



Nectec  
**Annual  
Report**

NECTEC  
**2022**

National Electronics and Computer Technology Center





# Nectec Annual Report

**NECTEC**<sup>11</sup>  
a member of **NSTDA**

# 2022

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National Electronics and Computer Technology Center

# NECTEC Annual Report 2022

## National Electronics and Computer Technology Center

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## Message from NECTEC's Executive Director

During the year 2022, the National Electronics and Computer Technology Center (NECTEC) under the National Science and Technology Development Agency (NSTDA) has been driving the BCG (Bio-Circular-Green) Economy Model in accordance with the Sustainable Development Goals (SDGs) by determining its four substantial targets following the NSTDA's 7th Strategic Plan (2022 - 2027).

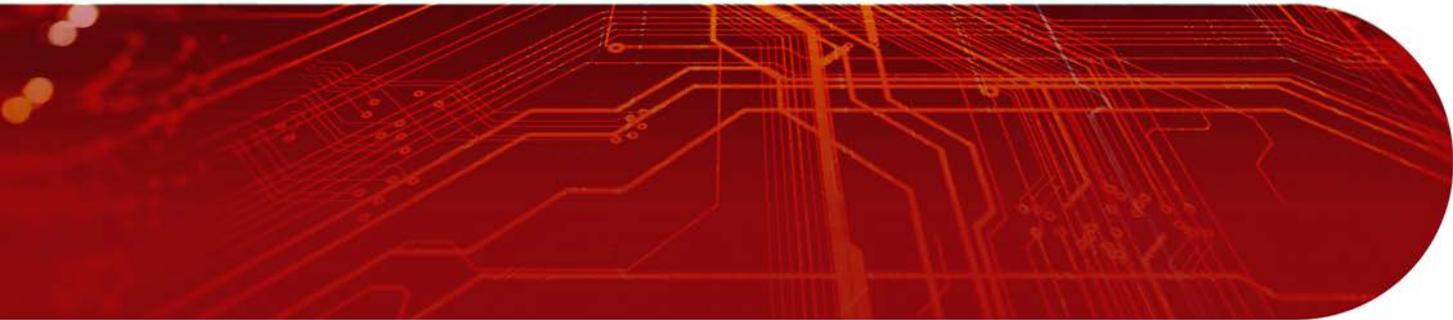
NECTEC set its achievements in developing digital and electronics technology to drive the country towards the innovation-based and the new-economy-based society using digital technology as a key mechanism. Under the policy-driven context, it's challenging for NECTEC to develop human resources and the state-of-the-art infrastructure especially in the field of intelligent electronics and advanced information to enhance the development of innovation in which the integration of big data and the collaboration from all sectors are required.

In the fiscal year 2022, NECTEC's strategies have been adjusted in accordance with the NSTDA's context by bringing superior talents in science and technology to leverage the country's agricultural and industrial sectors and to improve their efficiencies.

NECTEC is committed to carry on the development of related knowledge to be fundamental for advanced electronics and information technology development in Thailand, aiming to empower the country's capabilities to cope with the advent of future technologies and the world's technological changing directions. The accumulated knowledge will benefit the industrial sectors and the country's development through the utilization of research and development particularly in the field of artificial intelligence, sensors, intelligent systems and networks.

With numerous intensive research and development activities, NECTEC is intended to accomplish research outcomes that will be delivered to the country following the 8-2-2 goals that include eight technology foundations; two frontier research related to technology for the future; and two key infrastructures for research and development in science and technology.

As a national research center that mainly focuses on technology development, NECTEC has made a paradigm shift to broaden its operational goals and adjusted the role of its internal units to suit the development of new technologies and essential foundations to enhance Thailand's capabilities in advanced electronics and information technology development.



For example, NECTEC has supervised the Sustainable Manufacturing Center (SMC) that was established to promote and support the operations of the Eastern Economic Corridor of Innovation (EECI). The center has also overseen the Assistive Technology and Medical Devices Research Center (A-MED), the research center specialized in the development of medical devices and health innovation, which is a key part of NSTDA's strategic missions.

As the secretary of the National Artificial Intelligence Committee, NECTEC took part in the committee's strategic planning and drove the plans into a real implementation to leverage the development of artificial intelligence in Thailand to achieve effective and substantial results.

In addition to the center's hard working, the distinguished panel of professionals is another vital mechanism to push the growth of NECTEC. Thanks to their supervision and recommendations, the center's directions and policies have been reshaped to achieve the goal of creating Thailand's potential and capabilities in electronics and computer technology. They also help make management plans to be in line with the policies and criteria set by the NSTDA Governing Board.

On March 21, 2022, the NSTDA Governing Board approved the appointment of "NECTEC Executive Committee", to be on duty for a 2-year term.

NECTEC's ultimate goal focuses on creating sustainability based on a robust technology foundation with the delivery of beneficial research outcomes in the form of potential and practical platforms. NECTEC is also intended to utilize its accumulated 36-year research experiences to deliver research and development outcomes for use with the maximum benefits, support the country's development in various fields, and importantly, enhance the quality of life and well-being of Thai people.

Finally, I would like to thank our management team and partners from all sectors that entrust NECTEC's abilities in bringing our research and development works for further expansion. If you are interested in academic research, technology consultancy, or technology licensing and would like to utilize NECTEC's technologies and knowledge to support the operations of your organization, we're very pleased to contribute our efforts to support your growth.

Dr. Chai Wutiwivatchai  
Executive Director

National Electronics and Computer Technology Center



# Executive Summary

In the fiscal year 2022, NECTEC carried out its activities in accordance with Thailand's 20-year National Strategy (2018–2037) in building up the country's competitiveness, promoting the development of human resources, and rebalancing the public administration system.

The rearrangement of NECTEC's strategies was executed using the 5th Strategic Plan as a guideline in determining the center's directions, operational activities, and research and development framework to be in line with the NSTDA's 7th Strategic Plan and the (Draft) 13th National Economic and Social Development Plan (2023–2027) of the Office of the National Economic and Social Development Council, which aims to reshape Thailand to be the center of digital and intelligent electronics industry in ASEAN.

NECTEC also took a key part in driving the implementation of the BCG (Bio–Circular–Green) Economy Model and supervised the operations of research centers related to advanced electronics and information technology especially in artificial intelligence and computation. The center is committed to work alongside with partners to push the establishment of an ecosystem where all stakeholders are able to utilize local technology research and development to build the country's technological foundation and prepare Thailand's readiness towards future technology research.

The center has carried on intensive research and development activities following its 8–2–2 framework, emphasizing on the development of eight research targets included Strategic Big Data Platform; Precision Farming Platform; Smart Factory Platform; Strategic Sensor Process and Device Platform; Thai AI Service Platform (AI for Thai); Smart City Platform; Intelligence Innovation for Education Platform; and Digital Wellness Platform.

The framework also incorporates the development of two national science and technology infrastructures to enhance Thailand's S&T capabilities. Academic technical services using advanced technologies have been provided along with the formulation of alliance networks with local and international agencies. The two infrastructures comprised of:

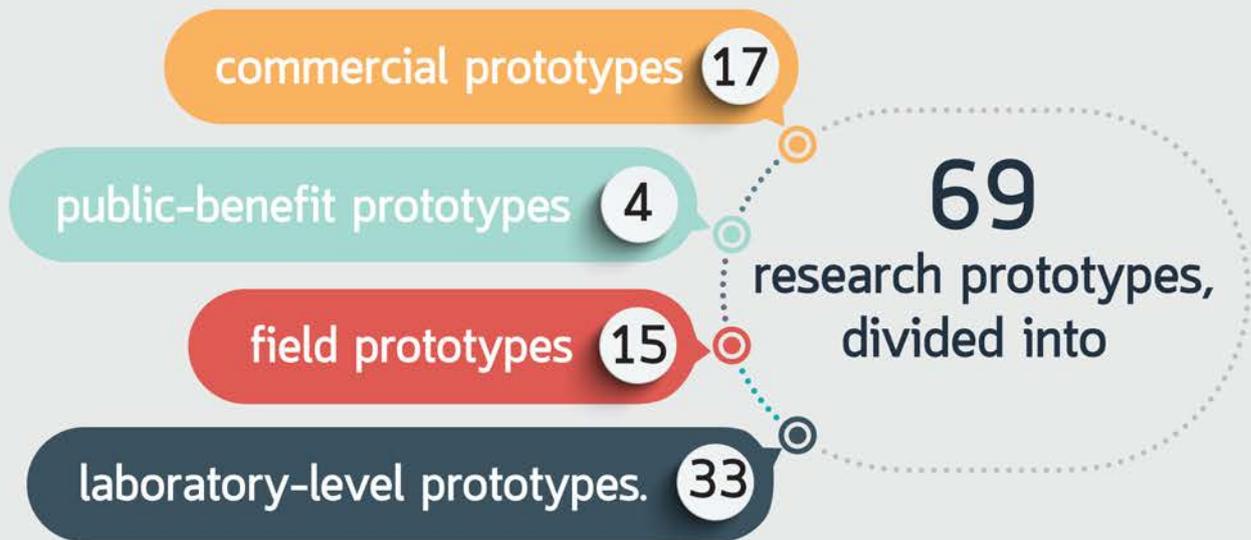
- NSTDA Supercomputer Center (ThaiSC): Developed to be the national service platform for science, technology and innovation, ThaiSC provides cutting-edge high-performance computing services for Thailand's research and development community.
- Thai Microelectronics Center (TMEC): The center develops and offers one-stop service for advanced sensor systems and innovations.

Additionally, the framework set a target to accomplish the other two frontier researches to help lay down the country's foundation for future technology development including the Terahertz Research and Development Platform; and the Quantum Computing & Engineering Research.

Moreover, NECTEC has taken a role in supervising the Sustainable Manufacturing Center (SMC), a translational research unit overseeing platform development for Industry 4.0. SMC acts as a central point where manufacturing entrepreneurs, system developers, innovators, researchers and students can meet together and use the center's facilities for demonstrations, learning, conducting hands-on experiments and participating in research activities. The center was established in accordance with the NSTDA's strategic missions.

In an area of fundamental technology research to respond to the country's specific needs, NECTEC has supervised the operations of specialized research centers such as the Assistive Technology and Medical Devices Research Center (A–MED) that oversees the development of medical devices and health innovation including a management system for the elderly care center and technology for accessibility and utilization.

# NECTEC's key performance in 2022 was visibly illustrated through the delivery of



|  |   |
|--|---|
| <p>Its accomplishment included a total of <b>80</b> articles</p>   | <p>published in well-known academic journals and <b>77</b> invention patents in the filing process.</p>   |
| <p>A total of <b>18</b> awards were received from local and international stages.</p>                              | <p>The collaboration with various sectors to utilize NECTEC's research through technology transfer showed its success, generating economic impact, income and investment value totaling at Bt <b>2,894</b> million.</p> |
| <p>The <b>183</b> cooperation agreements with local partners were made; worth more than Bt <b>200</b> million.</p> | <p><b>38</b> local agencies while achieving the other <b>27</b> international collaborative projects.</p>   |

# Organization Overview

The National Electronics and Computer Technology Center (NECTEC) emphasizes on the development of electronics and computer technology and it's operated under the supervision of the National Science and Technology Development Agency (NSTDA) and the Ministry of Higher Education, Science, Research and Innovation.

Established under the Science and Technology Development Act 1991, the center set its mission in developing advanced electronics and information technology especially in the field of artificial intelligence and computation.

## Vision



To be Thailand's leading research agency to develop a robust foundation for advanced electronics and information technology



## Mission

- To foster the development of a technology research and development ecosystem with strategic alliances.
- To be a key mechanism in building Thailand's technological foundation.
- To prepare Thailand's readiness for the development of frontier technology.



# NECTEC Executives



Mr. Chai Wutiwivatchai  
Executive Director



Mr. Sarun Sumriddetchkajorn  
Acting Deputy Executive Director



Miss Panita Pongpiboon  
Deputy Executive Director



Miss Alisa Kongthon  
Deputy Executive Director



Miss Kalaya Udomvitid  
Deputy Executive Director

# Executive Board

**Mr. Wanchai Phanomchai**  
Chairman



**Prof. Sukit Limpijumnong**  
Vice-Chairman



**Mr. Danucha Pichayanan**  
Committee



**Mr. Sangchai Theerakulwanich**  
Committee



**Mr. Nuttapon Nimmanphatcharin**  
Committee



**Miss Wiparat Deong**  
Committee



**Mr. Wanpracha Chaovalitwongse**  
Committee



**Mr. Prabhas Chongstitvatana**  
Committee



**Mr. Pochara Arayakarnkul**  
Committee



**Mrs. Kanit Muangkrachang**  
Committee



**Miss Oranuch Lerdsuwankij**  
Committee

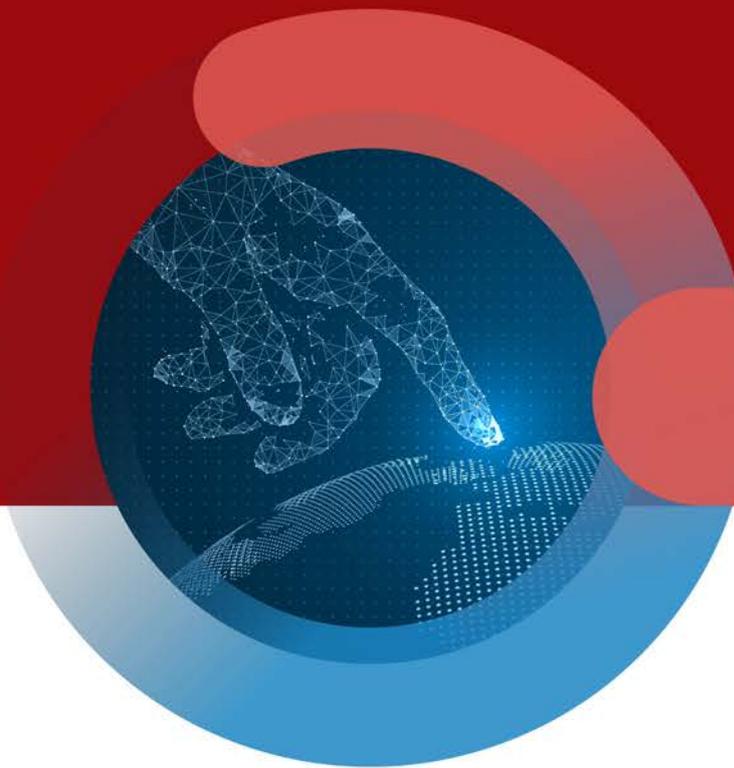


**Mr. Chai Wutiwivatthai**  
Committee and Secretary



**Miss Kalaya Udomvitid**  
Committee and Assistant Secretary





# Goals and Directions

NECTEC defined its operational guidelines following the 5<sup>th</sup> Strategic Plan (2022–2028) in line with the NSTDA’s 7<sup>th</sup> Strategic Plan and the (Draft) 13<sup>th</sup> National Economic and Social Development Plan (2023–2027) of the Office of the National Economic and Social Development Council. The guidelines were formulated under the “sustainable research” framework, aiming to build the country’s technology foundation through NECTEC’s more-emphasized strategies which are highlighted on the development of explicit technologies.

NECTEC also determined its organizational-level strategic goal towards developing the “National Platform” for public utilization, or the so-called the “De Facto National Platform.”

## Strategies

**The strategies have been implemented to drive the organization to achieve its goals.**

- Strengthen the excellence in research and development following the TOP research targets, emphasizing on explicit research results.
- Establish a foundation and the excellence in frontier technology research to create future strengths.
- Develop and strengthen research networks with knowledge exchanges locally and internationally and encourage the emergence of an ecosystem and new sources of research funds.
- Mature local human resources and establish supporting systems to cope with organizational changes through a proactive and target-oriented approach.

# Budget

**NECTEC received a total annual budget of Bt 1,360.82 million** in the fiscal year 2022 of which **73%** million was actually spent. The expenditure was divided into three groups;



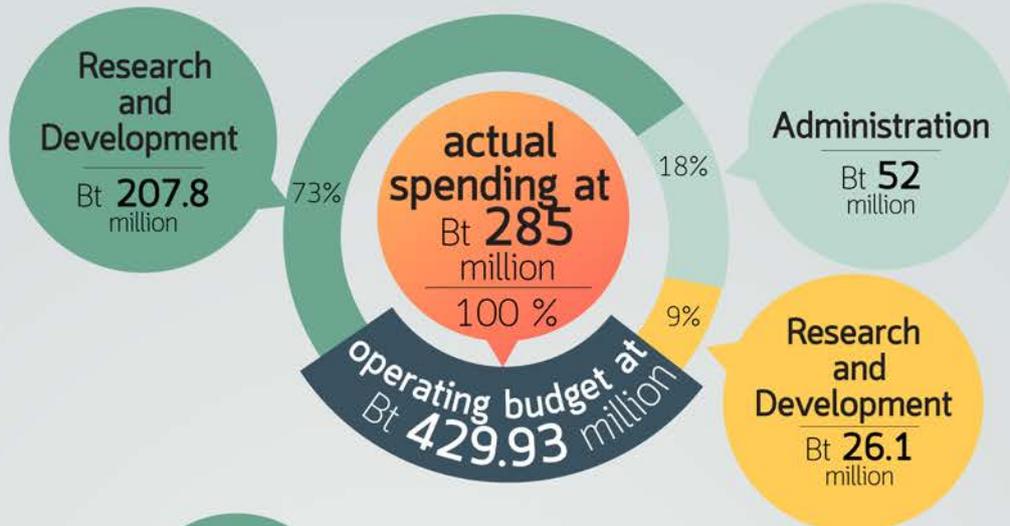
**operating budget at Bt 429.93 million**  
(actual spending at Bt **285.91 million**)



**personnel budget at Bt 529.43 million**

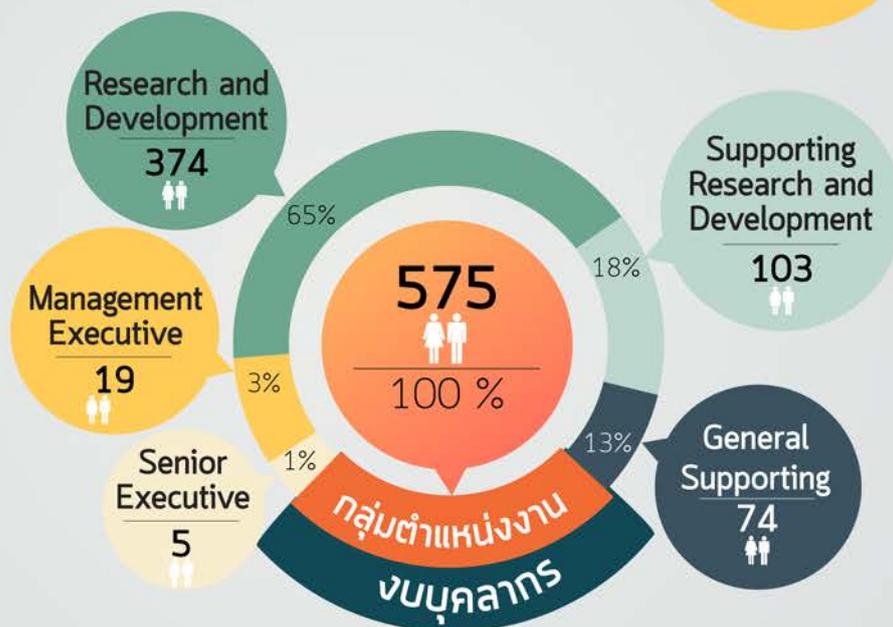


**investment budget at Bt 172.45 million**



## Personnel

As of September 30, 2022  
% - Percentage of Categorized Job Titles in Fiscal Year 2022





# Performance

NECTEC has been driving the country towards an innovation-based economy using digital technology as a mechanism to foster the country's development.

In 2022, the center delivered significant research outcomes and activities in accordance with the sustainable development goals as follows:

## Promoting Government Data Ecosystem

- Handed over Thai People Map and Analytics Platform (TPMAP) Logbook to the Office of the National Economic and Social Development Council to solve the country's household problems with 99 per cent achievement.
- The 198,800 government projects employed the Electronic Monitoring and Evaluation System of National Strategy and Country Reform (eMENSOCR) in 2022.
- Established government data management standards used in 155 agencies and provinces.
- The 2,287 government data sets and the other 9,369 organizational data sets have been accessed through OPEN-D, the Open Data Service Platform.
- The 142,019 entrepreneurs registered to use SME-GP.



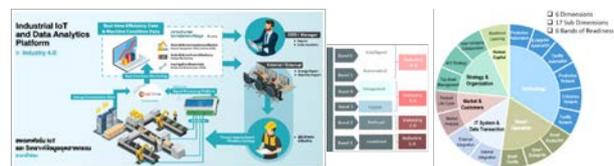
## Development of Open-Source Standards and Data Sharing for Agriculture

- HandySense, the precision farming system, was certified by the Electrical and Electronics Institute and met DEPA standards for agricultural IoT.
- The linkage of agricultural data of Thailand Agricultural Data Collaboration Platform (THAGRI) with the agricultural mapping system, the Agri-Map, and the hydro-informatics data of Hydro-Informatics Institute (HII) was established to support the development of the BCG (Bio-Circular-Green) Economy Model. A pilot project for the utilization of lands and soil resources was also introduced.
- A partnership was established with the Government Big Data Institute (GBDi) to utilize THAGRI for agricultural development in BCG's pilot provinces.



## Development of IDA Platform for Data Accumulation and Analysis for Industrial Plants

- Encouraging the use of the IDA Platform for energy conservation in the industrial plants, facilitating the plants to see energy consumption data on the dashboard for further analysis and production planning.
- Driving the establishment of a criteria for assessing the Thai industry's readiness (Thai Industry Index) towards Industry 4.0.
- Board of Investment (BOI) included Article 6 to allow Thailand i4.0 Index to be submitted for tax benefits.
- Formulating a smart warehouse ecosystem to drive Thai industry towards Industry 4.0.



## Development of High-Quality Specialized Strategic Sensors to Enhance International Competitiveness

- Driving the establishment of a tuberculosis detection ecosystem using Surface-Enhanced Raman Spectroscopy (SERS) techniques.
- Driving the establishment of an ecosystem for forensic science; and formulating the draft of drug and explosive testing standards using SERS techniques.
- Raising awareness of the use of SERS techniques in forensic science for the Forensics Science Office.



## Development of AI for Thai as National AI Service Platform

- Developing human resources in AI through the Super AI Engineer Program to drive the National AI Strategy.
- Enhancing the ability of the AI for Thai version 3 to calculate service fee for commercials.
- Launch of seven new services: Text Summarization / Question Search / Longan / Vaja9 / Diarization / Thai Text Parser / UNSPSC Suggestion



## Smart City Platform

- Developing a platform to link with the country's dam safety information.
- Enhancing the efficiency of saltwater intrusion management system.
- Piloting an integrated energy management system in buildings.
- Extending the platform to increase the efficiency of Traffy Fondue city management system for use in responsible departments; and increasing channels to notify the National Health Security Office (NHSO) about the problem of using Thailand's Universal Health Coverage Scheme (30 Bath Program).



## Driving the Emerging of Practice Learning Platform in Community using Local Technology and Innovation

- Promoting the use of the KidBright platform and its activities as a technology learning media with a goal to develop 894 teachers in 490 educational institutions.
- 910 journals available on digital content management platform and on Journal Impact Factor Analysis system.
- Driving Navanurak and Museum Pool as a learning platform to accumulate cultural and community's biological identity data through a collaboration with educational institutions and government agencies; as well as establishing alliance networks with UNESCO, Designated Areas for Sustainable Tourism Administration (Public Organization) (DASTA), Program Management Unit Competitive-ness (PMUC), and THNIC, etc.



## Integration of Data Platform for Holistic Child Health Information

- ThaiSchool Lunch Users: 58,046 educational units.
- Integrating Farm to School and Handy Sense (HDS) to enhance the quality of life of people in the communities.
- Appointed a working group to drive Big Data on nutrition and student well-being.
- Providing a hearing screening system in early childhood using a free mobile application, the PASS Pro Version 1.0.
- Behind the Ear (BTE), the hearing aid device, is available for commercial use (in conjunction with a private company).



## Research and Development of Terahertz Technology

It can be used in important industries of the country to have an impact on the future economy and society.

- Prototype 3D Scanner for Imaging Object's External and Internal Structures
- THz Spectroscopy for Biomolecule, and Data Analysis Algorithm
- Photoconductive Antenna (PCA) Receiver (in-house fab.)



## Research and development of quantum engineering technology

To create knowledge and intellectual property in the way of QCE for the country, along with demonstrating the use of QCE that has the potential to create economic and social impact.

- QRNG Web service V3, a web service for generating a random number with quantum in the form of an application on a smartphone.
- Tunnel Diode Lab prototype V.3 passed the standard random number test from the institute. United States National Standards and Technology (NIST) and Diehard Standards.
- Two publicly available platforms : randomQ.org and luckyPLAY.org.



## Startup

Drive the process of Deep-Tech Startup by establishing a company to create a mechanism for collaboration between companies from research.

- DarwinTech Solutions (Thailand) Co., Ltd. provides a one-stop platform for food management and student health care in schools. Including applications in other related businesses. Developed from the results of research and development of food management systems in schools and Data Analytic Platform, registered for establishment in May 2022.
- Approved the establishment of Traffy FondueCompany Limited.



# NECTEC'S Policy-Driven Achievements

## NAIS: The National Artificial Intelligence Strategy (2022 - 2027)

The National AI Strategy is Thailand's first action plan for AI technology development initiated under a collaboration between the Ministry of Higher Education, Science, Research and Innovation and the Ministry of Digital Economy and Society.

On July 26, 2022, the Cabinet had a resolution approving NECTEC to be a working group and the secretary to drive the strategy development through the integration and the collaboration from all sectors in formulating the action plans that are appropriate to the country's social and economic context and are able to solve the problems with concerns on the people's maximum benefits and the country's sustainable development.



N AIS set its vision in establishing Thailand’s integrated ecosystem to promote the development and the utilization of high-performance AI technologies and applications to leverage the country’s economy and the quality of life of Thai people within 2027.

## The strategy focuses on three main goals.



**Developing Human Resource Capabilities and Technology**

- Reskill and upskill AI technology for teachers, lecturers and students.
- Cross skill and enhance AI skills to workforces in various fields.
- Build up new careers using digital and AI skills and knowledge.



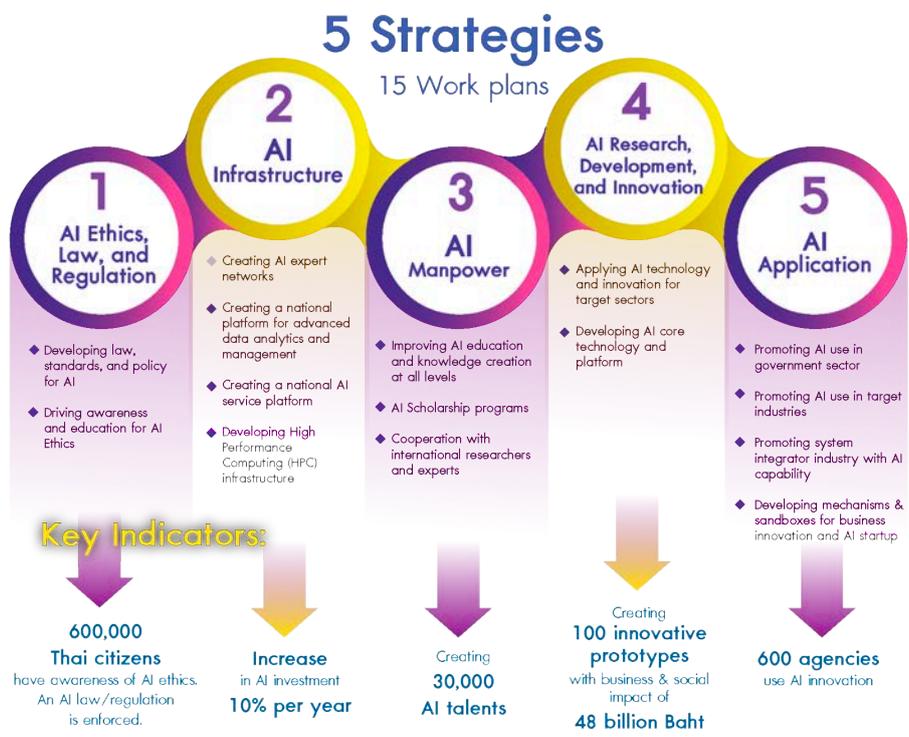
**Driving Economic Growth**

- Develop high-value products and services to increase productivity.
- Drive major government agendas.
- Promote Tech startups / SMEs / Digital Business.



**Generating Social and Environmental Impacts**

- Encourage Thai people to understand the impacts of AI, live and work collaboratively with AI.
- Offer public access to government services thoroughly and fairly.
- Reduce a gap of inequalities in income, education and medical health.
- Diminish environmental pollution with best use of all resources.
- Make Thailand stable and secure.



The National AI Strategy has been implemented under five key strategies and 15 action plans and focuses on the development of 10 targeted industries. The plan is divided into two phases.

Phase 1 is an urgent phase during the year 2022 to 2023, involving the implementation of pilot projects related to infrastructure establishment to prepare the country's readiness for further development of AI technology. Of the total 10 targeted industries, three sectors including agriculture and food industry, medical and well-being industry, and the government services are set as the first priorities of the development in this phase.

Phase 2 will start during the year 2024 to 2027 to drive the utilization of AI applications among target groups and ultimately to build an efficient AI ecosystem in Thailand.

The development of AI human resources was placed as the most important plan in the five AI strategies. At the end of 2021, the AI Thailand Consortium was established to work in parallel with the implementation of AI Strategy. The consortium brought together a network of AI developers from the Artificial Intelligence Association of Thailand (AIAT) and other alliances to help drive Thailand to become a center for the development of AI networking and experts.

To achieve the human resource development plan, the Super AI Engineer Project was introduced and incorporated into the AI urgent action plan to accelerate the development of AI workforces to respond to the country's needs.

The project is aimed to develop human resources with AI skills and knowledge to drive the country forwards, exposing Thailand to become one of the countries developed and modernized by AI technology.



The Sustainable Manufacturing Center (SMC) was established under the support of the Eastern Economic Corridor of Innovation (EECi) ARIPOLIS for BCG, aiming to develop a platform in which manufacturing entrepreneurs, system developers, innovators, researchers and students in related fields are able to utilize the center’s facilities to initiate new innovations through a variety of activities including demonstrations, learning, hands-on experiments, and other research activities.

SMC is a key infrastructure to enhance the Thai industry’s competitiveness towards Industry 4.0 and empower the country to achieve the innovation-based economy (Thailand 4.0) goal.

In 2022, SMC’s activities mainly focused on location preparation to set up a testing center and a learning center as well as the installation of essential machinery and facilities. The center has been creating its awareness through public communication, seminars, exhibitions, and member relations activities and organized various training and human resource development events. Research and development activities to solve the problems of industrial factories were initiated with full services launched as follows:



- ASSESS:** Providing factory readiness assessment and problem analysis.
- TRAIN:** Developing manpower with expertise to cope with the changes.
- CONSULT:** Providing consultancy services to encourage the industry to utilize appropriate and cost-efficient technology.
- IMPLEMENT:** Developing systems and applying effective technology to enhance the production.
- Testbed:** Offering testing services to facilitate the manufacturers to develop and test their new technology without interfering with the actual production process.

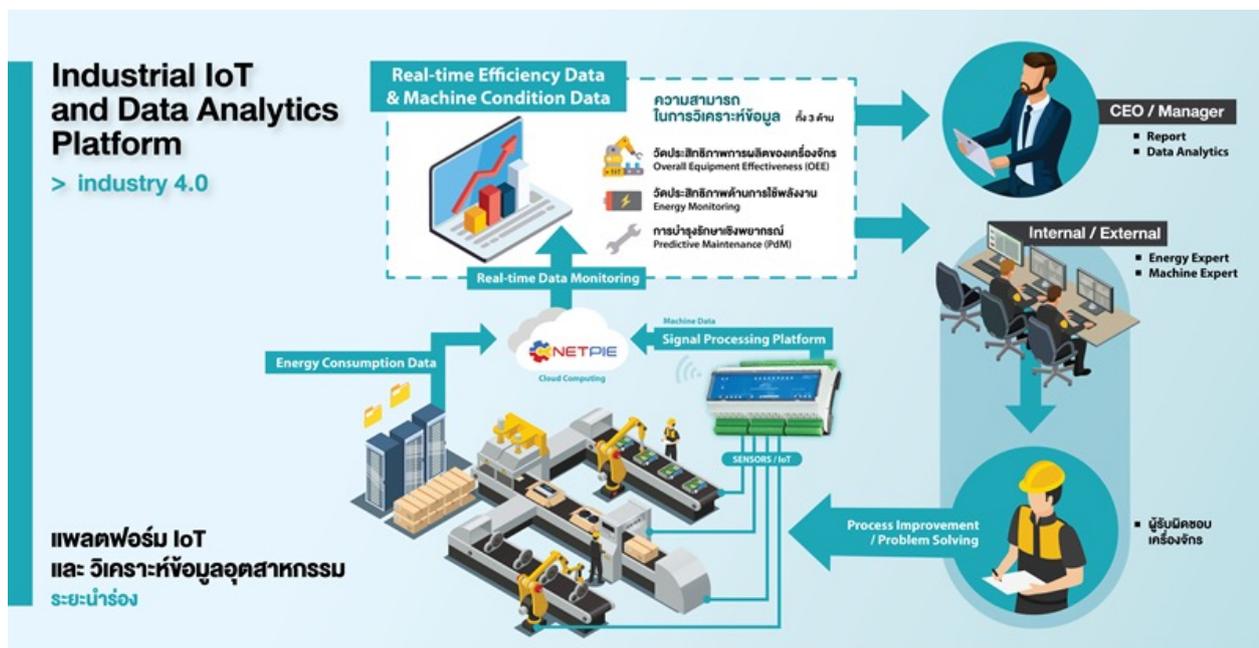
Currently, SMC has more than 30 members in the network, consisting of industrial plants, system integrators, technology manufacturers, and the general public. The center has been working closely with the industry through collaborative pilot projects, research contracts, joint research, and consultancy.

In 2022, SMC showed its success in pushing the establishment of BOI's measures to support investment for Industry 4.0. The IDA Platform, which is the center's flagship research work, was deployed for real use in 13 industrial plants and it received good response in terms of energy saving, machinery status tracking, and production process enhancement.

SMC's full services also cover the upgrading of local industrial entrepreneurs towards Industry 4.0 by utilizing sustainable production innovations. The center has trained and up-skilled personnel in the industrial fields as well as the other 100 students from vocational institutions around the EEC area with 17 enterprises showing their interests to employ the internships.

A total of 10 training courses were organized with 1,332 people participated including EV Conversion, Industrial Automation Training Systems, Aqua IoT, and Smart Farming Technology Fundamentals.

Entrepreneurs in the EEC area that received industrial upgrades are benefiting from production cost reduction. Thanks to the improvement of their technological skills, they're also capable of utilizing efficient technology not only to support further marketing planning and market expansion, but also broaden their investment and joint-investment internationally.



The National Science and Technology Infrastructure (NSTI) is an initiative developed in line with the NSTDA's Strategic Plan, covering the establishment of NSTDA Supercomputer Center (ThaiSC) in providing high-performance computing services to researchers in Thailand.

As the national service platform for science, technology and innovation, ThaiSC offers ASEAN-level scientific computing infrastructure to drive forwards the country's research and development and elevate Thailand's economy. The high-performance computing resources deliver the service capacities at  $\geq 25$  million core-hours with high-efficient standardized services. So far, more than 300 targeted users nationwide have accessed to ThaiSC's services.

- In 2022, ThaiSC's supercomputer successfully decoded the COVID-19's Omicron strain with fast results. The system analyzed the genetic codes in real-time to compare the sequence of the genetic codes with the database of the COVID-19 strains found in other countries around the world. Thanks to the high-processing power of GPU, the investigation of the virus' 30,000 genetic codes could be completed within 12 hours.
- The ThaiSC's supercomputer, known as LANTA, was ranked as the world's 70<sup>th</sup> most efficient supercomputer or the number 1 in ASEAN by the 60<sup>th</sup> edition of the TOP500 with its computational performance of up to 8.1 petaFLOPS (PFlop/s).

LANTA is Thailand's first supercomputer using warm water cooling technology that offers higher cooling efficiency than the traditional air cooling technique. The technology helps save energy costs in the long term and it's a foundation for Thailand to pace into the so-called "Green Computing" era following other leading supercomputer centers around the world.



# Economic-Impacted Research Achievements

In the fiscal year 2022, NECTEC's research outcomes contributed the economic impacts to the country by generating incomes and investment in science and technology with a total value of Bt2,553.85 million.

## Top 5 Research with Highest S&T Investment Value



**Top 5 Research with Highest Economic Impacts**



**Top 5 Research with Highest Income**



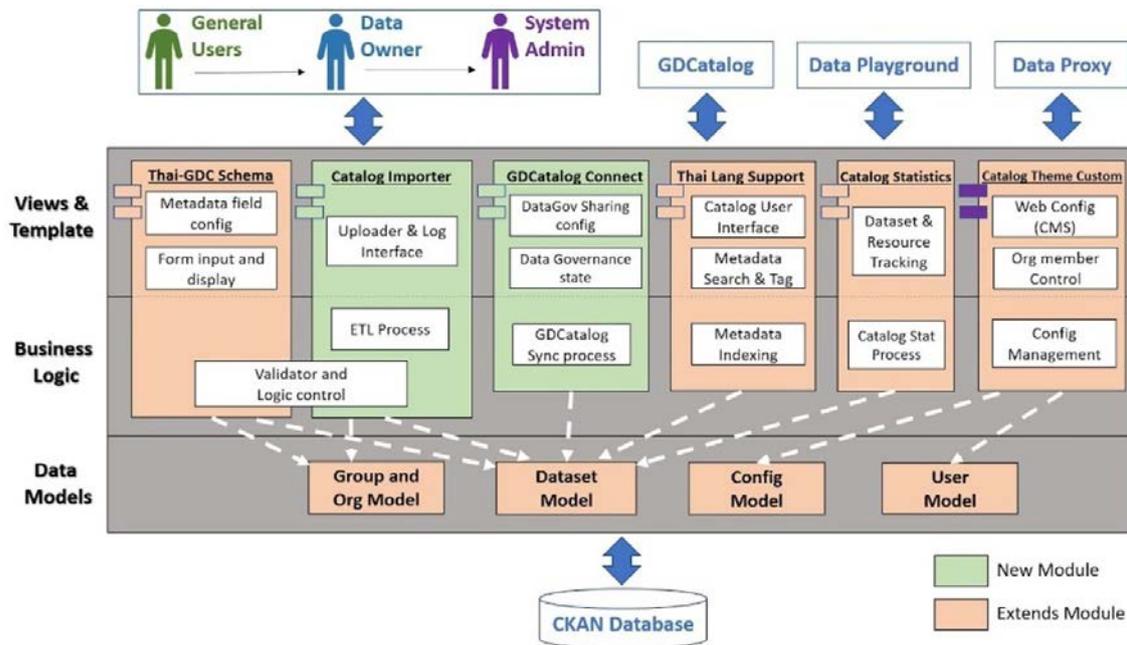
# Research for Utilization



During the year 2022, NECTEC has delivered numerous research and development works for practical use. According to its continual follow-ups, NECTEC's development outcomes have been entrusted and recognized in terms of its quality with standards certified.

# CKAN Open-D

Technology Research under CKAN Platform Development for Government Data Catalog Project in Fiscal Year 2022 Funded by Faculty of Science, King Mongkut's Institute of Technology Ladkrabang



CKAN Open-D is a data management system developed under the cooperation of the National Statistical Office of Thailand, the Digital Government Development Agency (Public Organization) (DGA) and NECTEC to build an open-system software for use in government agencies. The system supports the government data set description standards, facilitates government data catalog sharing, and simplifies information retrieval in Thai language. It allows the agencies to regulate the rights of authorized access and serves the input of a large amount of government data catalogs.

CK Open-D enhances the development of the government data catalog to be in line with the government standards. It supports the linkage with the other national data platforms, making the software used by all departments in the same level of quality and standards.

The process of bug fixing and new feature updates can be done conveniently. Designed to support the Cloud platform, the system enables each department to manage server resources flexibly and easily, and importantly, takes less time in learning. It's suitable for use in agencies that have no expertise on server management and do not have their own system administrators.

The National Statistical Office of Thailand has deployed the CKAN Open-D platform to provide its services through the Government Data Center and Cloud Service (GDCC) to serve the expansion of more participants. Using the Docker-based container management system, GDCC can utilize and manage the limited server resources for sharing use with many departments.

CKAN Open-D enables the government agencies to improve their working efficiency while reducing the officials' time spending on their learning process, thus saving training costs, the staff's compensations, and the software development expenses. Thanks to its actual benefits, the technology generated an impact value totaling at Bt53.64 million in 2022.

So far, more than 200 government departments have implemented the CKAN Open-D for use as the agency data catalog platform.

# TSIC & UNSPSC Suggestion for SME-GP

Research under SME-GP Project Funded by  
Office of SMEs Promotion (OSMEP)



The TSIC (Thailand Standard Industrial Classification) and UNSPSC (United Nations Standard Products and Services Code) Suggestion for SME-GP was developed to be a tool to support SME entrepreneurs and the officials to shorten operational time when they come to search for relevant product and service information. The system utilizes research knowledge of text processing and text similarity to create a terminology index according to the Thailand Standard Industrial Classification (TSIC) and the United Nations Standard Products and Services Code (UNSPSC).

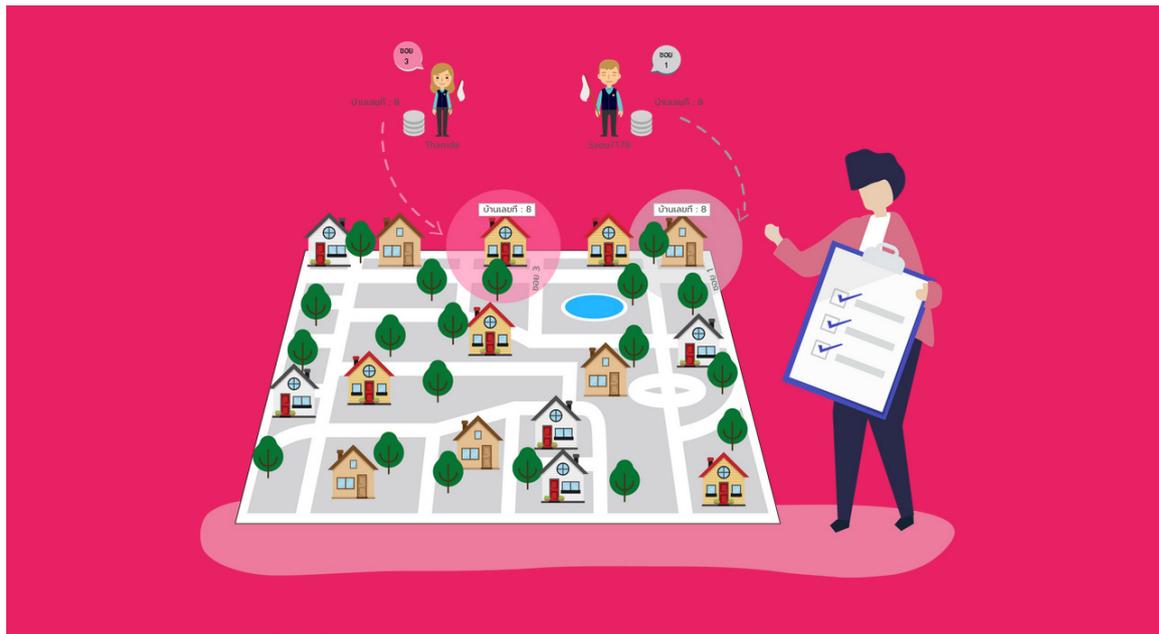
The prototype comes with an ability to suggest an option of TSIC numbers related to the type of SMEs business and a collection of UNSPSC codes associated with the category of registered products to offer users a faster selection with more accurate results.

The suggestion process was developed to improve the retrieval time to accomplish 1,000 times faster than the traditional methods. The system can offer recommended codes with the accuracy ranked in the top 2 and 3 on average, overcoming other systems that have no recommended options so users have to make their own selection from more than 100 searching results.

- User Statistics: 15,000 – 20,000 daily users
- Number of Data Retrieval: 2,132,678 times
- Registered Entrepreneurs: 142,019 companies
- Products: 1,061,671 items

# TanRabad-QUALITY: On Demand Larval Survey Data Manipulation to Improve its Quality

Technology Research under Information System Development for Proactive Prevention and Control of Dengue Outbreak - TanRabad and TanRabad BI Project Funded by Department of Disease Control



TanRabad-QUALITY is a web application under the TanRabad software suite developed to support the quality management of TanRabad-SURVEY in the process of data accumulation, duplicated houses/buildings data alteration, incorrect data deletion, and location type correction. The prototype offers an automatic evaluation on the location type quality with notifications to users for further correction.

The system incorporates a terminology archive covering both correct and incorrect words to help identify the meaning of words related to the houses or the buildings with an algorithm to specify the meaning of its name, which usually consists of two or more words with different meanings.

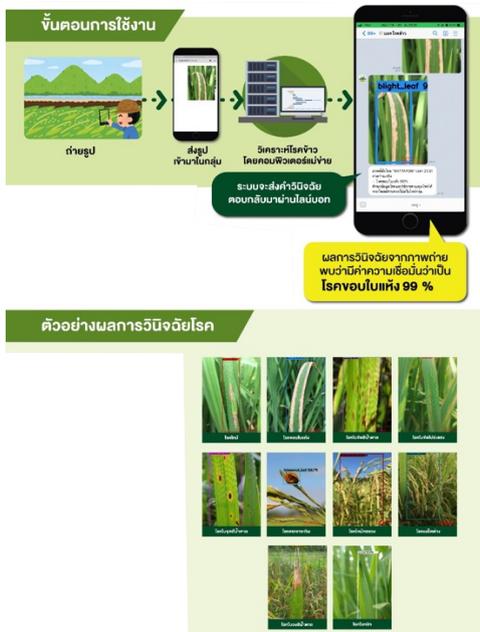
The system uses a model to classify the type of location from the set of meanings of the house or building as well as a quality rating model to evaluate the quality class of location types starting from low-quality level, ambiguous-quality level and high-quality level.

TanRabad-QUALITY has been used since June 2019 in relevant public health departments including the Office of Disease Prevention and Control Region 1 to 12 and the Bureau of Vector Borne Diseases with usage statistics of 3,899 times through September 2022.

**Economic and Social Impact Value:** Bt384.18 million

# Rice Disease Linebot

Technology Research under Mobile Application for Rice Disease Diagnosis using Image Analysis and Artificial Intelligence Project



Rice Disease Linebot was developed to be an instrument for Thai farmers and agricultural academics to early detect rice diseases through the analysis of rice images taken in the field. The photos will be sent via Line application and the system will proceed and make automatic replies using artificial intelligence (AI) and deep learning technology.

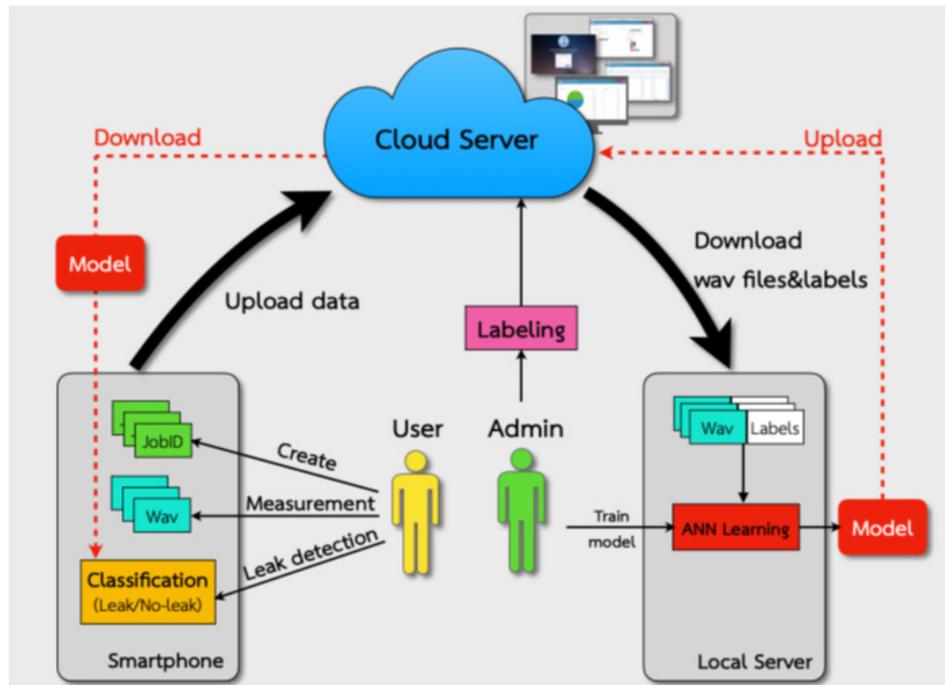
The system offers image-based rice disease detection for 16 diseases including Rice Blast, Bacterial Leaf Blight, Brown Spot, Narrow Brown Spot, Bacterial Leaf Streak, Red Stripe, Grassy Stunt, False Smut, Neck Blast, Orange Leaf, Sheath Blight, Sheath Rot, Dirty Panicle, Root-Knot Disease, Leaf Scald, and Rice Ragged Stunt. The analysis process is taken within one to three seconds offering 90.21 per cent accuracy.

The application allows users to send images of infected crops and their questions through Line's chat and they will receive automatic responses within a few seconds. The system enables farmers to make early self-diagnosis, track the rice diseases, and get faster warning notifications, thus reducing damages from rice diseases during cultivation.

So far, the application has been used among 1,522 farmers and agricultural academics, having totally 15,401 images submitted into the system or 23 images sent daily on average.

# AI-based Water Leak Detection System with Cloud Information Management

Technology Research under AI-based Water Leak Detection System with Cloud Information Management Project Funded by Metropolitan Waterworks Authority



The water leak detection platform was designed to identify the water leakage sounds from the meters using advanced mathematical methods to generate a model to characterize the sounds of water leakage with artificial intelligence. Coming with data management adaptability, the system can transmit data and connect with the central servers at anytime and anywhere.

The acoustic sounds of water leakage detected in each area will be sent to the center and it will be processed to improve the model's performance, making it more accurate in detecting the problems covering all areas.

To classify the water leak sound characterization, the model makes preliminary processing to analyze the frequency signals and then uses the artificial neural network to learn and recognize the characteristics of the sound signal. With this method, the system can be used concurrently on numerous smartphone devices in different areas with no limit of usages.

The integration of data management technology with the artificial intelligence helps the waterworks authority to reduce the burdens when it comes to survey the leakage pipelines, making better pinpointing of the malfunction area while tackling the water loss problems with more efficiency.

The system delivers more than 90 per cent accuracy and it can be used in any area through the cloud network. Complied with the information security standard, the ISO/IEC 27001, the system comes with high-level resilience.

## μTherm-FaceSense: Smart Temperature Measurement System via Communication Networks

Technology Research under Non-Contact Multi-People Face Temperature Screening System with Data Transmission via Communication Networks Project



μTherm-FaceSense was developed to simultaneously measure multiple people's body temperature with no contact for just 0.1 seconds. Featuring a maximum screening range of 1.5 meters, the system uses infrared cameras combined with the automatic face detection technology to measure the temperature of people even covered by masks to prepare a preliminary screen for the COVID-19 infection.

The system incorporates its own processing system and data storage to link collected data to an IoT computing system and it supports the connection and the storing of data through the internet, Wi-Fi and LAN. A new version of firmware can be updated automatically over the air with remote maintenance to facilitate system management and offer cost-saving.

Developed under the contexts of security and safety, the μTherm-FaceSense prototype was certified by the safety standard for information technology equipment, the IEC60950-1, and the Information Technology Equipment-Radio Disturbance Characteristics-Limits and Methods of Measurement standard, the CISPR 22:2008. The Certificate of Calibration was also received at the accuracy rate of  $\pm 0.5\text{ C}^\circ$  with a function test in accordance with the ISO/IEC25010 standards and requirements.

The commercial production of μTherm-FaceSense (40 systems) has been licensed with certain calibration procedures. The prototype was filed for three patents, one petty patent, and four design patents.

**Invention Patent:** Application No. 1301001943

**Utilization:** Technology licensing to one private company with 36 machines installed for use nationwide.

## Signal Receiving Device for Real-time Indoor Localization System using Bluetooth Low Energy Version 2



The signal receiving device or Anchor is a part of Indoor Localization System (UNAI Platform) developed to work with the transmitting device known as Tag to send signals to the computer server for identifying the tag's location and displaying the position and a route to the targeted objects for users.

Anchor uses Bluetooth low energy wireless communication technology to save energy and offer constant location tracking much more accurately than the use of WiFi networks. The device can connect with 3G/4G mobile phone networks and comes with temperature and humidity sensors, making it possible for multi-purposed usage in various sectors including manufacturing and logistics industry, tourism and transportation industry, and medical and health care industry.

With its 6-volt maximum voltage, Anchor passed the industrial product standard test from the Electrical and Electronic Products Testing Center (PTEC) to ensure the product safety. It was in the field test in three exhibitions organized at BITEC Bangna including Thailand Franchise & Business Opportunities 2019, Thailand Lab International 2019 and COSMEX 2019.

# Development of Weather Station for Education using Block-Structured Programming

Technology Development under AI@School Project



The weather station prototype was developed as an educational tool for the secondary school students to learn about new technology under the Data Science@School project. Learners are able to create a set of commands to control the operations of devices using Block-structured Programming just by dragging and dropping blocks through the KidBright IDE program on the KidBright board.

KidBright board can connect to 10 types of weather-related sensors including light intensity, temperature, relative humidity, wind speed, wind direction, rainfall, barometric pressure, GPS, PM10 and PM 2.5. It also supports the connection with other additional weather sensors through KidBright extension board to offer the scalability for use in other automation systems.

The weather station prototype known as UtuNoi Station utilizes the KidBright board to connect with meteorological sensors in which data from sensors will be preliminary processed on Real-time Data Platform before sending to the Cloud for display in the UtuNoi Watch, a web application for weather data tracking, and the UtuNoi PLAYGROUND, a web application for data science learning that allows students to make real experiment with weather data gathered throughout the country from the UtuNoi Station.

The project received support from the Institute for the Promotion of Teaching Science and Technology (IPST) in developing and producing Data Science educational materials for public use.

**1 Patent Filing:** Application No.1601005546

**Economic and Social Impact Value:** Bt8.78 million

## Behind the Ear (BTE)

Technology Development under Behind the Ear Project



Behind the Ear (BTE) is a digital hearing aid designed for people with mild hearing loss to severe hearing loss. The device offers a maximum loudness level at 130 to 141 decibels and the highest amplification in the range of 60 to 80 decibels. Integrated with automatic features, the device enables users to easily adjust the sound amplification on the unit with no need to use additional equipment.

The BTE was developed to serve the market's needs with its performance equaling to the international-standard products. The local development offers cost effectiveness, lowers users' maintenance burdens and importantly, reduces the use of imported technology. The prototype has passed the testes under IEC60118-7, IEC60601-2, IEC60601-1-2, IEC60118-13 standard and clinical tests.

BTE comes with two models. The Normal model was designed for people with mild to moderately severe hearing loss. This model has a maximum loudness of 136 decibels and a maximum amplification of 60-70 decibels.

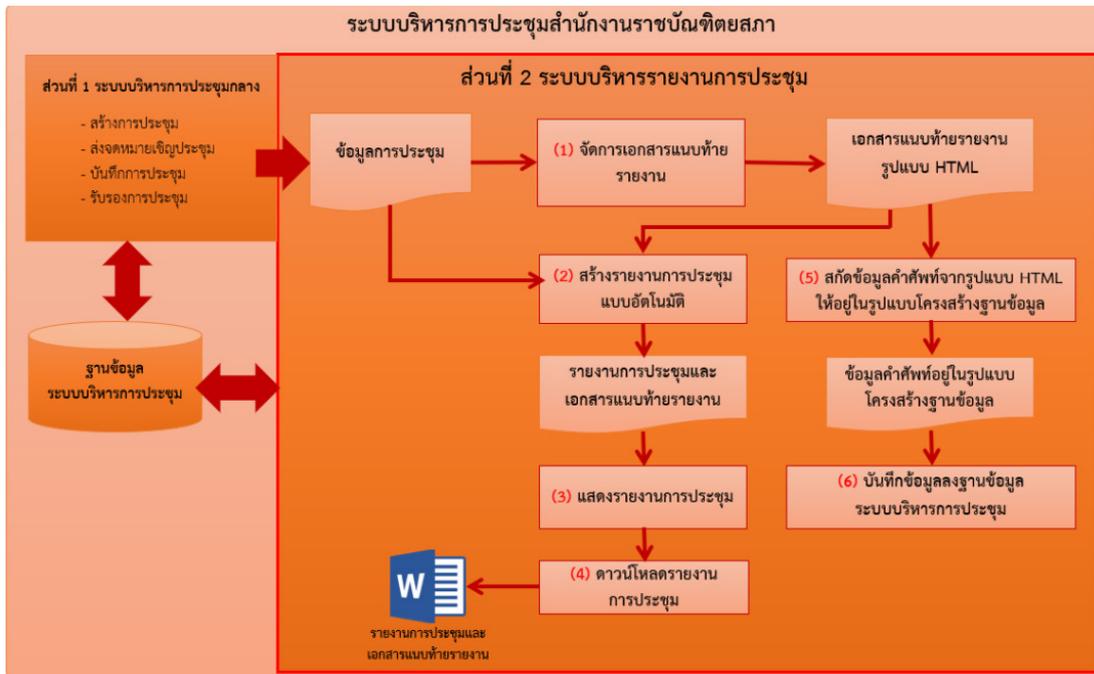
The Power model features a maximum loudness of 141.1 decibels and a maximum amplification of 70-80 decibels and it's suitable for people with moderately severe to severe hearing loss.

At present, 120 prototypes have been delivered to the Faculty of Medicine, Ramathibodi Hospital for clinical testing. The technology was transferred and licensed to Audimed Co., Ltd for further commercial production.

**1 Petty Patent Filing:** Application No.1601005546

# Minutes Management System for the Office of the Royal Society

Research under Database Support System for the Office of the Royal Society Project



The system was developed to facilitate the Office of the Royal Society’s subject–dictionary meetings by allowing the officials to automate meeting minutes under the office’s specific format for immediate use. The alteration of the contents and the attachments can be done easily and a complete version can be printed and downloaded in the .docx format.

The system is capable of extracting vocabulary data from HTML format into database structure automatically at 99.99 per cent faster than the manual method, enabling the process of vocabulary checking, vocabulary consideration, and detecting incomplete vocabulary definitions achieve 94.60 per cent accuracy. The system helps reduce the difficulty when it comes to search for a list of approved words to be published.



# Partnership Development

## Local Partnership Development



Cooperation Agreements  
with Local Agencies

**48**



Partners

**44**



Research  
Projects

**20**

NECTEC has established partnerships with numerous agencies, educational institutions and the private sector throughout the year 2022 under the Memorandum of Cooperation to promote research and development in electronics and computer technology.

1. Research and Development on Museum Pool Project, in cooperation with Rajabhat Maha Sarakham University, Surindra Rajabhat University, and Buriram Rajabhat University.
2. Development of Thailand Agricultural Data Collaboration Platform (THAGRI), in cooperation with the Office of Agricultural Economics, the Land Development Department, and the Digital Economy Promotion Agency.
3. Development of Artificial Intelligence for Performance Audit (AI for PA), in cooperation with the State Audit Office of the Kingdom of Thailand.
4. Establishment of Thailand Artificial Intelligence Consortium.
5. Co-Research and Development with AI9 Co., Ltd. to develop and provide AI-based technology services.
6. Co-Research and Development with Biggo Analytics Co., Ltd. to develop data analytics technology for a decision support system.
7. Initiated AI Learning Management Driven Project in Schools in cooperation with the Institute for the Promotion of Teaching Science and Technology (IPST).
8. Academic Knowledge Development on Personal Identification Database and Reconciliation Process, in cooperation with the Central Institute of Forensic Science to enhance Thailand's forensic science for justice.
9. Research and Development on Museum Pool Project, in cooperation with Loei Rajabhat University.
10. Creating a cooperation in developing a customer service system via Line's chatbot with the National Saving Fund.
11. Medical Research and Development using Artificial Intelligence Technology to Improve Quality of Life, in cooperation with the Department of Disease Control, Khon Kaen University, and Suranaree University of Technology.
12. Establishment of standards and assessment measures for information and communication technology for electronic transactions, in cooperation with the Electronic Transactions Development Agency.
13. Co-Research and Development on Regional-based Innovative Education Platform, in cooperation with 11 Northeastern Rajabhat universities.
14. Encouraging the development of manpower in Innovation and Cultural Heritage and Creative Industries Management, in cooperation with the College of Innovation, Thammasat University.
15. Establishing a knowledge center to transfer specialized technologies including Digital-Lean Production System and Logistics Management, in cooperation with the Thai-Nichi Institute of Technology.
16. Development of Innovative Chatbot Prototype, in cooperation with the Institute for the Promotion of Teaching Science and Technology (IPST).
17. Development of Innovation and Technology for Agriculture and Livestock for Keha Sukpracha Project, in cooperation with the National Housing Authority.

18. Artificial Intelligence Technology Development and Transfer, in cooperation with the Revenue Department.
19. Collaboration with Rajamangala University of Technology Isan, Khonkaen Campus to develop human resources and Teaching Manual for Basic and Advanced Software Testing (2022–2024).
20. Development of Information System to enhance the quality of Thai journals using an online journal management system, in cooperation with King Mongkut's University of Technology Thonburi.
21. Research on Design and Development of Silicon Detector Prototype for Particle Physics Testing (2<sup>nd</sup> edition), in cooperation with the National Astronomical Research Institute of Thailand (Public Organization).
22. Development of Strawberry Pest Diagnosis System using Artificial Intelligence Technology Phase 1, in cooperation with the Royal Project Foundation.
23. Expansion of Municipality Complaint Reporting and Management System (Traffy Fondue) to local administration level, in cooperation with Rajabhat Maha Sarakham University, Rajamangala University of Technology Lanna, Phetchaburi Rajabhat University, and Chaiyaphum Rajabhat University.
24. Development of Intelligent System for Data Gathering and Issuance of Vaccination Certificates for Travel, in cooperation with the Department of Disease Control.
25. Research and Development Project to enhance the potential of designated areas for sustainable tourism using digital innovation and artificial intelligence technology, in cooperation with the Designated Areas for Sustainable Tourism Administration (Public Organization).
26. Establishment of Knowledge and Technology Transfer Center Specialized in Intelligent Manufacturing System, in cooperation with King Mongkut's University of Technology Thonburi.
27. Development of CCTV Platform for Traffic and Safety in Chiang Mai Province, in cooperation with Chiang Mai Provincial Administrative Organization and Chiang Mai Provincial Police.
28. Development of Liver Fluke Screening System using Artificial Intelligence, in cooperation with the Department of Disease Control under the Ministry of Public Health to enhance the medical officials' working efficiency and improve the quality of life for Thai people.
29. Co-Research and Development on Smart City Data Platform, in cooperation with Multi Innovation Group.
30. Research on the development of modern-agricultural demonstration areas for cultivation control using HandySense to improve the efficiency of water management, in cooperation with Siam Kubota Corporation Co., Ltd.
31. Research Utilization for Commercial Purposes with Talent Mobility under a cooperation with CP Group.
32. Academic knowledge development in personal identity database, drug and explosive identity analysis, and recognition of tattoos for missing person tracking using Surface-Enhanced Raman Spectroscopy (SERS) chip and Object Recognition technology under a cooperation with the Central Institute of Forensic Science.
33. Driving the use of e-Document systems in the government sector under a cooperation with 7 government agencies.

# International Affairs Performance

NECTEC set up the Foreign Operations Steering Committee to determine the directions and drive foreign affairs operations to establish international awareness and recognition, motivate NECTEC's research for real use, increase business target ratio in technology transfer, and broaden its academic excellence. The center's international affairs performance in 2022 included:



Awards Received **3**  
Awards



Talent Exposure in **7**  
International Stages



Funded Projects **8**  
Projects



European Network Collaboration Activities **6**  
Projects



Asian Network Collaboration Activities **21**

NECTEC's international affairs has been divided into four areas.

## Awards

**2022 SPIE Women in Optics Planner**

**Dr. Atcha Kopwithaya**

Photonics Technology Research Team (PHT)



**SPIE. WOMEN IN OPTICS**

**ASEAN-U.S. Science Prize for Women 2022: AI for Health & Safety**

**Dr. Supiya Charoensiriwath**

Human Behaviour Analytics Research Team (HBA),  
Data Science and Analytics Research Group (DSARG)



**SPIE Fellow**

**Dr. Sarun Sumriddetchkajorn**

Deputy Executive Director – National Electronics and Computer Technology Center (NECTEC)



## International Talents Exposure

Sub-Committee on Microelectronics and Information Technology (SCMIT)  
Focal Point of Thailand

**Dr. Chai Wutiwivatchai**

Executive Director  
National Electronics  
and Computer  
Technology Center  
(NECTEC)



Steering Committee ของ ICT  
Virtual Organization of ASEAN  
Institutes and NICT (ASEAN IVO)

**Dr. Chai Wutiwivatchai**

Executive Director  
National Electronics  
and Computer



Co-Chair, ASEAN HPC Taskforce

**Dr. Piyawut Srichaikul**

Director – NSTDA Supercomputer  
Center (ThaiSC)

Director – Industrial IoT and  
Automation Research Group  
(IIARG)



Professional Certificates in  
Cyber Security for Cybersecurity  
Network Development

**Information Security Research  
Team (SEC), Communications  
and Networks Research Group  
(CNWRG)**



Visiting Professor for Japan  
Advanced Institute of Science  
and Technology (JAIST)

**Artificial Intelligence Research  
Group (AINRG)**



Executive Committee of  
Thailand Advanced Institute of  
Science and Technology and  
Tokyo Institute of Technology  
(TAIST-Tokyo Tech) หลักสูตร  
Artificial Intelligence and  
Internet of Things (AIoT)

**Artificial Intelligence Research  
Group (AINRG) / Communica-  
tions and Networks Research  
Group (CNWRG) / Intelligent  
Transportation System Network  
(ITSN) Research and Develop-  
ment**



AI for Social Good Project Specialist

**Strategic Analytics Networks with Machine Learning and  
AI research team (SAI), Data Science and Analytics Research  
Group (DSARG)**



## Funded Research

Accelerating Industry 4.0 Technology Adoption in Manufacturing Sectors through STI  
Partnerships among Smart Manufacturing Research and Innovation Centers

Source of Fund: APEC Policy Partnership on Science, Technology and Innovation (PPSTI)  
Industrial IoT and Automation Research Group (IIARG)



**Open-source SOC-as-a-Service for Strengthening Cybersecurity in Small and Medium Manufacturers in Thailand toward Industry 4.0**



**Source of Fund: Information Society Innovation Fund (ISIF ASIA)**  
Sustainable Manufacturing Center (SMC)

**Automatic Forest Fire Detection System to Reduce Haze Pollution in the Transboundary Area between Northern Thailand and Lao PDR**



**Source of Fund: JASTIP-Net**  
Advanced Control and Electronics Research Group (ACERG)

**Development of a sustainable business model for Farm-To-School, aiming to support the local food supply chain for healthy school lunch meals while connecting farmers and their products with potential buyers**



**Source of Fund: Asia-Pacific Telecommunity (APT) / Extra Budgetary Contribution from the Government of the Republic of Korea (EBC-K)**  
Human Behaviour Analytics Research Team (HBA), Data Science and Analytics Research Group (DSARG)

**USDA: Food for Progress Program**



**Source of Fund: U.S. Department of Agriculture**  
Intelligent Transportation System Network (ITSN) Research and Development / Knowledge Elicitation and Archiving Research Team (KEA) / Data Science and Analytics Research Group (DSARG) / Image Processing and Understanding Research Team (IPU), Artificial Intelligence Research Group (AINRG)

**Visual IoT Network for Environment Protection and Disaster Prevention**



**Source of Fund: ICT Virtual Organization of ASEAN Institutes and NICT (ASEAN IVO)**  
Advanced Control and Electronics Research Group (ACERG)

**Agricultural IoT based on Edge computing**



**Source of Fund: ICT Virtual Organization of ASEAN Institutes and NICT (ASEAN IVO)**  
Information Security Research Team (SEC), Communications and Networks Research Group (CNWRG)

**Regional Impacts of Stratospheric Aerosol Injection on Temperature, Precipitation, and Sea-Level Rise in Thailand**



**Source of Fund: Degrees Modelling Fund**  
Data-Driven Simulation and Systems Research Team (DSS), Data Science and Analytics Research Group (DSARG)

## European Network Collaboration Activities

**IRRIGATION 4.0: Strengthening Agriculture 4.0 Technology in Thailand – Myanmar – Germany Collaboration: Development of “Plant-based Irrigation Platform”**



**International conference on Research infrastructures**

Participated in the plenary session:  
Research Infrastructures Addressing Grand Societal Challenges.



- Giving an interview to the “OECD Task Force on AI Compute” team on Thailand’s High-Performance Computing (HPC) with results reported to the 1<sup>st</sup> Working Party on Artificial Intelligence Governance.
- Participated in OECD Expert Group on AI (AIGO)



**Partnership Development Meetings on Smart Manufacturing, and 5G and Communications**



**Optical-Based Sensor for Virus Detection: Platform for Future Optical Sensing Applications**



**Development of Fast and Scalable Atomistic Simulation Algorithm for Exascale Supercomputer**



## Networks in the Americas and Pacific



Development of Fast and Scalable Atomistic Simulation Algorithm for Exascale Supercomputer Project

## Networks in Asian Countries



- Paddy field Land Use Change Detection using Data Cube Phase II
- Guided Mode Resonance Sensing Technology for Volatile Organic Compounds and gas



中国科学院  
CHINESE ACADEMY OF SCIENCES

- Wireless VOCs Sensing Modules for IoT Environmental Monitoring
- Individual Behavior Recognition based Multi-Sensor Network for Intelligent Elderly Care System
- Control System of Greenhouse Environment Based on Crop Growth



- Microfluidic nanowires coupled with gold nanoparticles for Dengue viral disease diagnosis
- Establishment of a Landslide Monitoring and Prediction System



- Visual IoT Network for Environment Protection and Disaster Prevention
- Agricultural IoT based on Edge computing



Digital Content Management Platform (ThaiJo System Training for Journal Editors Phase 3 and ThaiJo Service for Thai Journals Phase 2)



Project Agreement on Collaboration in the Field of Information and Communications Technologies Utilization Thailand-Japan Advanced Research and Development Network



Collaboration Development with 8 Global Supercomputer Centers to Drive the Establishment of World's HPC Core Group.

## Key Opinion Leader ของประเทศไทย และ Co-chair ของ ASEAN HPCTF



Activities under ASEAN Committee on Science, Technology and Innovation (COSTI) through the ASEAN-HPC Task Force.

- Being a key opinion leader from Thailand and the Co-chair of the ASEAN HPCTF.
- Co-organized EU-ASEAN HPC School 2021 & 2022.
- Collaborated with Singapore in developing contents related to the ASEAN HPCTF for publishing on ASEAN's ASTNET website.
- Reported the committee's performance at the COSTI meeting.
- Participated in activities under the ASEAN Regional Research Infrastructure Strategy.



Being a session chair and an invited speaker to give a lecture on Tunable Shape and Composition of Three-Dimensional Oxide Nanostructure via GLAD Technique and their Applications at the 2021 International Chemical Congress of Pacific Basin Societies (Pacifichem).



Being an invited speaker on Research and Development of Optical Nanostructures for Sensor Applications at NECTEC in the Joint Symposia on Optics in Annual Conference of the Optical Society of Japan.



**Asia-Pacific  
Economic Cooperation**

- High Performance Computing Infrastructure Management Ecosystem Model for Sustainable APEC Science and Technology Development
- Accelerating Industry 4.0 Technology Adoption in Manufacturing Sectors Through STI Partnerships Among Smart Manufacturing Research and Innovation Centers
- Being a speaker in APEC Symposium on Capacity Building for Digital Innovation using Block-Chain Technology.
- Being a speaker at the APEC's Policy Partnership for Science, Technology and Innovation (PPSTI) Workshop on Digital Manufacturing for Supply Chain Resilience.



**ITRI**  
Industrial Technology  
Research Institute



IRS(S) PTE., LTD.

Partnership with international agencies for the development of an ecosystem for sensor technology.

# Technology Transfer



Cooperation Agreements

183



Total Value:

Bt200,306,409.09 million



Divided into

61%

government contracts

17%

contracts with the private sector

13%

contracts with the state enterprises and the educational sector

respectively

3%



# National Electronics and Computer Technology Center



Your Resource



Your Analytic



Your Tool