

KWPF 10th Anniversary Conference

Toward a
New Decade
of Inspiration

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Internet of Things (IoT) in Agriculture : Vietnam Pilot for Improving Rice Water Use Efficiency



Presentation Overview

- Context and Problem
- KWFP Financed Pilot in Vietnam
- Results from the pilot
- Going Forward

Paddy : Big Challenges (From Global Public Good Perspective)

- **Greenhouse gases (GHGs):**
 - Global rice production emits 500 to 800 million tons of CO₂ equivalent/year.
 - Rice accounts for at least 10 percent of total global agricultural GHG emissions.
- **Water Usage:**
 - Rice consumes almost 21 percent of the total volume of water used for global crop production, putting pressure on scarce water resources.
 - 1 KG of rice = 3000 Liters of water while 1 KG of maize = 900 liters of water and 1 kg of wheat = 1100 liters of water.



Meeting future rice demand, while drastically reducing GHG emission and water usage, is a global challenge that needs to be addressed.

Potential Solution: Alternate Wetting and Drying

- Paddy fields are alternately irrigated and dried
- AWD techniques can reduce water use by up to 30 percent and reduce GHG emissions, especially methane by 48 percent.

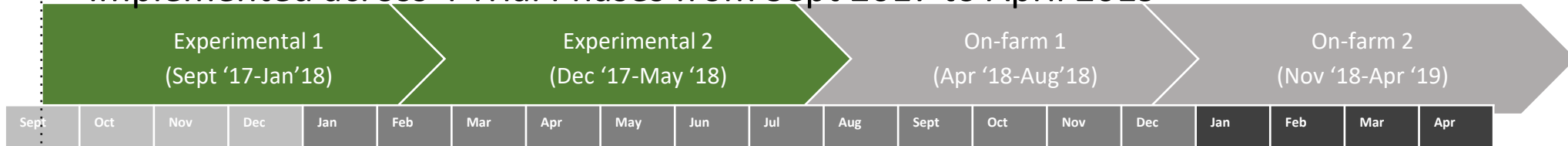


Challenges to adoption of AWD

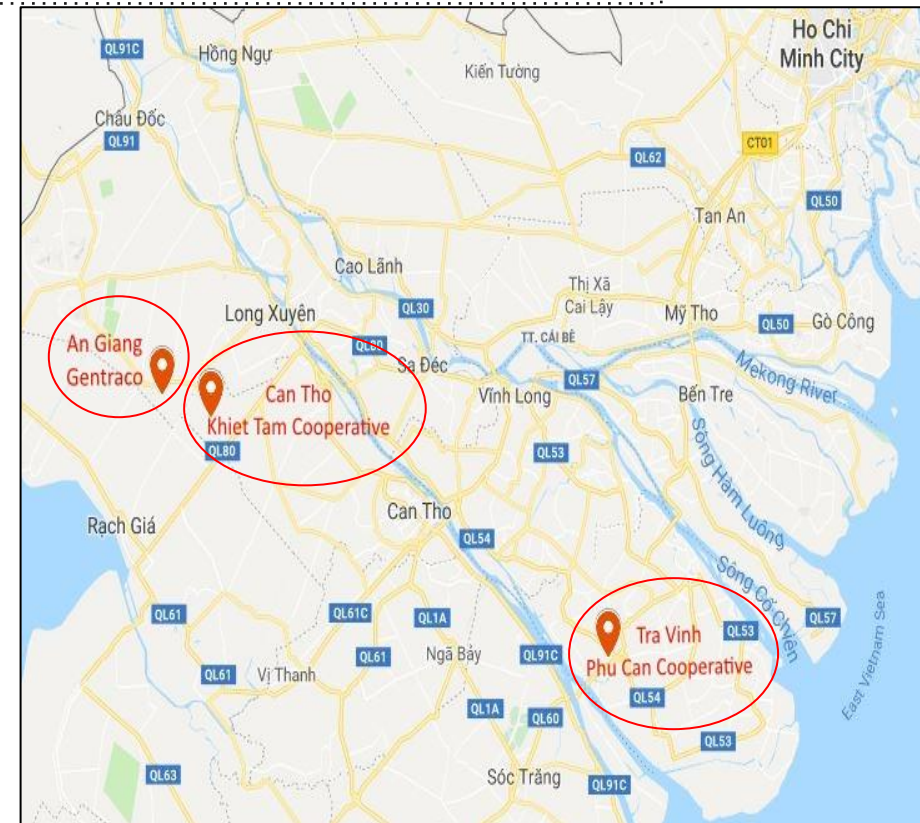
- 1) Knowledge intensive:** AWD requires good understanding and measurement of soil moisture and rice crop water requirements.
- 2) Labor intensive:** Frequent flooding and drying of paddy and water monitoring increases labor requirements and cost.
- 3) Time intensive:** The new technique requires more management oversight and puts higher demands on farmers' time.
- 4) Reliable water supply :** If irrigation is not available when needed, then fear of crop loss

Piloting of IOT in Agriculture in Vietnam

- Implemented across 4 Trial Phases from Sept 2017 to April 2019



- 80 Farmers and one Farm enterprises
- 72% of farmers participated in 2 on-farm trails
- Implemented by Tra Vinh University (TVU) in Tra Vinh, Can Tho, and An Giang provinces in collaboration with local stakeholders
- Technical partner Mimosatek
- <https://www.worldbank.org/en/news/video/2020/04/06/a-smarter-way-to-grow-rice>



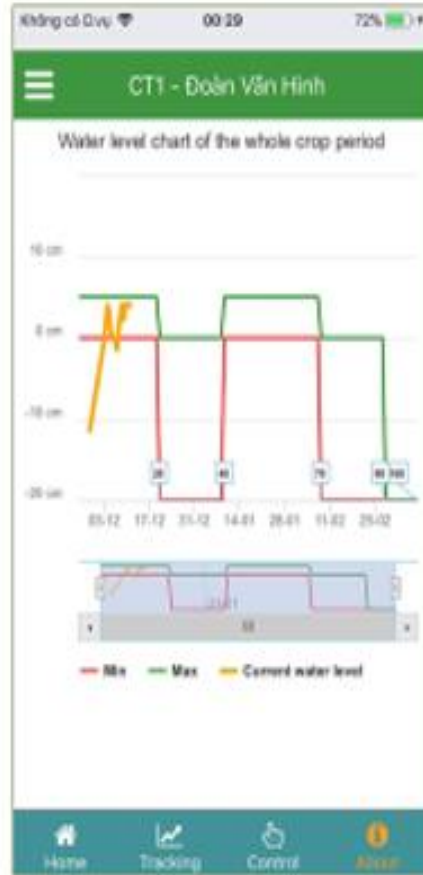
Potential Solution



IOT APP



Field water level monitoring anytime, anywhere via mobile app



Watering schedule for whole crop cycle



Watering record for whole crop cycle



Fully automatic watering via farmers smartphone

IoT-based AWD investment - Unit of Economic



+ 15% * = + 825 KG /ha = + 221 USD/ha



- 20% = - 4.36 USD/ha



- 20% = - 15.88 USD/ha



Not qualified in pilot but up to -48% methane reducing as IRRI documents **

TOTAL benefit for farmer by applying technology = **241.4 USD/ha**

* Average 8.9% from pilot in various infrastructure conditions (but with average of 24.3% in standard infrastructure with good leveling and independent water supply capability in Can Tho), 15% will be targeted for average yield increasement.

** <https://ghgmitigation.irri.org/focus-countries2/vietnam>

IoT-based AWD investment - Unit of Economic

TOTAL benefit for farmer by applying technology = **241.4 USD/ha**



FOR INDIVIDUAL FARMER INVESTMENT

A farmer of minimum 3 ha will have full payback after 1 crop season

The more land farmers have, the more benefit they will get from technology investment



FOR COOPERATIVE INVESTMENT

A cluster of 12 farmers in cooperative, each has minimum of 1.2 ha will have full payback after 1 crop season

The more land each individual farmer has, the more benefit of cooperative in technology investment

Rigorous Research Design- Tra Ving University

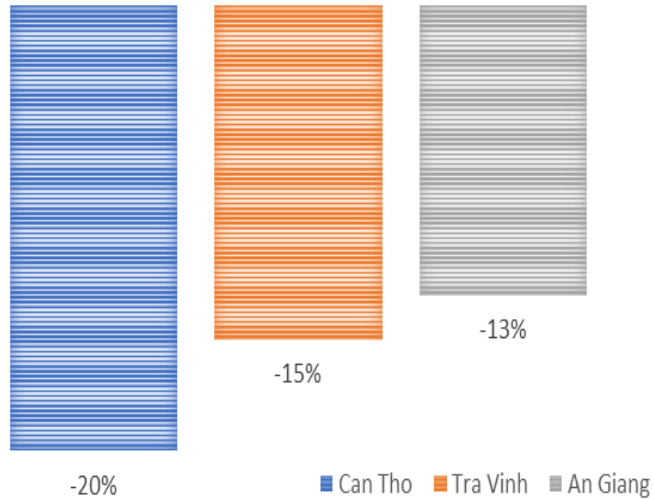
- Each trial consists of three treatments:

Treatment	Irrigation Type
Control Plot	Normal Flooded Irrigation
AWD	Manual measurement in AWD tubes
AWD+Sensors	Deployment of smart AWD tubes

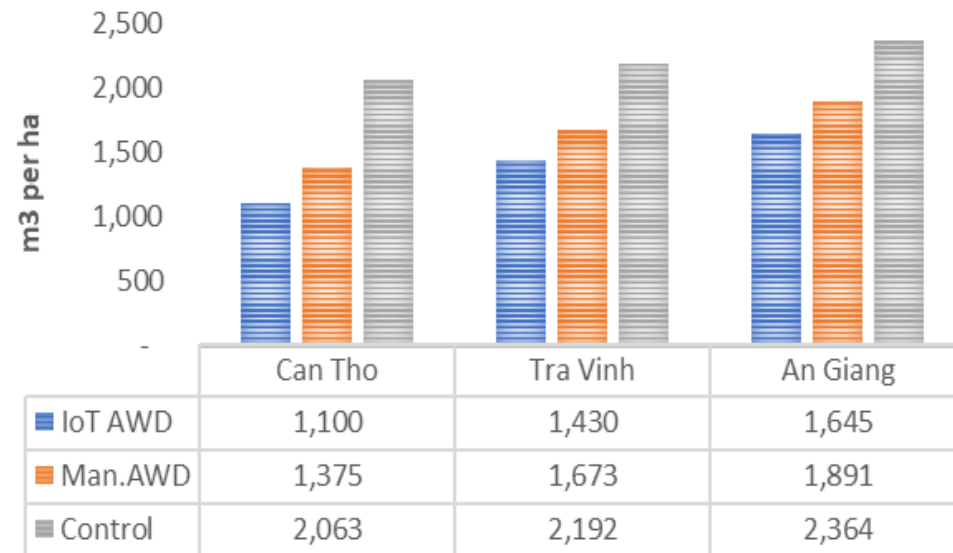
- To gather empirical evidence of benefit of IoT solution

Results: 13-20% Additional Water Saving- Over Manual AWD

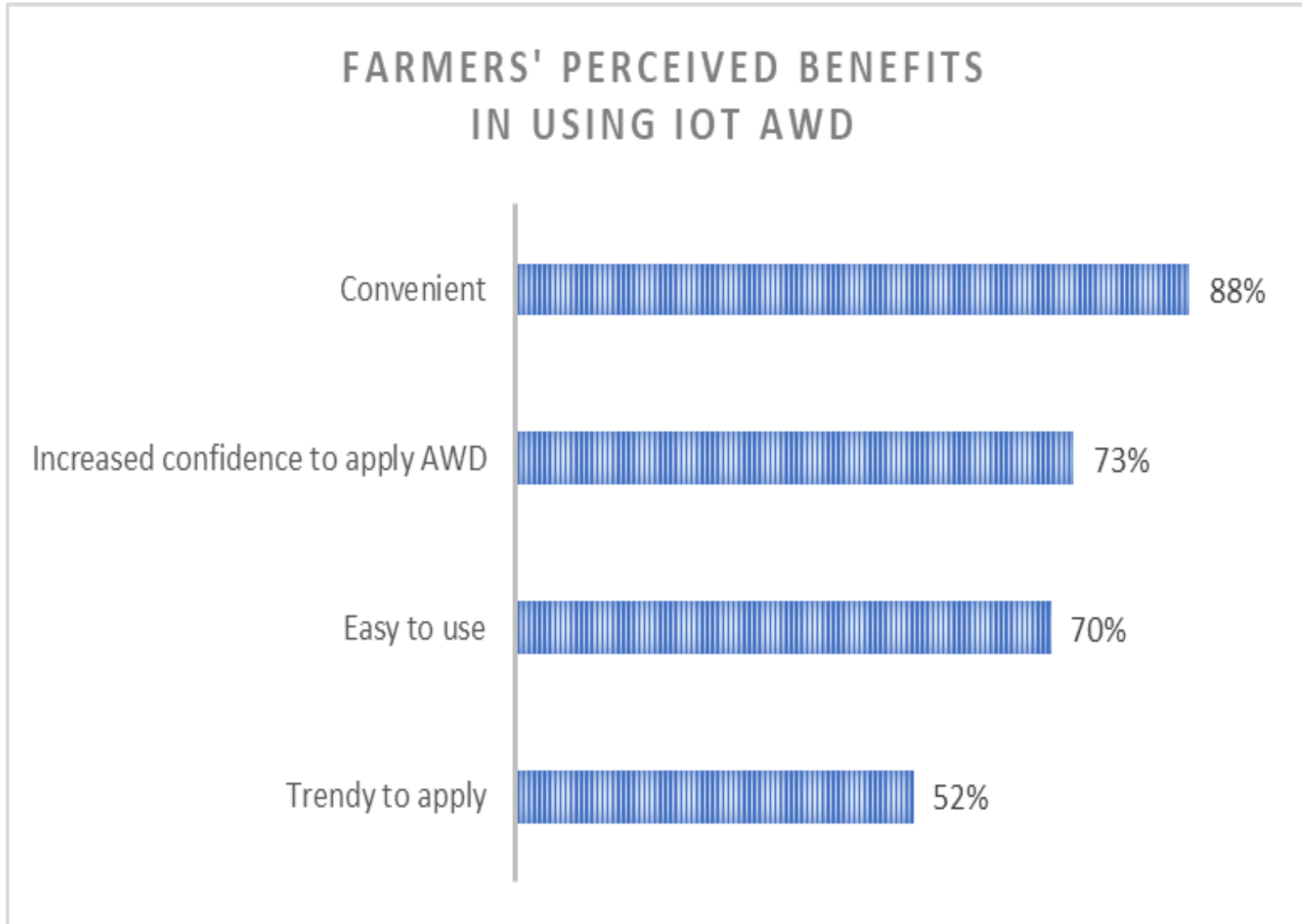
PERCENTAGE DIFFERENCE WATER USAGE
IOT AWD OVER MANUAL AWD



PHASE 2 - WATER USAGE



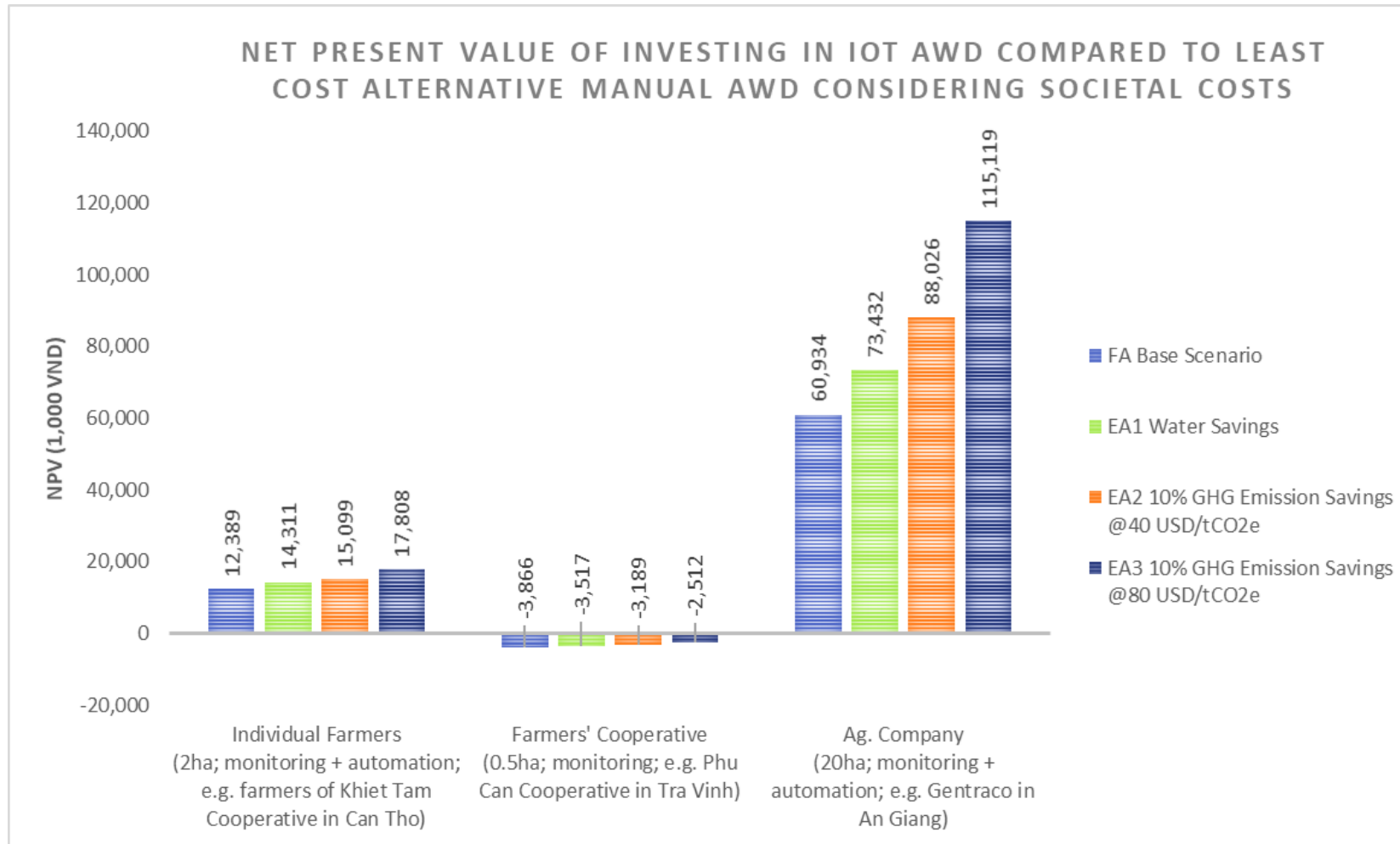
Result: Convenience Matters !



Results: Energy Saving (over 20%), time and GHG emission reduction

- 86% of farmers stated that IOT saves time in implementing AWD.
- Energy saving over manual AWD plots in Can Tho (-24% in phase 3 and -25% in phase 4), where farmers operate individual pumps
- Lower water usage on IOT plots reduces the anaerobic environment and thus greenhouse gas emissions from rice cultivation, but the **pilot did not quantify** this effect.

Results: Financial Viability



At **today's cost**, the investment is **financially viable** for smallholder farmers with plot sizes **over 2 hectares**

Result and Lessons: Prerequisite for full benefit of IoT !

- Land levelling to allow effective AWD practices
- Organizing farmers into cooperatives or farmer organizations to undertake collective investment and AWD application to benefit from economies of scale
- Ensuring sufficient and reliable water supply

Potential for scaling up in the 'One Million-Hectare High-Quality Low-Carbon Rice Program in the Mekong Delta of Vietnam

- Adopt IOT technologies to reduce input use further, thereby reducing further environmental pollution and GHG emissions from rice farming
- Improve access to climate finance, carbon finance, and carbon markets to increase returns to investment and financial sustainability
- Improve the enabling policy environment by providing climate-smart incentives, leveraging private sector investment and participation, and repurposing public expenditures
- The Bank's Transformative Carbon Asset Facility (TCAF) is providing support to GOV in designing and implementing the proposed 'One Million-Hectare High-Quality Low-Carbon Rice in the Mekong Delta

Thank you!

