, automated harvesting and system integration
- Environmentally controlled cultivation technology has matured, but due to lack of labor, production efficiency needs to be improved urgently
- Lack of equipment integration systems and automated upgrades, and insufficient quality standardization management

Import Productivity 4.0 Application Scenarios
- Full environmental control of intelligent production, providing consumers with traceable products with peace of mind
- Build a smart agriculture alliance, receive orders for mass production, and compete in the global market
- The use of liquid strain production and inoculation technology, combined with energy-saving equipment and intelligent management, reduces production costs and increases efficiency
- Integrate automated handling and harvesting operation modes, connect production scheduling and order management decision-making systems, increase product specifications and quality, and enhance international competitiveness.

Digital Twin Solutions for Smart Farming
- Build a virtual farm in the digital world, synchronize records, react to simulate the real environment, farmers' harvests, and crop growth conditions
- Combined with artificial intelligence (AI), sensors and data models are used to establish farmers' agronomic techniques and decision-making behaviors as knowledge models, improve farmers' ability to "smart monitoring and precision production", and digitize the technology of crop experts. way of inheritance.
- Through the digital avatar technology, AI dynamically learns the experience and knowledge of farmers, thereby achieving collaborative operation and greatly improving the effect of decision-making optimization.

Understand Customer Needs and Respond Flexibly to the Market
- Gain insight into the market context and grasp the leading business opportunities - business opportunities during the pandemic
- Change in consumer behavior: reduce going out, shorten shopping time, convenient and quick guidance, internet/supermarket shopping, prefer ready-to-eat small package & small package ingredients
- Organic live plant series
- Small package finished plant specifications

2022 Magic Mushroom Tribe-Live Series Fresh Mushroom 's Staged Product Promotion and Marketing

2022/Feb

- 7-11 DIY mushroom &YT

Mar. • Fengkang Supermarket & Shin Kong Mitsukoshi & CitySuper Fresh Mushroom Zone

6. Quezon City's Urban Agriculture Initiatives (The Philippines)

Quezon City, also known as the City of Quezon and Q.C. (read and pronounced in Filipino as Kyusi), is the most populous city in the Philippines. According to the 2020 census, it has a population of 2,960,048 people. It was founded on October 12, 1939, and was named after Manuel L. Quezon, the second president of the Philippines.
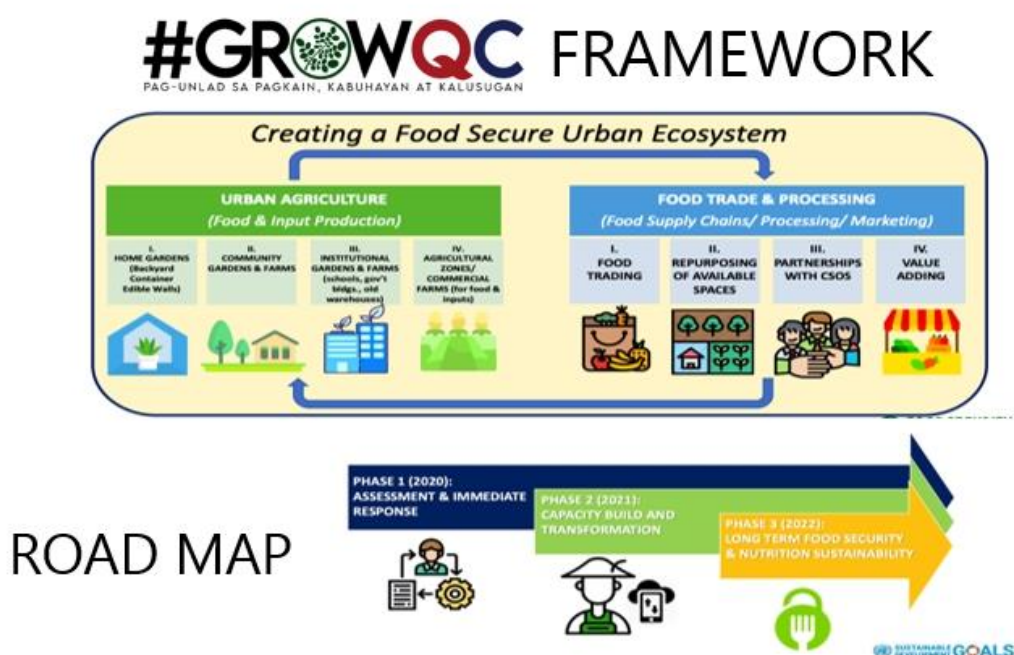
Urban Farming
Ma. Josefina "Joy" G. Belmonte is the Mayor of Quezon City from 2019 till now. She initiated Joy of Urban Farming project in 2010. The project aims to reduce poverty and improve the nutrition of urban residents in partnership with local barangay councils. It also encourages City residents to produce and grow vegetables for food on their tables and as a source of income to mitigate hunger.

GROW QC Food Security Campaign
In 2020, the city initiated another project called "GROW QC Food Security Campaign". The Quezon City Food Security Task Force (QC FSTF), the #GrowQC Campaign goes beyond setting-up more urban farms, but hopes to achieve a food secure and self-reliant city through the development of better food systems, establishment of special zones for urban agriculture, and food processing zones, in order to achieve Sustainable Development Goals (SDG) #2: Zero Hunger.

QC Public Employment Services Office (PESO)
One of PESO's mandates is to provide temporary employment for displaced workers, the underemployed and the unemployed poor, under the Employment Promotion and Generation Program. Workers were hired as part of the City's drive in propagating Urban Agriculture which provided livelihood and sustainable food supply especially during the pandemic.

#GROWQC 7-POINT ACTION PLAN

Urban Agriculture
Food & Input Production

1. **Vegetable Nurseries** (Seed Starter Kits)

2. **Community Model Farms / Gardens**

3. **Aquaculture**

4. **Feeding Program** (Community Soup Kitchen / Commissary)

Food Systems
Food Trade & Processing

5. **Agri-overlay Zone**

6. **Food Processing Zone**

7. **Food Trade** (GrowQC Kadiwa)

Summary Overview—as of June 2022

381,650 m²
Productive Land

4,119
Urban Farmers

347
Urban Farms & Gardens

146,039
Seed Starter Kits & Seedlings

23,550
Fingerlings

96
Aquaculture/ Aquaponic Units

450K*
Meals Served

Php 1.3M Worth (3,150.9 kg)
Kadiwa Food Traded

*2022 SSD Kalutong Pinoy Filipino Food Month Feeding linking QC urban gardens & farms

Challenges
- Sustainability/Self-reliance of Urban Agriculture when government funding/assistance is over
- Upscaling of Farms and Establishment of Markets for trading
- Continuous resource mobilization and capacity building of urban farm communities

Next step
- Engage in Private-Public Partnerships (PPP)
- Enhance collaboration with government agencies

- Further strengthen cooperation with various departments of Quezon City government
- Improvement of research activities

7. Digital farm management platform for know-how transfer (Thailand)

Mr. Opas Trithaveesak from National Electronics and Computer Technology Center (NECTEC), Thailand shared their digital farm management platform for know-how transfer.

The National Electronics and Computer Technology Center (NECTEC) was established on 16 September 1986 under the Ministry of Science, Technology and Energy (the former name of Ministry of Science and Technology). On 30 December 1991, following the enactment of the Science and Technology Development Act of 1991, NECTEC was transformed into a national technology center under the National Science and Technology Development Agency (NSTDA), Ministry of Science and Technology. At present, NECTEC is a statutory government organisation with its main responsibilities of under taking, supporting and promoting the research and development of electronics and computer technologies. NECTEC also provides linkage between research communities and industries through the established industrial clusters and programmes.

Know-how transfer
For precision farming, we need digital transformation to put the image processing and big data from **Real Farming** into AI Augmented Reality then transform to **Digital Farming**. Required data include crop requirement, irrigation, pest & diseases, fertilization, weather data. Above mentioned data can be used to create a **Digital Crop Management Calendar**.

WiMarC: Wireless Sensor Network for Management and remote Control
Users (farmers, learning center, and research center) will use WiMarC to manage and remote control their crop fields by use data uploaded in the cloud server. Through image information, we can have visible crop-management to have better products from farm management, exact period for irrigation, responses for fertilization, and reaction of pest &pesticide.
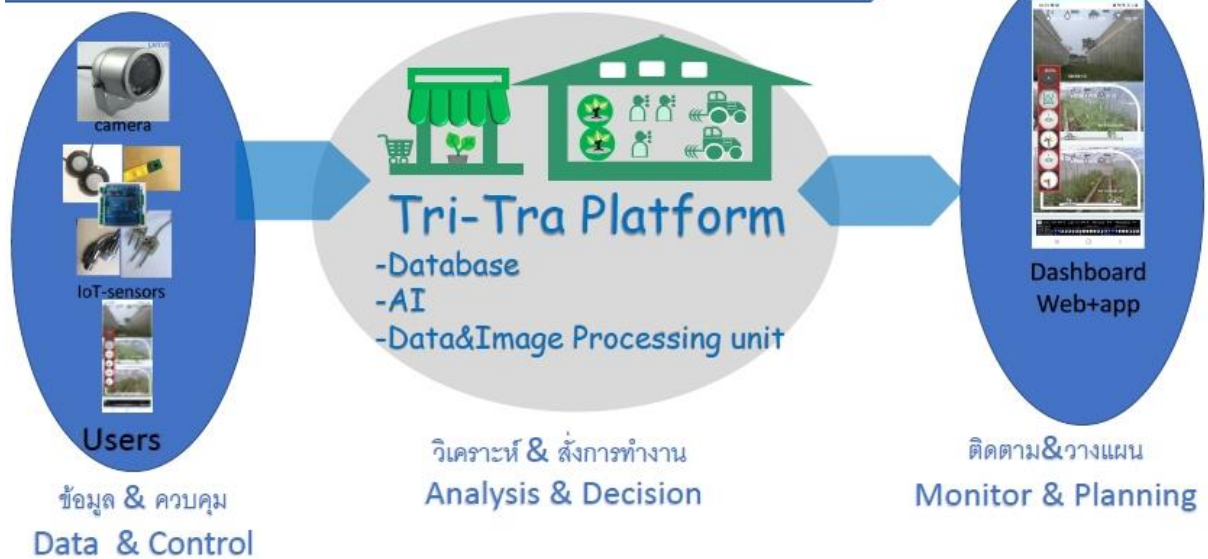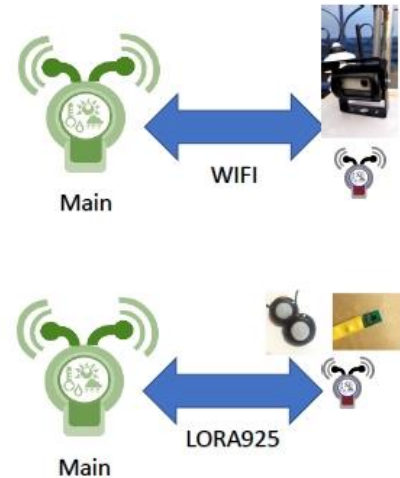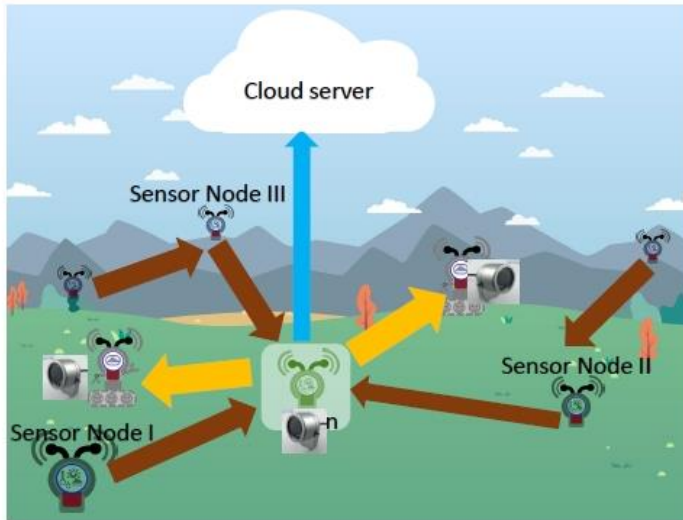
WIMARC: 3 Tra

Trade
-Virtual shop
-Seed
-Fertilizer
-Machine & instrument
-Pesticide

Transfer
-Learning Center
-University
-Agricultural Institutes

Trace
-Food Industry

NECTEC | TOGETHER

Open Innovation : WIMARC

camera

IoT-sensors

Users

ข้อมูล & ควบคุม
Data & Control

Tri-Tra Platform
-Database
-AI
-Data&Image Processing unit

วิเคราะห์ & สั่งการทำงาน
Analysis & Decision

Dashboard
Web+app

ติดตาม&วางแผน
Monitor & Planning

21

Wireless Sensor Network

8. **How to Cooperate with Industry to Develop Decision-Making Models for Smart Agriculture Production**

Ling Cheng Technology Corporation, Ltd., founded in April 2006, is dedicated to research and development and services of application related technology. Our focuses are "Food Safety Traceability", "Exquisite Agriculture"," Information Platform" and "System Integration" and we have strengthened the capabilities in software development and professional services. By incorporating quality policy of Capability Maturity Model Integrated (CMMI), we offer the best consultation services, sound solution programs and fast technical support.

Challenges of Agriculture Production
• Efficient Communication: How to effectively and instantly communicate and transfer information under larger scale farming?
• Climate Change: How to improve risk resilience and adaptability when facing severe climate change?
• High-value Production: How to increase the yield of specifications with higher economic value?
• Business Management: How to master the planting cost in detail, predict the harvest period and yield?
• Food Safety Crisis: How to implement the traceability in agricultural production process?

Implementation of Technology and Innovation
Smart Production Management includes these dimensions: Mobile APP (mobile application) Management; Food Traceability; Big Data; Experience Inherit; Production and sales coordination; Cropland Visualization.

Implementation of Technology and Innovation

© Ling Cheng Technology Co., Ltd.
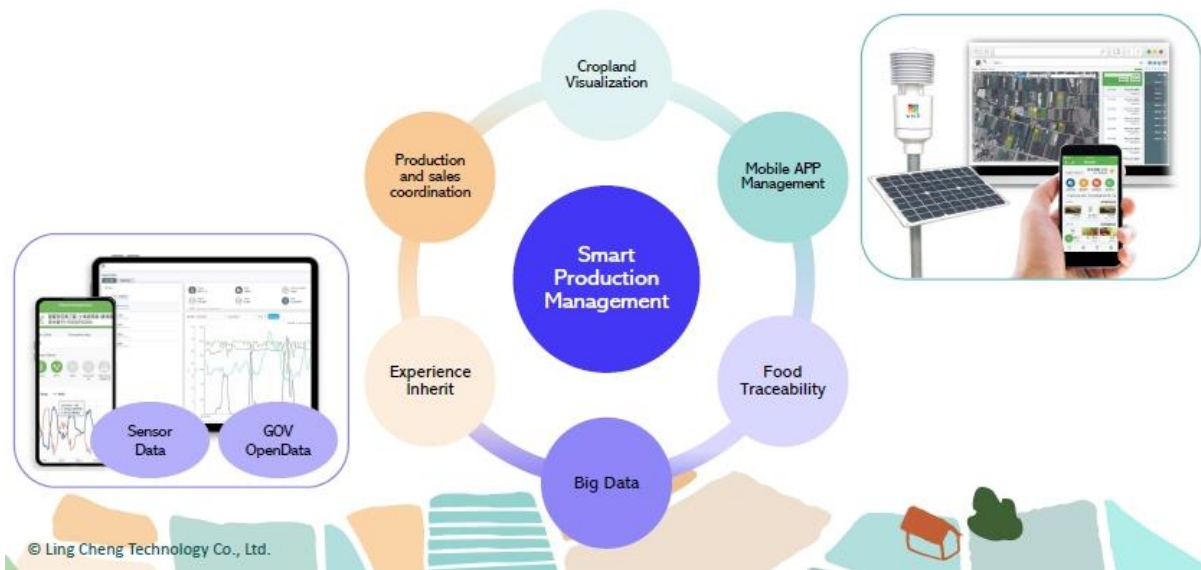
How to collaborate with the industry to research and develop technology

Collaborate with partners:
- Agribusiness or farmers who plant rice or sweet potato, etc.
- Research institution located in different areas.

Collect and analyze data:
- Real-time environmental data from sensors.
- Field work recording data from **JoinFarm**.
- Weather forecast data from CWB and companies.

Develop models:
- Establish planting growing models to optimize production efficiency
- Phenological stage (plant growing stage)

Define research goals:
- Adapt to climate change and workforce decline
- Predict planting period and harvest time

Data Collection Application Scenario

Conclusion: Data Collection Application Scenario

"Fundamental records can trigger the most efficient analysis and bring the decision module in the near future."

© Ling Cheng Technology Co., Ltd.
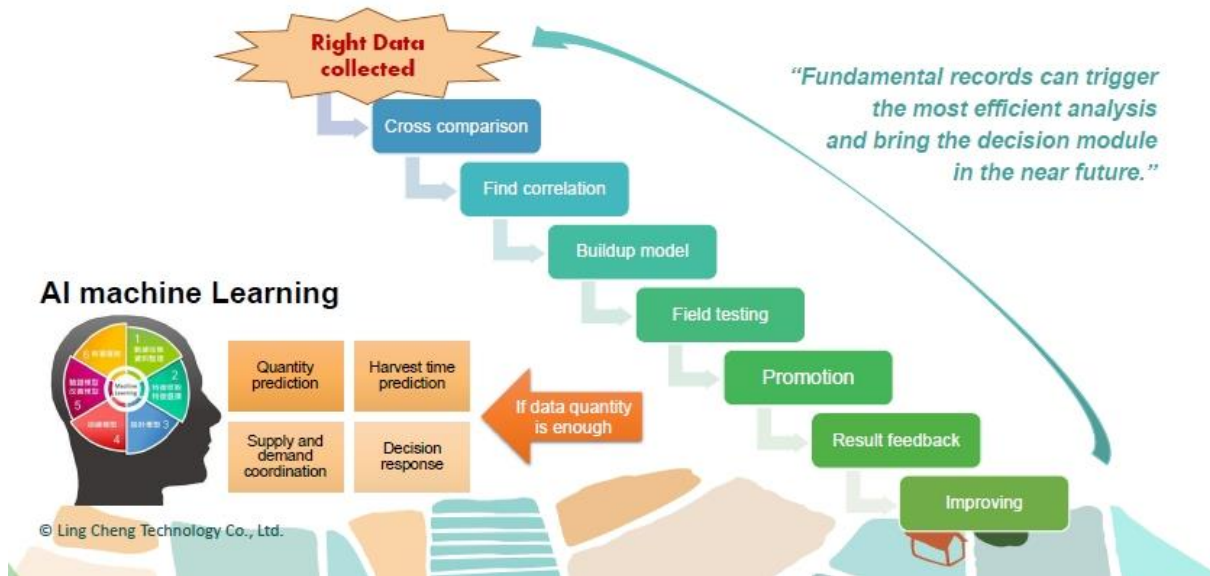
Difficulties of Big Data in Agriculture
• Hard to analyze: Most people don't know the meaning behind the data.
• Shortage of data: Collecting agricultural data takes time.
• Incorrect data format: It's hard to find good quality data to analyze even nowadays.

What we can do with our limited data
While big data helps us find complicated and unknown factors, it is sometimes hard for agriculture producers to collect that amount of data. Thus, we can start with small but accurate date.
• Utilize nearby weather station data.
• At least integrate temperature data if your budget is limited.
• Collecting accurate data is better than big data.

9. IoT and Phenotyping System for The Future of Smart Agriculture

When in 1984, our chief executive officer (CEO) Mr. Kingco (CHIANG CHIEN, CHIN-BIN) found HI-Point Corporation, his first mission was to bring the safest high technology equipment to the researchers, providing the best lab tools from overseas. Hi-point has evoluted during all these years. From a little importing/distributing company, we became the leader on the market, manufacturing Agro-biotech equipment, designing and building laboratories.

Hi-point 4B Target: Better Production, Better Food, Better Environment, Better Life. Hi-point focuses on below 4 dimension's developments:

Environment control
- LED plant incubator
- walk-in climate chamber
- Environmentally controlled plant factory
- Environment Simulation

Smart Agriculture System
- Pest Detection Early Warning System (PDS)
- Microclimate Monitoring System (Klimalog)

Phenotyping System
- AI Image Analysis Software (TronD)
- 3D Multispectral Image Analysis system
- Gantry system (Entoscan)
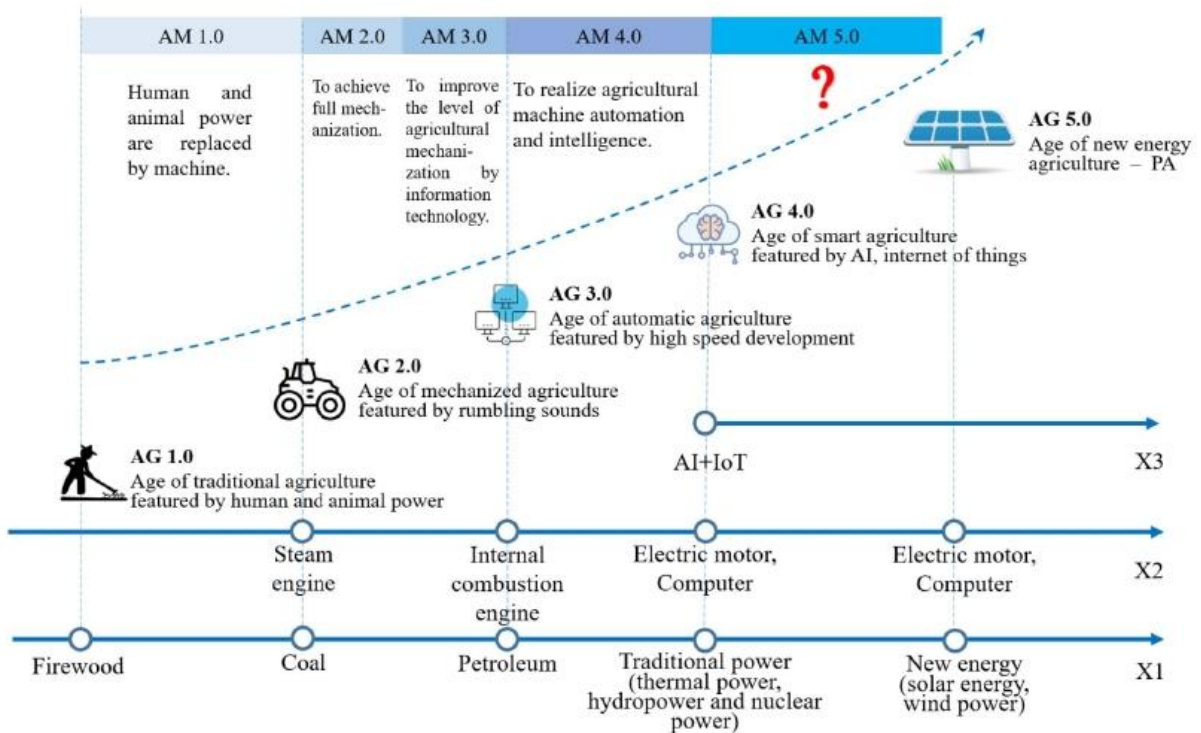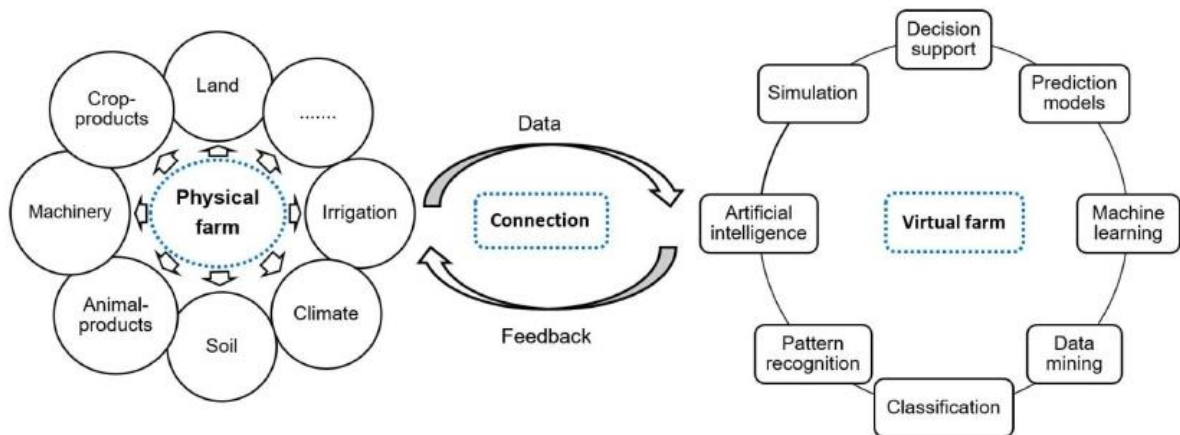- Multi/Hyperspectral Imaging Systems

Smart AG service
- Smart agriculture service
  - Integrated Pest Management
  - Integrated Crop Management

Next Generation of Smart AG (smart agriculture)

Future of Smart Agriculture with the Digital Technologies

Smart Agriculture Technologies
• Integrated Pest Management / Integrated Crop Management
• IoT Device, Camera, and Phenotyping system
• Pest DL (Delete), Plant Growth Stage, Plant Disease Model
• Microclimate Risk Alarm, Plant Growth prediction, Pest, and Disease Alarm
• Alarm message, Image model, GIS (Geographic Information System) and Drone Technologies
• Smart AG cloud service

10. From farm to table, what we can do and have been doing along the chain

Prof. Kune-muh Tsai shared what universities can do and have been doing along the supply chain regarding agriculture and fishery products traceability and flexibility operation.

What we ask for of fresh foods: food safety, fresh and long shelf-life, reasonable price, responsiveness, and multiple choices. A fresh food value chain and well-managed should pay attention to the whole process:


Problems from farm to table

- **Unbalanced** produce production: **Coordination** between fruits / vegetables production and consumption allows **more time to respond** to the unbalance
- Efficiency and manpower shortage: **AIoT** to enhance efficient decisions and automation to achieve labor-saving
- Traceability for food **quality/safety** to build customer faith
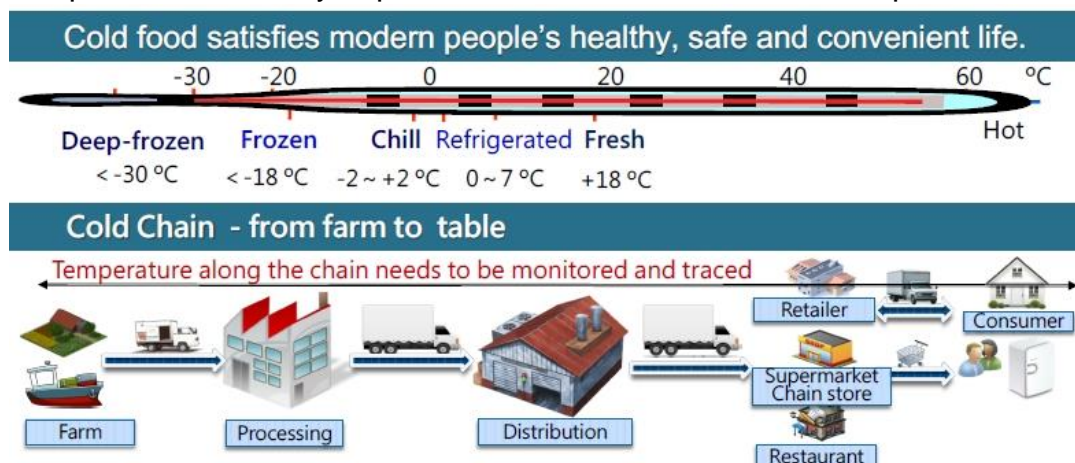
Problems along the fresh food supply chain

- Traceability
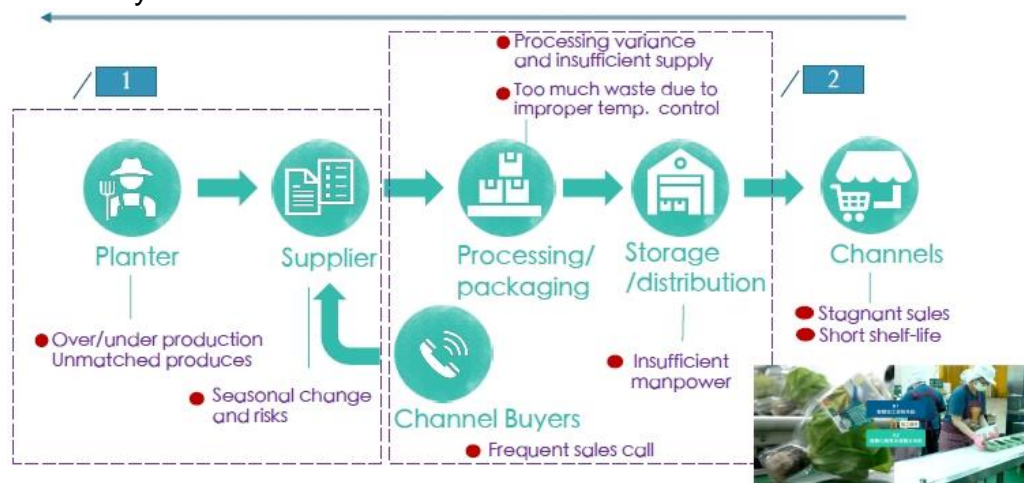
- **Temperature Monitoring in the Cold food chain**

Low-temperature is the key to preserve and extend the shelf life of products.

Traceability – food quality/safety

Traceability is like a tag of a produce and it shows the history of the produce for customers to judge the value in price and food quality/safety. We have two traceability systems in Chinese Taipei: TGAP ( ) & QR-code (Quick Response Code).

TGAP: a full tracking system from growing, harvesting to processing and sale. Farmers need to pay for each product.

QR-code traceability systems:

11. **From Farm to Restaurant, Agriculture and Fishery Products Traceability and Flexible Supply Chain Operation Sharing (Peru)**

GS1 Peru did below to promote traceable supply chain in Peru:
*   Issue global open data standards: identifying what (e.g. products), who (e.g. entities) and where
*   Verify associated data so it works and is trusted in market
*   Operate global registries

GS1 identification standards help brand owners, retailers, and marketplaces meet demand for trusted product information.
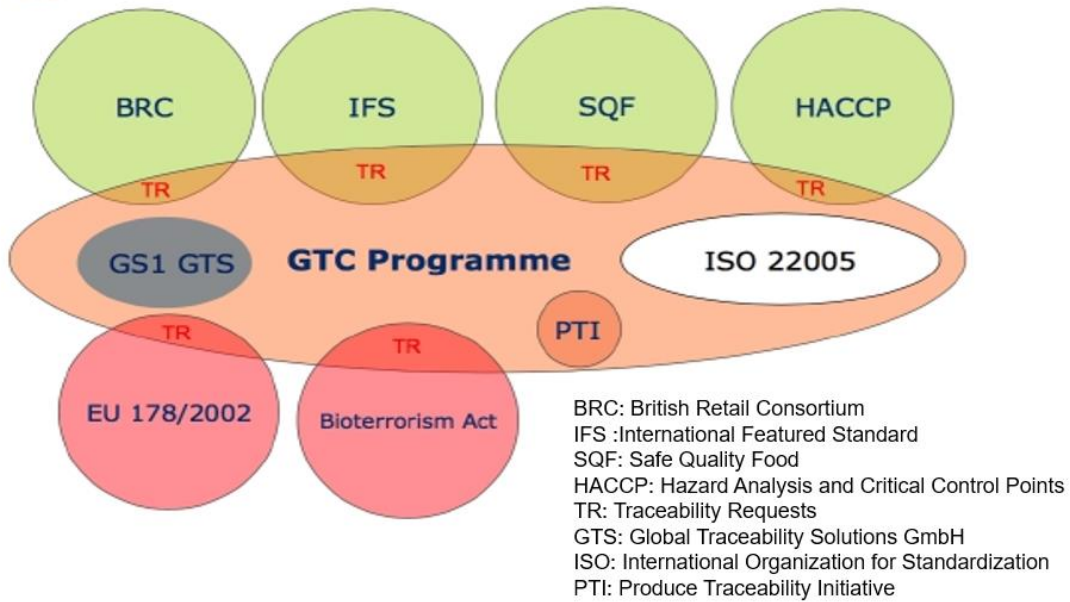

How can these standards help improve Traceability procedures? Unequivocally identifying the different actors and products that participate in the global supply chain.

Global Traceability Conformance (GTC)

GTC Programme includes all the traceability requests from regulations and quality standards around the world

BRC: British Retail Consortium
IFS :International Featured Standard
SQF: Safe Quality Food
HACCP: Hazard Analysis and Critical Control Points
TR: Traceability Requests
GTS: Global Traceability Solutions GmbH
ISO: International Organization for Standardization
PTI: Produce Traceability Initiative

GTC Program – Global Traceability Conformance Program is the traceability assessment and implementation based on Global Data Standards.

APEC pilot project – Supply Chain Visibility
• Validated the use of Global Data Standards
• Benefits on increase visibility, better responsiveness and risk management

Agroindustrial Beta - Green Asparagus

12. Smarter Approaches to Reinvigorate Agriculture as an Industry in the Philippines

Project **SARAi** (Smarter Approaches to Reinvigorate Agriculture as an Industry) is Funded by the Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (PCAARRD-DOST).

Agriculture problems in the Philippines
- Problems on climate change, soil degradation, food insecurity, soil and water pollution can be addressed using biofertilizers instead of chemical fertilizers
- Chemical fertilizers and other farm inputs are expensive, could be hazardous to health, and pollute soil, air and water
- Biofertilizers such as MYKOVAM®, MYKORICH® and MYKOCAP, are environment friendly, cheap, and easy to apply
- Plants with these biofertilizers are healthier, grow faster, and with higher biomass or fruit yield thus, more income to farmers
- Biofertilizers do not directly increase soil fertility but they initiate or accelerate the process of mineralization
- Apps are important to assist in the management of crops
- Biofertilizers produced are organically grown crops

Biofertilizers
- Biofertilizers contain beneficial microorganisms developed at the National Institute of Molecular Biology and Biotechnology University of the Philippines Los Banos as an alternative to chemical fertilizers and other farm inputs
- Proven effective as plant growth promoter of selected agriculture and forestry crops species
- Example are such as MYKOVAM®, MYKORICH® and MYKOCAP
- Contain spores, chopped colonized roots and other infective propagules of arbuscular mycorrhizal fungi collected from stressed environment such as grasslands, mined-out and mine tailing areas

30

- One gram (or two capsules) per plant is placed in the root zone during transfer into individual container or pot, 10g per tree in field grown crops

Advantages of biofertilizers
- EFFECTIVE for forest tree species, fruit crops and agricultural crops
- LESS cost
- More HARVEST and HIGHER income
- PROVEN and TESTED by farmers all over the Philippines
- Effective REPLACEMENT (60-85%) of chemical fertilizer requirement of plant
- No HARMFUL EFFECTS to human and animals
- ENVIRONMENT FRIENDLY

SARAi framework
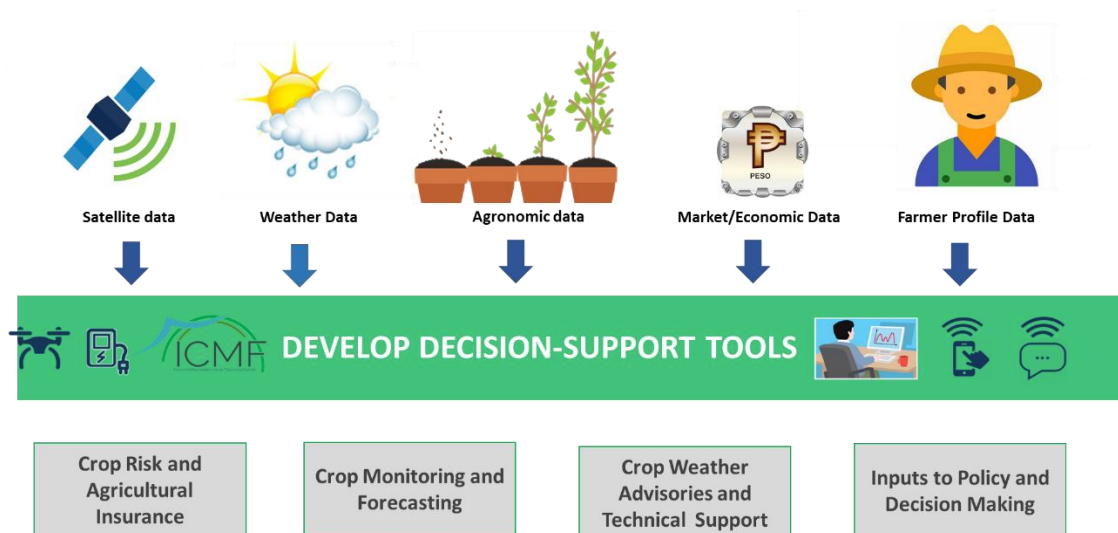
This is the working framework of project SARAi. With the inputs such as satellite data, weather data, agronomic data, economic data, and farmer profile data that were collected, SARAi developed decision-support tools that can help in crop risk and agricultural insurance, crop monitoring and forecasting, crop weather advisories, and policy making.

Support tolls showcasing
1. BANATECH – harvest date estimation of LAKATAN (Musa acuminata) and SABA/CARDABA (Musa acuminata x balbisiana) banana

Uses Phenological Study Led to the Development of BANATECH
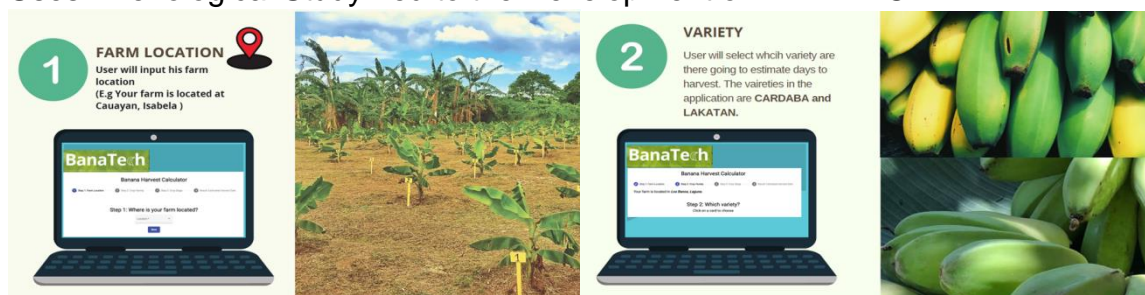
The application and wide use of BanaTech contributes towards the 4th Agricultural Revolution (Agriculture 4.0) – "fusion of precision and digital agriculture interconnecting technologies to improve crop yield and sustainability, working conditions and quality of production and processing"

2. SARAI-Enhanced Agricultural Monitoring System (SEAMS)
Another technology developed by SARAi which is a big help to our Agricultural Officers and Technicians is the SARAi-Enhanced Agricultural Monitoring System or SEAMS. SEAMS uses Remote Sensing (RS), Normalized Difference Vegetation Index (NDVI) and Geographic Information System (GIS) to provide a near real-time and site-specific crop monitoring and damage assessment based on free and daily updated satellite images (from US and Europe Union).
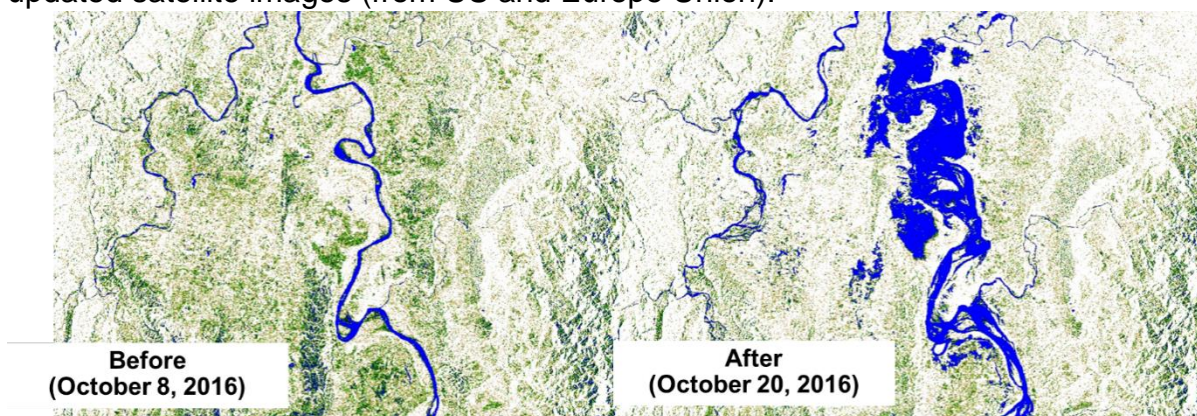
In this picture, we can see the before and after image of the river in alcala, Cagayan where after the typhoon Lawin struck the province, the estimated flooded area computed using SEAMS is 19,764ha. This is very useful in planning for the disaster response and estimating of damages to crops due to flooding.

3. Water Advisory for Irrigation Scheduling System (WAISS)
Another technology is the WAISS for smart irrigation management which is applying the right amount of water to crops in the right place and at the right time. "WAISS is composed of a field unit and a computer software. The field unit is comprised of a set of soil moisture sensors, a transmitting data logger, and 5-V solar panel. The sensors are installed underground where the crops are planted and are connected to the transmitting data logger which sends the measurements to the software via GSM network."

4. Smarter Pest Identification Technology (SPIDTECH)

Another solution of SARAi for the problem of our farmers in crop and diseases infestation is smarter pest identification technology or SPIDTECH. It is an android application for digital identification of insect pests and diseases of the SARAi 9-priority crops. In reducing damages and losses to crops due to insect pests and plant diseases infestation, correct identification of these actors can guide proper pest and diseases management and with the help of SPIDTECH, we can reduce risk of income loss of our farmers.

FEATURES OF SPIDTECH for pest identification
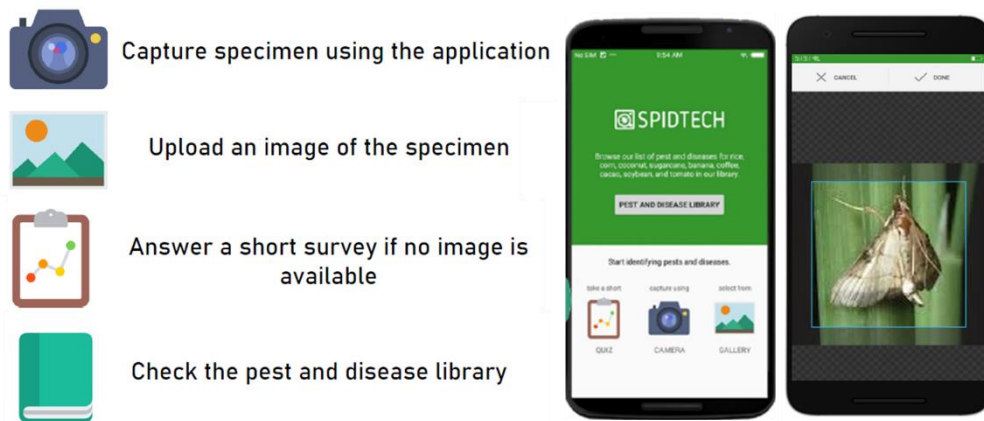
SPIDTECH contains different functions. One. It can identify pests and diseases by capturing or uploading images of the specimen. It will give you its identification results. Recommended control management and methods are also a bonus! Second function, it has Pest and Diseases Library that serves as a knowledge portal of common pests and diseases for SARAi crops. This helps to familiarize and inform users about insect pest and crop diseases as well as its control methods, bridging the gap between crop protection experts and end-users like our farmers and agricultural technicians. Students can also use this as a digital and portable library of pests and diseases of different crops. Third, SPIDTECH as a tool for remote monitoring. It collects data such as GPS location, image data, time stamp, and user information. With these data, the application is very useful in fast and remote monitoring of insect pests and crop diseases occurrences in different parts of the economy. This will help our farmers and agricultural technicians in early detection of infestations which will be the basis of giving advisories to our farmers.

5. SARAi Web and Mobile Applications
Another set of mobile applications are the SICApp or the SEAMS Image Capturing Application that let the users to view the crop status and damage reports during natural disasters in their farm.
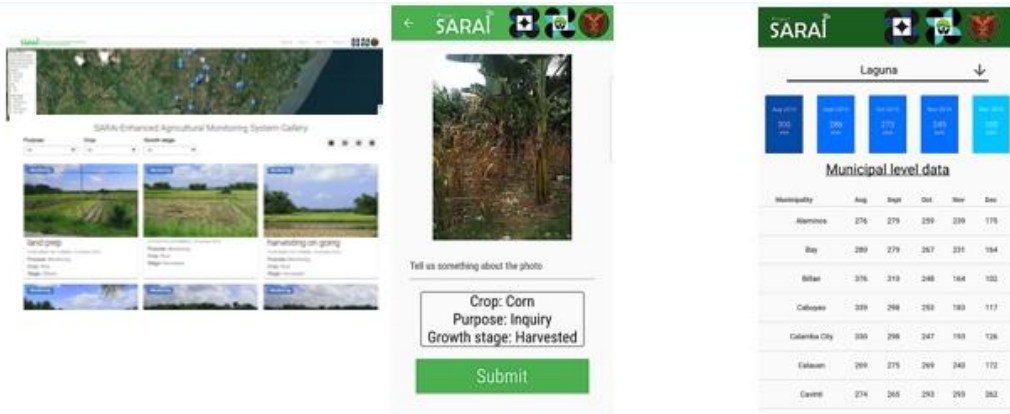
SEAMS Image Capturing Application (SICApp)
A web and mobile application to view crop status and damage reports during natural disasters in the field.

Rainfall Outlook Mobile App
A mobile application showing the 5-month municipal level rainfall outlook can be viewed offline.

Rainfall Outlook Mobile App is a mobile version of the SARAi knowledge portal (www.sarai.ph) that shows the 5-month rainfall outlook down to municipal level which can be used even the user is offline.

CAPHE or the Coffee Application Harvest Estimator is also a mobile application which can help our target users to calculate and track the harvest dates of their coffee crops which can produced the best quality of coffee beans.

From rainfall outlook mobile app, we also have SARAi alerts and advisories to get the latest alerts and advisories on rice, corn, coconut, banana, sugarcane, coffee, cacao, sugarcane and tomato.

6. SARAi Knowledge Portal (www.sarai.ph)
All the outputs, advisories and data products produced by SARAi (Smarter Approaches to Reinvigorate Agriculture as an Industry) are uploaded in the portal, called the SARAi Knowledge Portal (www.sarai.ph). Navigating this portal will lead you to the different services of Project SARAi.

Conclusions

- Application of biofertilizers assures faster plant growth, early fruiting and longer harvesting, thus higher income
- The developed decision-support tools help in the reduction of risks and losses
- Collectively, leads to better planning, monitoring and crop management thus, higher crop production and sustainability
- Produce safer and more nutritious food on the table and in restaurants

POLICY RECOMMENDATIONS

Objectives

The basic premise behind the adoption of the Digital Twin, or any other proposed digital transformation, technology in reshaping the agriculture and fishery industry lies in the ensuring of a more robust food supply chain for the entire economy, so as to meet the challenges posed by food insecurity, expert labor shortage, population growth, as well as inadvertent events of a force majeure nature that often leads to disruption of the existing global supply chain order. Moreover, digital conversion of the farming and fishing sectors via adoption of digital product traceability mechanisms may also enhance food safety and carbon footprint monitoring and standards implementation.

Basic Conception

Member economies should consider working towards promoting the establishment of a digital platform, from which crucial data are gathered in relation to agriculture and

fishery production management, so as to allow for the aid of AI to optimize cultivation or breeding decisions.

Policy

The varying stages of policy implementation may accord to the following description:

1. Creation of a digital platform, to which data is to be fed and from which AI calculations performed to optimize production decision-making.
2. Installation of IoT devices, namely quality sensors, in the farming or fishing area, from which specific data can be gathered in relation to parameters intrinsic to the success of production yields. So, for instance, in the case of farming sensors shall be installed for the gathering of data relating to weather conditions, crop-growth status and in the case of fishery management, water quality and breeding schedule.
3. Formulation of AI computational models based on the pooling-in of industry-specific knowledge and experiences.
4. Allow for AI models to work out best practices at any given stage of the production process.
5. Once the agricultural and fishery produce has been harvested and collected, traceability certificate is appended thereto, to ensure proper tracking and monitoring of their processing, ultimately affording better guarantee of food quality and safety standards.

Additional Recommendations

Stronger partnership between academia, private sector and government is also strongly encouraged. Moreover, cross-domain integration of data sets can also lead to better and more sophisticated computational models for decision-optimization.

Legal Issues

There are legal challenges that need to be considered revolving the implementation of the proposed digitalization policy. First and foremost, the element of trust is of foundational significance in persuading interested sector participants to pool in industry knowledge and experiences into the digital platform, without which would stagnate the ideal development of the transformational framework. Therefore, data, intellectual property and trade secrets protection need altogether be ensured. Moreover, accessibility qualifications need to be put in place to avoid maligned disruption of the platform.

CONCLUSION

Within the confines of this final report, it has been illustrated as to how the digital transformation of standard industry practices and know-how could not only

convincingly improve yields of production, but also serve to conserve precious accumulated industry knowledge and experiences passed down to the current generation. Successful application of this transformative process can be seen in Chinese Taipei's implementation of the Digital Twin solution within the fishery sector, as well as the adoption of smart agriculture and innovative food traceability mechanisms to guarantee food quality and safety. Furthermore, by means of utilizing IoT devices, a more comprehensive scope of data concerning, but not limited to, breeding, farming, irrigation and weather conditions could be gathered, so as to bring about decision optimization, with the aid of AI analysis, in overall crop production management.

Peru has proposed a Control Tower solution model for building a sustainable and resilient supply chain in the post-pandemic area by employing big data technology. They have also put forth a from-farm-to-restaurant agriculture and fishery products traceability platform, in which products and producers can be both registered and identified on a verifiably transparent basis. These standards are put in place to help brand owners, retailers and marketplaces to meet public demand for reliable production information, hence further reducing supply chain information opaqueness.

The Philippines, apart from setting forth an ambitious urban agriculture initiative to combat poverty and food production supply so as to strengthen food security, has inaugurated the SARAi (Smarter Approaches to Reinvigorate Agriculture as an Industry) Project to combat climate, soil degradation, food insecurity, soil and water pollution challenges, via usage of biofertilizers. Moreover, the SARAi framework allows for better and smarter decision-making processes to take place, through the utilisation of an array of decision-support tools.

Thailand's digital farming and wireless sensor network for remote management and control systems seek to pool in extensive image data over farming conditions, out of which efficacious crop management decisions may result. Information gathered therefrom includes those relating to irrigation schedule, fertilization and reactions to pests and pesticides.

In summary, by showcasing successful cases studies from other economies in this international conference, it is hoped that the technologies and innovative practices presented can be promoted to all APEC member economies so as to further foster cross-domain innovation and cooperation.

APPENDIX I – POST-EVENT SURVEY

APEC Project Survey **PPSTI 03 2021A**

PPSTI 03 2021A
Leverage Digital Twin Technology to Enhance Supply Chain Productivity for Resilient Economy
November 3-4, 2022

Thank you for attending the

PPSTI 03 2021A forum on

November 3-4, 2022 in Taipei. We would now like to gather your feedback with regards to how well the event has been organised and how it has helped build capacity for you. We value your inputs and this survey takes about 10 minutes to complete. We would appreciate the completion of this survey no later than November 17, 2022. Thank you.

alan23035@gmail.com   Switch account

* Required

Email *

Your email

Page 1 of 4

Next   Clear form

APEC Project Survey **PPSTI 03 2021A**

alan23035@gmail.com Switch account

* Required

---

1. The objectives of the training were clearly defined *

◯ Strongly agree

◯ Agree

◯ Disagree

---

2. The project achieved its intended objectives *

◯ Strongly agree

◯ Agree

◯ Disagree

---

3. The agenda items and topics covered were relevant *

◯ Strongly agree

◯ Agree

◯ Disagree

---

4. The content was well organised and easy to follow *

◯ Strongly agree

○ Agree

○ Disagree

---

5. Gender issues were sufficiently addressed during implementation *

○ Strongly agree

○ Agree

○ Disagree

---

6. The trainers/experts/facilitators were well prepared and knowledgeable about *
the topic

○ Strongly agree

○ Agree

○ Disagree

---

7. The materials distributed were useful *

○ Strongly agree

○ Agree

○ Disagree

---

8. The time alloted for the training was sufficient *

○ Strongly agree

○ Agree

○ Disagree

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* Required

10a. How relevant was this project to you and your economy? *

○ Very relevant

○ Mostly relevant

○ Somewhat relevant

○ A little relevant

○ Not much relevant

10b. Please explain your answer given in 10a.

Your answer

---

11. In your view what were the project's results/achievements? *

Your answer

---

12. How was your capacity built by this project? What new skills and knowledge *
did you gain?

Your answer

13. Rate your level of knowledge of and skills in the topic prior to participating in the event: *

○ Very high

○ High

○ Medium

○ Low

○ Very low

14a. Rate your level of knowledge of and skills in the topic after participating in the event: *

○ Very high

○ High

○ Medium

○ Low

○ Very low

14b. Please explain your answer given in 14a.

Your answer

15. How will you use the skills and knowledge gained from this project to build capacity in your home economy? Please provide examples (e.g develop new policy initiatives, organise trainings, develop work plans/strategies, draft regulations, develop new procedures/tools etc). *

Your answer

16. What needs to be done by next by APEC? Are there plans to link the project's *
outcomes to subsequent collective actions by fora or individual actions by
economies?

Your answer

17. How could this project have been been improved? Please provide comments *
on how to improve the project, if relevant.

Your answer

Page 3 of 4

Back   Next   Clear form

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Participant Information (optional)

Name:

Your answer

Organisation/Economy:

Your answer

Gender:

○ Male

○ Female

Page 4 of 4

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APPENDIX II – AGENDA

International Conference on
Leveraging Digital Twin Technology to
Enhance Supply Chain Productivity for Resilient Economy

AGENDA   1103

Time	Agenda	Speaker
09:30 | 09:50	Opening Ceremony & Group Photo	**Welcome Speeches from MOEA & MOFA** • Dr. Eugene Lin Science and Technology Advisor, Department of Industrial Technology, MOEA • Mr. Jiun-Shen Hwang Counselor, Department of International Organizations, MOFA
09:50 | 10:10	**Keynote Speech** Experience of promoting Digital Twin technology solutions in Chinese Taipei	**Improve Supply Chain Resilience with Digital Twin and Human Intelligent** Dr. Neng-Kai Chang, Section Chief, PhD. Department of Industrial Technology, MOEA `Chinese Taipei`
10:10 | 10:20	**Keynote Speech** Applications of AI in Aquaculture	**Applications of AI in Aquaculture** Dr. Rick Pan Executive Assistant, Fongyu Co. Ltd. `Chinese Taipei`
10:20 | 10:30	Coffee Break	
10:30 | 10:50	**Session I** How to Build a Sustainable and Resilient Supply Chain for APEC Economies in the Post-epidemic Era	**Building a Sustainable and Resilient Supply Chain, NOW!** Ms. Vanessa Ying Lin COO, AgriGaia Social Enterprise Int'l Ltd. `Chinese Taipei`
10:50 | 11:10	**Host** Dr. Yu-Ling Hsu Assistant Professor, Dept. of Industrial management, NTUST `Chinese Taipei`	**How to Build a Sustainable and Resilient Supply Chain for APEC Economies in the Post- Epidemic Era** Ms. Mary Carmen Wong Suehiro Deputy CEO, GS1 PERU `Peru`
11:10 | 11:30		**Q-yo Biotechnology Co., Ltd.** Mr. Fang, Shao Yu Deputy GM, Q-Yo Biology `Chinese Taipei`
11:30 | 12:00	Discussion & Q&A	Speakers of Session I
13:00 | 17:00	Digital Twin Demo site visiting: Q-Yo BioFarm	

MOEA: Ministry of Economic Affairs
MOFA: Ministry of Foreign Affairs
NTUST: National Taiwan University of Science and Technology

AGENDA
1104

Time	Agenda	Speaker
09:30 | 09:35	Opening Speech	Dr. Jyh-Rong Tsay Deputy Director-General Agricultural Research Institute, Council of Agriculture, **Chinese Taipei**
09:35 | 09:55	**Session II** Digital Transformation of Production Technology:	Quezon City's Urban Agriculture Initiatives Dr. Theresita V. Atienza President, Quezon City University **The Philippines**
09:55 | 10:15	Experience Sharing of Digital Twin Technology in Agriculture and Fisheries	Digital farm management platform for know-how transfer Mr. Opas Trithaveesak Researcher, National Electronics and Computer Technology Center **Thailand**
10:15 | 10:35	**Host** Dr. Nen-Fu Huang (Fred Huang) Distinguished Professor, Department	How to Cooperate with Industry to Develop Decision-Making Models for Smart Agriculture Production Mr. Tai An, Tom, Chen Chief Consultant, Link Join Agricultural Technology Co., Ltd. **Chinese Taipei**
10:35 | 10:55	of Computer Science, Tsing Hua University **Chinese Taipei**	IoT and Phenotyping System for The Future of Smart Agriculture Mr. Hsin-cheng Chen Technical manager, TWHipoint **Chinese Taipei**
10:55 | 11:00	Discussion & Q&A	Speakers of Session II
11:00 | 11:10	Coffee Break	
11:10 | 11:30	**Session III** From Farm to Restaurant, Agriculture and Fishery Products Traceability and Flexible Supply Chain Operation Sharing	From farm to table, what we can do and have been doing along the chain Dr. Kune-muh Tsai Professor, Department of Logistics Management, College of Management, NKUST **Chinese Taipei**
11:30 | 11:50		From Farm to Restaurant, Agriculture and Fishery Products Traceability and Flexible Supply Chain Operation Sharing Ms. Mary Carmen Wong Suehiro Deputy CEO, GS1 PERU **Peru**
11:50 | 12:10	**Host** Ms. Madeline Su Founder & GM, Creative Intelligence **Chinese Taipei**	Smarter Approaches to Reinvigorate Agriculture as an Industry in the Philippines Dr. Nelly S. Aggangan Researcher, National Institute of Molecular Biology and Biotechnology (BIOTECH) **The Philippines**
12:10 | 12:15	Discussion & Q&A	Speakers of Session III
12:15 | 12:20	Closing	

NTHU: National Tsing Hua University
NKUST: National Kaohsiung University of Science and Technology