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# Scaling solar drying technologies for smallholder farmers in Kenya: Adoption barriers and policy interventions

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**Abstract**

Postharvest losses remain a major constraint in Kenya's horticultural sector, with estimates of 30–40 % for fruits and vegetables and reported upper bounds as high as 70 %. Up to 80 % of fruits and vegetables are primarily produced and marketed by smallholder farmers and traders operating under fragmented and resource-constrained conditions, which exacerbate losses across the value chain. Solar-powered processing of fruits and vegetables has been shown to be viable for decentralised smallholder systems by reducing postharvest losses and lowering energy costs while improving farmer incomes. However, adoption of improved solar drying technologies in Kenya remains low.

This study examined adoption barriers and willingness to invest (WTI) in solar drying technologies among 226 smallholder farmers in Nakuru and Meru counties, two key horticultural production areas in Kenya. A mixed-methods approach was used, combining household surveys, focus group discussions, key informant interviews and direct observations. Results show that awareness of improved solar drying methods is moderate, at 43 % of respondents, while most smallholder farmers still rely on open-sun drying, reported by 62 % of respondents. Adoption of improved solar drying technologies remains low, at 9.7 %. The dominant constraints are high upfront capital costs, reported by 52.7 % of respondents, insufficient technical skills (72.3 %) and weak market linkages for dried products (60 %). Nevertheless, WTI is significantly higher under collective ownership models, with 62 % willing to invest, than under individual ownership, at 38 % ($p < 0.01$), indicating that group-based investment improves perceived affordability.

Cost-benefit assessment, considering an annual median income of KES 100,000 (€ 650), shows that an improved dryer costing KES 300,000 (€ 2000) is likely unaffordable for individual farmers. However, improved access to credit, market premiums and group ownership could make solar drying technologies more attractive with break-even achievable within 2.5 years. Realising these benefits requires targeted institutional support including tailored financing mechanisms, structured capacity building, improved technology access

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and organised market linkages to scale solar drying for horticultural processing and preservation. These interventions could strengthen local value addition while supporting more resilient and climate-smart horticultural value chains.

**Keywords:** Kenya, postharvest loss reduction, smallholder farmers, solar drying, technology adoption, willingness to invest