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New technology introduced in an Irrigation Project to solve water conflict (TTD case study)

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Presentation topics

- Introduction
- Objectives and scope
- Approach
- Procedures
- Activities
- Results
- Findings
- Conclusions

Introduction

- The water management strategies in irrigation areas for minimizing water losses encompass various techniques. These methods include estimating water requirements, evaluating groundwater potential, implementing automated systems for managing water releases, and establishing water user groups. The data on soil moisture from paddy fields and water levels in the main canal support the determination of automated gate control. This innovation target of reduction of more than 15% in water losses from canal conveyance.
- Related studies
  Technical system design (Pinthong P., 2022, Sak S., 2022), Water User Group Development (Chisanuwat M., 2022), Assessment Criteria (Jitrapon S., 2022), Policy recommendations (Koontanakulvong S., 2023)

Objectives and scope

- The research, under the TSRI-NRCT Spearhead Research Program aims to improve water management efficiency at local level; to reduce the disparity in access to water resources of people in the community within the Thor Tong Daeng (TTD) Irrigation Project area, Kamphaengphet Province, Thailand, that the local agriculture communities have long been traditionally adopted the conjunctive use of water for their crop production.
- To save irrigation water via reducing water conveyance loss crop production and to summarize key characteristics of good water management practices at local level achieving through the process of participatory and training approach (PAR/CBR) for future applications of capacity assessment of water community organization.

SCOPE

In the TTD Irrigation Project located in Ping River Basin below Bhumipol Dam with irrigation area of 550,688 rai (80000 hectares).
Research conducted during 2020-2024

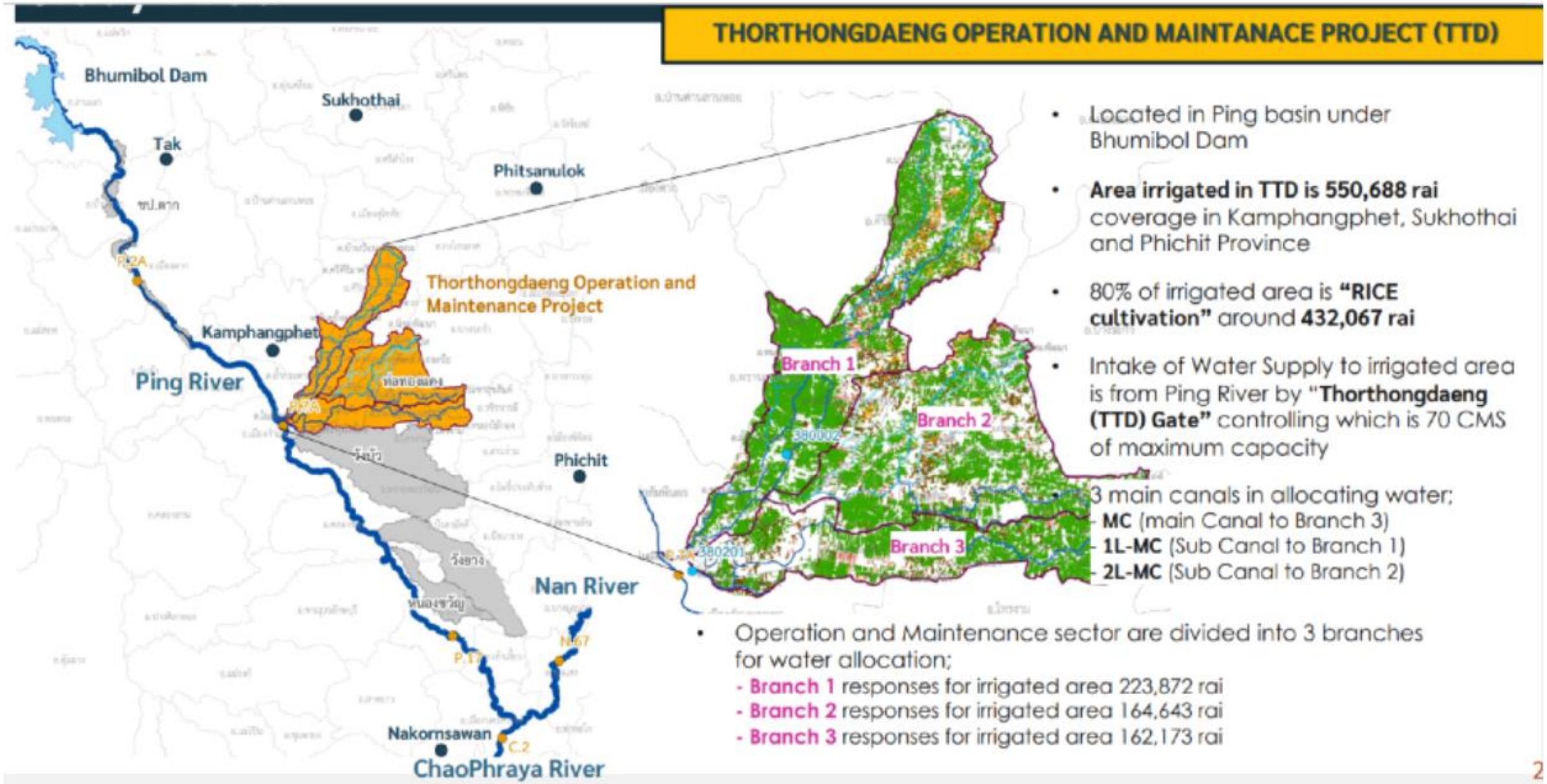


Fig.1 Study area and location

Approach-1

- **Hardware**
  Installations of In-situ soil moisture sensor, water level monitoring, automatic gate control
- **software**
  software of water demand planning, water allocation, water release, feed back
- **Human ware**
  Community-based action research (CBR) is a core method of research operation by organizing a small group meeting, an in-depth interview, collecting community data using online tools. The key focuses are to encourage community leaders (Water User Group) on the participatory and integration and to find ways to increase the efficiency of water management at local level in the area among water users, farmers, and government staffs.

Approach-2

- This research aims to evaluate the economic, social, and participation impacts from participating in activities in the project to develop mechanisms for participation in the use of irrigation water and improving the efficiency of water management in Thorthongdaeng (TTD) operation and maintenance irrigation project located in Kamphaeng Phet Province after the project phases 1 and 2
- There are areas of 5 subdistricts, namely (1) Tham Kratai Thong Subdistrict (2) Nong Luang Subdistrict. (3) Sa Kaeo Subdistrict, (4) Nikhom Thung Pho Thale Subdistrict, and (5) Nong Mai Kong Subdistrict. The five subdistricts are located in the three irrigation water delivery zones of Thorthongdaeng operation and maintenance irrigation project.

Procedures

- Phase 1 Technical system survey, test and installation
  training RID staff - how to use the system
  - how to work with WUG
  water user group training-1 how to manage group
  training-2 how to plan crop and water
- Phase 2 Expand water service area and expand sensor installations
  water user group training-3 how to plan for extra crops
  WUG assessment
- Year 3 Project evaluation and socio-economic assessment

Activities

- Technical

  Hardware (automatic gate control, water level monitoring, installation soil moisture sensor)

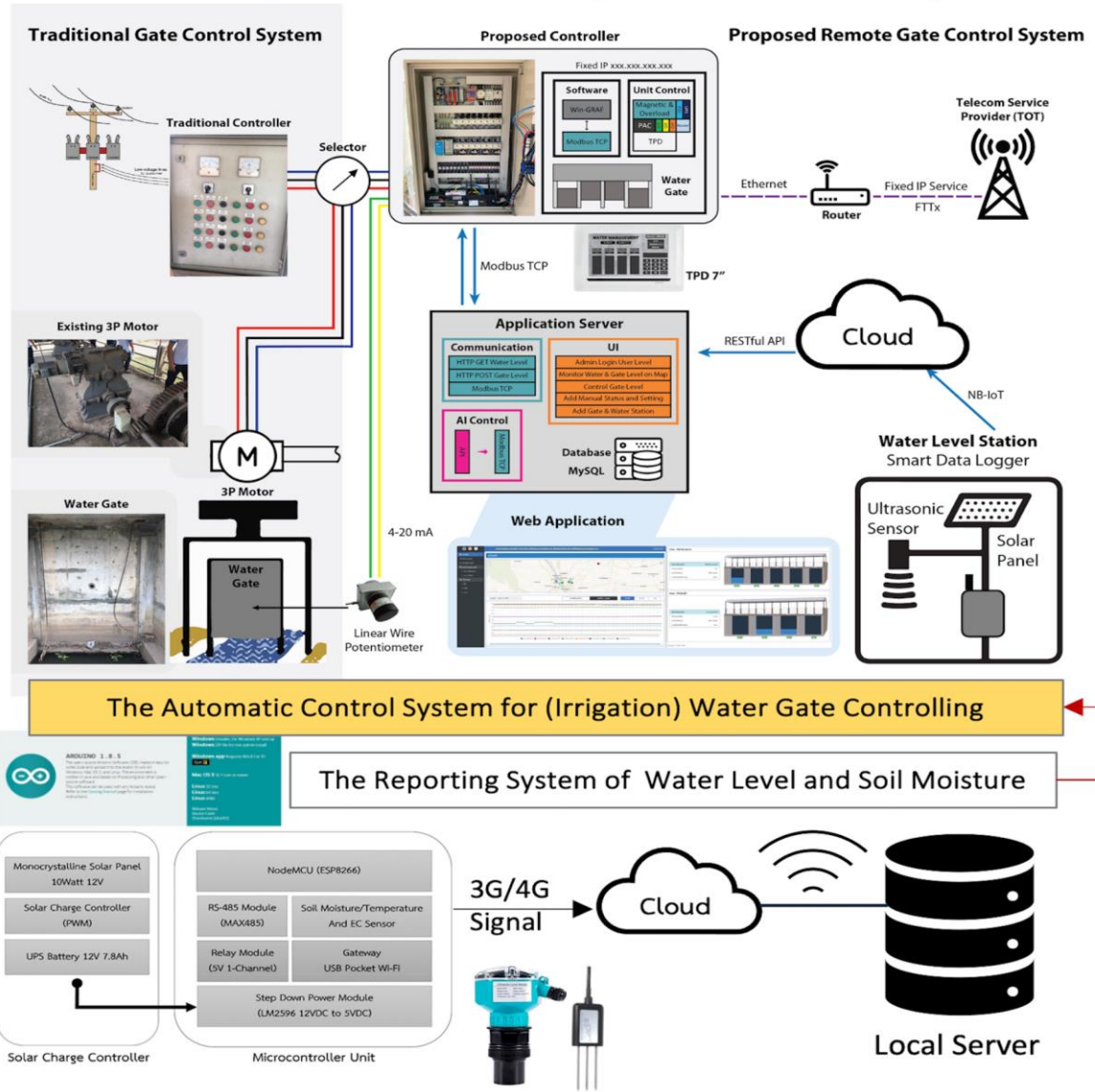
  Soft ware (demand prediction, water allocation, water development release, feed back)

  Human ware (0: RID staff training, WUS training 1: how to manage group, 2: how to plan crop and water, 3: extra crop planning)

The linkage of real-time IoTs Data Reporting to Monitor Water and Agricultural State into Mathematical Modeling for Water and Agricultural Operating System

The Reporting and Monitoring System for Water and Agricultural Changing Condition of the Prototype Area

IoTs System for water and agricultural land tracking



Water Management and Operating System for Irrigation Control

Mathematical Models for Irrigation Water Management and Allocation

Frequency Data at 3-hours reporting

Soil Moisture at Field Capacity

Frequency Data at 15 mins reporting

Water Level in Canals

The Data Processing Model of Meteorological and hydrological changing conditions in the prototype are

Linkage observing data to mathematical modeling

Rainfall and Runoff Forecasting Model

Forecasting discharge in Ping River and Inflow to Bhumibol Dam In 7-days ahead and in seasonal

Warning of agricultural area in Drought and flood Impact

Crop Demand Evaluation with soil moisture into Water Allocation Model

Increasing the water supply efficiency by 85%

Reservoir Decision Making Model

Release recommend in 4 modes application such as Efficiency/ Standard/ Dynamic/ Individual

Evaluate crop water need 7-days in advance and seasonally by applying the actual planted area on a weekly basis.

Hydrodynamic Simulation of Main River and Irrigation Canals

Simulate the Ping river flow and main canals of irrigation systems

Decreasing irrigation water loss by 15%

Recommend Water Delivering through Gate Controlling in proper with actual crop situation and water demand

Automatic Gate Controlling

In Manual/ Recommend 7 days ahead/ Emergency mode

Collaboration between irrigation water user groups and irrigation officers

- Water management efficiency can be enhanced by creating a network and building the capacity of human resources. This process involves forming a team of local coaches, establishing teams of water users at the village/district level, and connecting with the network of organizations. This team formation leads to the emergence of community leaders/water user groups, connecting upstream, midstream, and downstream areas. The development also includes improving the efficiency of the mentoring mechanism, where irrigation officials work collaboratively with all stakeholders continuously. This collaborative effort aims to reduce conflicts in water allocation among upstream, midstream, and downstream areas.

Results-1

- **The water delivery in accordance with demand, water demand management, and precision agriculture guidelines are implemented through real-time monitoring using IoT technology. This implementation involves automated control of water discharge gates, accessing current canal water level data, and checking real-time soil moisture data in agricultural plots via mobile/tablet/computer. The results of IoT technology systems have demonstrated a significant reduction in irrigation water usage in agricultural plots, achieving a minimum reduction of 15%.**

Results-2

- Field survey in five districts in TTD area found that the economic changes after participating in the project phases 1 and 2 resulted in an increase in household income from rice cultivation amounting to 1,942-3948 baht per rai (US 360-750 $ per hectare) from average rice income of 11, 888 baht per rai (US 2250 $ per hectare) or 16 – 33 % increase.
- For the economic changes, they developed further to implement community enterprise for Azolla, lemon, lemon grass cultivation. It was found that there was an increase in income of 1,634 – 35,756 baht per rai (US 310-6700 $ per hectare)
- On the social side, it was found that there was more discussions and help each other in the community, better water sharing and reduce conflict in the area.
- For participation, it was found that they participated in meetings or other activities of the group and followed the rules and regulations.

Findings

- Creating water and land management plans involves training people or communities (peopleware) for group management; establishing rules, regulations, and guidelines (software); developing infrastructure (hardware); and specifying measures to cope with droughts and floods under climate change. In terms of rules and regulations, collaborative efforts are made between water user groups and irrigation officials to report the water usage needs for agriculture in each season. This process includes joint water tracking, establishing a water management fund, and collaboratively addressing obstacles/barriers that affect water management with the goal to ensure equal access to water resources for everyone.

Conclusions

1. Applying a tracking system with measurement system and sensors in irrigation projects can enhance water delivery efficiency and reduce losses during distribution.
2. The development of water user group could transfer knowledge and techniques and made farmers utilize the developed water information system.
3. This initiative created a continuous learning experience and serve as a collaborative workspace for water user groups, organizations, and relevant agencies, thereby supporting water management planning in the area.
4. The scheme enhance water use efficient, reduce water conflict and increase farmer incomes.

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- Introduction web and clip of SIP : www.sip-water.com and https://www.youtube.com/watch?v=r9m621kOPn0&list=PL2qBZChb2KWJFr48dlK12gzJav0W6RikO&index=1

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