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Gender-responsive mechanization in climate-smart agriculture

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Women are central to agrifood systems- but under-resourced

71%
of women workers in South Asia work in agrifood systems (47% men)

<15%
of agricultural landholders worldwide are women

24%
land productivity gap, female- vs male-managed farms

18.4%
lower pay for women in agricultural wage employment

What these gaps can mean in practice

ASSETS & VOICE

Less secure access to land, credit, machinery and decisions about farm income.

TIME POVERTY

Farm work is layered onto unpaid care and domestic work; new practices may add labour.

NOT ONE “WOMAN FARMER”

Caste, class, ethnicity, age and marital status shape access and agency differently.

Climate shocks amplify existing inequities

+34%

greater total-income loss for female-headed households per 1°C rise in long-term average temperature

FAO, The Unjust Climate (2024)

EXPOSURE

Heat, floods, pests and disease affect production, health and income.

ADAPTATION CAN ADD WORK

Water management, weeding and other coping practices may increase women's labour burden.

CAPACITY TO RESPOND

Fewer assets, credit options and reliable information can constrain adaptation.

CAPABILITY IS NOT THE GAP

Women plot managers adopt adaptive practices as readily as men, yet can lose more income and off-farm opportunities.

Climate-smart agriculture is not distribution-neutral

Three questions should sit alongside every “climate-smart” intervention.

1 WHO CAN ADOPT?

Land, capital, machinery, information and decision-making power shape who can take up a technology first.

2 WHO BEARS THE COST?

Labour savings for one household may mean lost wage work for another - especially where women do transplanting or weeding.

3 WHO IS COUNTED?

If outcomes are not disaggregated by gender, class, caste and age, unequal gains and losses remain invisible.

The goal is not to reject climate-smart technologies. It is to design transitions that are both climate-effective and socially just.

Mechanization changes who works and who earns

Paddy is a useful lens because mitigation, adaptation and livelihoods meet there. Study reference: direct-seeded rice (DSR) compared with puddled transplanted rice (PTR), Odisha

Change in labour hours per acre per season



Potential seasonal wage loss per acre

USD 40 Women

USD 6 Men

WHO GAINS?

Mechanisation can lower costs, reduce drudgery, save time and ease supervision.

WHO LOSES?

Landless women relying on transplanting for seasonal wages may have few alternatives.

NOT AUTOMATIC

Benefits depend on who controls saved time and income—and whether other work exists.

Same technology, different stakes

Larger commercial farms

Lower costs, less hired labour, less supervision.

Incentive: High

Exposure: Low

Family-managed farms

Value less drudgery for women; weaker cost incentive.

Incentive: Medium

Exposure: Low–medium

Landless labour households

Women rely on transplanting for seasonal income, with few alternatives.

Incentive: Low

Exposure: High

Landowners leasing out

Can speed adoption by leasing to larger farms, which may widen land inequality.

Incentive: High (indirect)

Exposure: Low

Incentives to adopt and exposure to loss tend to point in opposite directions

Equitable outreach for equitable resilience

WHO IS SELECTED?

Land titles, literacy and producer-group membership can favour men.

WHEN & WHERE?

Distant, daytime training can conflict with care work, mobility and safety.

WHICH CHANNEL?

Text, apps and shared phones can exclude people with limited literacy or independent access.

What studies in India and Nepal say about delivery

Video works

Video raised adoption by 10.4 pp in a Gujarat RCT; adding posters added little.

Fit women's routines

Afternoon sessions, 1–2 km from home, groups of about 10, local facilitator.

Match channel to task

Automated calls suit simple practices; judgement calls need a conversation.

Keep a human layer

Nepal app reached women (58% of users), but many relied on agents to use it.

Sustainable mechanization: Entry points and key messages

ENTRY POINT	WHAT WE KNOW	WHAT TO DO
Access to machines	Custom hiring lowers the ownership barrier; women service providers can help address constraints around norms.	**Design for differentiated realities.** Disaggregate by gender, landholding, caste/ethnicity, age and household position.
Skills and information	Women adopt as readily as men when constraints are addressed. Capital access and agency remain a constraint.	**Make services reachable and usable.** Co-design delivery with women; include local-language, low-literacy and human-support options.
Livelihood transition	Displaced women's labour often not absorbed by high-value segments of the agriculture value chain and non-farm work	**Protect livelihoods through transitions.** Pair labour-saving technologies with realistic alternative employment, skills or market opportunities.
Monitoring and learning	Reach is easy to track by gender; income, time and decisions are not.	**Measure more than adoption.** Track time use, wages, income control, decision-making, resilience and independent continued use.

A climate transition is resilient only when the people sustaining agriculture can also benefit from it.

THANK YOU

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