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Refining the Value-Ag framework for innovation impact evaluation in smallholder agrifood systems

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Abstract: Transforming smallholder agrifood systems is vital for sustainability, income growth, and food security. Sustainable intensification plays a key role but is difficult to evaluate, especially in complex crop-livestock systems. The Value-Ag modelling framework addresses this by integrating farm economics, climate risk, and adoption dynamics. Delivered via workshops, it enhances decision-making and stakeholder capacity. A new R-based Value-Ag package improves usability, automates analysis, and streamlines reporting for more effective RD&E investment planning.

Keywords: *Systems analysis, profit-risk trade-offs, farmer adoption, capacity building*

1. INTRODUCTION

Farmer decision-making is complex given multiple agroecological and socioeconomic constraints, risks, synergies and trade-offs over time. Evaluating the relative impacts of adopting sustainable intensification (SI) innovations (technologies or practice changes) remains a challenge for RD&E projects and agencies. There is growing demand to fill the evaluation gap through systematic, multi-metric evaluation approaches to inform smallholder transition to sustainable farming. To address this challenge, Value-Ag was developed – an integrated modelling framework that combines farm-level economics, risk and uncertainty analysis, and adoption dynamics to determine the likelihood of innovations being adopted and paying off over time (Monjardino et al. 2020a).

Delivered primarily through participatory workshops, the Value-Ag process helps to build analytical capacity, improve decision-making, and equip key stakeholders – including researchers, funders, and policymakers – with robust benchmarks and performance metrics to better prioritise RD&E investments. Recent enhancements to the Value-Ag framework have led to the development of a novel R-based package. The refined Value-Ag R package replicates key @RISK functionalities, streamlines the integration of profit, risk, and adoption metrics, and enables automated report generation – delivering greater usability and efficiency for robust decision support. An overview and case study of Value-Ag is being presented at MODSIM2025.

2. METHODOLOGY AND RESULTS

The Value-Ag framework integrates outputs of CSIRO models (IAT, ADOPT) and other metrics across spatial scales (Figure 1). Results are visually presented through graphs and tables that compare baseline and innovation performance using a range of metrics. These include whole-farm 10-year average annual net profit, downside risk, and profit-risk profiles of innovations. The analysis also accounts for risk-adjusted profit across five levels of farmer risk aversion, projected peak adoption rates and timing, the net value of innovations based on predicted adoption, and the overall profit impact of adopted innovations – providing a comprehensive view of both economic performance and adoption. across farm types, project sites, and/or climate scenarios.

Recent enhancements to Value-Ag have led to the development of a novel R-based package featuring the following improvements: a) replacement of the @RISK component in the risk analysis; b) generation of ADOPT data points using two input metrics produced by the ADOPT tool; c) full replication of Excel-based calculations and VBA processes within R; d) introduction of automated (or batch) result visualisation, enabling the creation of charts and tables from Value-Ag outputs for seamless inclusion in reports; e) streamlined automation of Value-Ag report generation; and f) enhanced user interface and documentation, particularly to support new users.

The modelling components of Value-Ag have been tested and validated extensively in developing country contexts. The Value-Ag tool-and-training package has been applied to various case studies through participatory workshops conducted in rice-based systems in South and Southeast Asia (e.g., Monjardino et al. 2020b); maize-based systems in Southern Africa (unpublished) and Central Mexico (Monjardino et al., 2021), and taro-based systems in the South Pacific region (Monjardino et al., 2025). New Value-Ag case studies are currently being developed to support irrigated mixed cropping systems in Punjab, Pakistan.

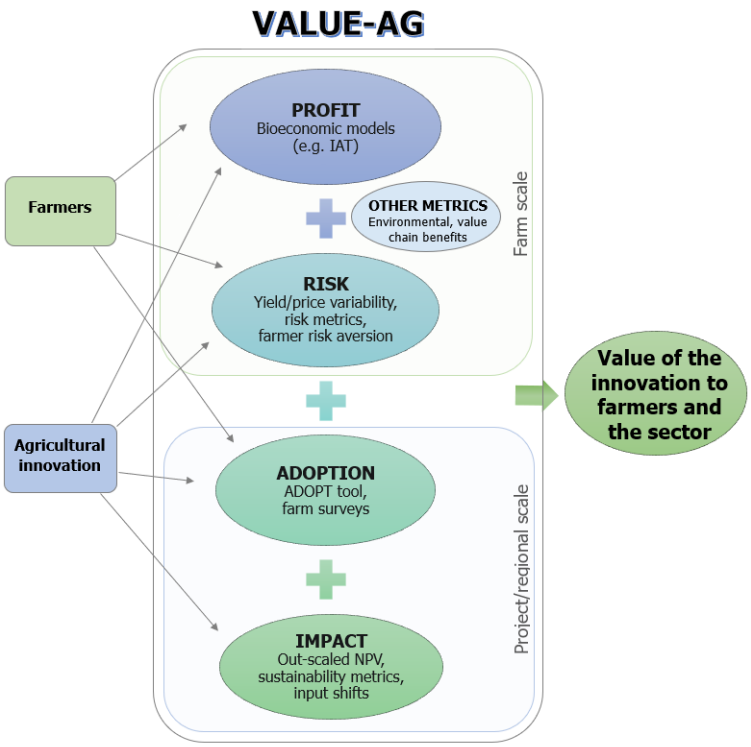

Figure 1 Value-Ag conceptual framework. Source: Adapted from Monjardino et al. (2020a)

3. CONCLUSIONS

The Value-Ag framework was developed to support ex-ante evaluation of agricultural innovations in complex and diverse smallholder systems. Designed as a tool-and-training package, it has been refined to enhance accessibility, usability, and functionality across a broad range of users and contexts. Current development includes expanding the framework's capacity by integrating additional metrics for a more holistic assessment of net benefits, including environmental and social dimensions. Value-Ag will be showcased through a case study at MODSIM2025.

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