Australian Government
Australian Centre for International Agricultural Research

# Integrating the electrification and smart mechanisation of two-wheel tractors with precision agriculture for improved productivity and sustainability

## Key details

**Location**
Cambodia

**Duration**

**Start** May 2024 **End** Jun 2029

**Budget** AUD 3,229,915

**Commissioned organisation**
The University of Sydney

**Partners**
Engineers without Borders Cambodia; Institute of Technology of Cambodia; Ministry of Agriculture, Forestry and Fisheries; Royal University of Agriculture; The University of Sydney

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**Program** Crops

**Project code** CROP/2023/129


## Overview

**This project aims to build the technological and socio-economic foundations for the design, manufacture and field evaluation of electric and smart 2-wheel tractors that also integrate precision agriculture capability. In doing so, it will evaluate the potential of 2-wheel tractors to enhance the sustainability and productivity of Cambodian agriculture.**

The key challenges facing Cambodia's agriculture sector include labour shortages and skill gaps, inefficient agricultural practices and operations, and

environmental degradation. There is reduced agricultural productivity due to high labour costs, a lack of available labourers, decreased involvement of young adults and women in the sector, and a lack of skills for employing new agricultural technologies.

To address the some of the challenges facing agriculture, many smallholder farmers in Cambodia have adopted new mechanised solutions such as using diesel-powered 2-wheel tractors (also called walking tractors). While 2-wheel tractors have many benefits, such as being easy to maintain and control, they introduce new problems such as increased greenhouse gas emissions, soil compaction and degradation, health impacts on farm workers, technological limitations to integrating smart farming tools and use being limited to high-powered activities such as tilling.

The electrification of small tractors, coupled with the adoption of precision agriculture technologies, presents a transformative opportunity for Cambodia's agriculture sector. This integration has potential to enhance the efficiency and sustainability of small-scale farming practices, as well as address the pressing challenges of labour shortages, energy efficiency, environment protection, gender equality using labour-saving technologies, young adult interest in agriculture, and diversification of crop production. The project also plans to address improper use and dependency on chemicals for weed control.

The project aligns with Cambodia’s National Agriculture Development Policy for 2022–2030 and its Agri-Tech Roadmap to address the broad challenges of risk mitigation and operational timeliness for smallholders, particularly in the context of climate change mitigation and adaptation.

## Activities

- Adapt existing technology to Cambodian conditions, including testing, gathering data, and developing future assets.
- Engage women, young adults and educational institutions to co-design user-friendly smart-mechanisation tools for farming.
- Develop and test a low-cost electric 2-wheel push tractor prototype, tailored for smallholder farmers, including rigorous performance testing on pilot farms.
- Implement training programs to equip farmers with electric tractor skills and monitor their adoption and impact.
- Conduct cost-benefit analysis for smart Ag tech adoption.
- Develop and optimise AI-driven weed detection systems, conducting field tests and gathering farmer feedback for improved performance.
- Co-design and prototype smart mechatronic tools for efficient weed removal, validated through extensive on-farm trials and farmer training.
- Monitor and quantify chemical reduction and soil impact and use this information for redesign of systems, economic models, and promotion of project.
- Engage with appropriate intuitions to identify current policies and how the project can participate in future policy development.

## Outcomes

- Increased farmer capabilities and confidence, through collaborative design and implementation of electric and smart mechanisation, to evaluate options for sustainable and productive agriculture.
- The development economic models to quantify potential farm operational improvements due to adoption of electric and smart mechanisation.
- The development of environmental models to quantify potential farm health improvements when using electric and smart mechanisation.