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## Making climate-smart technologies work for women farmers: Insights from socio-technical innovation bundling approach in India

PRAMA MUKHOPADHYAY, DEEPALI CHADHA, HOM NATH GARTAULA, RANJITHA PUSKUR,  
KRITIKA GOEL

*International Rice Research Institute (IRRI), India*

### Abstract

Being one of the climate change hotspots in the world, the agri-food systems in India face distinct gender-based challenges to achieve sustainable development goals (SDGs). Women often lack access to resources due to gender and social disparities. This renders them invisible in the traditional and/or formal extension systems, depriving them from participation in exploring and designing solutions to climate change adaptation. The opportunity for skill training, accessing information, and participation in the feedback loop are often plagued with inherent structural biases. This results in undervaluing women's knowledge and work, disregarding their needs and priorities, and dis-appropriately affecting their wellbeing. Consequently, many technologies that are promoted as climate solutions are either not reachable or not usable by them. Therefore, technological advancement is important, but promoting only technologies without the support of inclusive policies and institutions is insufficient in empowering women and building their resilience. While there is a growing emphasis on the importance of engaging multiple stakeholders and bundling various technical and social innovations, evidence on methodologies for enabling such integrations are lacking. Technological development commonly disregards gender considerations, perpetuating a 'gender blind' approach. Drawing from different regions and livelihood systems of India, this paper synthesizes four case studies where the projects and programmes have bundled social, and technical, innovations in their programming. The findings reveal that the interventions described in these cases were designed to facilitate a shift in agricultural practices aimed at mitigating the impacts of climate change, while also challenging gender norms and structural constraints, especially to improve women's economic conditions. Although not originally planned as the bundled set of innovations, the interventions implemented across these cases exhibited a symbiotic relationship and an organic interconnection. Social innovations, which are often overlooked, emerged as an integral component of the bundling process, fostering an enabling environment for women. However, ad-hoc bundling revealed certain gaps, including limited involvement of male stakeholders, insufficient recognition of women's unpaid care work, and a lack of gender responsiveness in designing climate-smart technologies. The study underscores the need for intentional bundling tailored on contextual requirements to ensure sustainable impact, empowerment, and resilience at scale.

**Keywords:** Empowerment, resilience, social innovation, technology