

Opportunities and Challenges for Enhancing the Quality of Solar Drying Technology and Agri-enterprise in Kenya - A Policy Dialogue

Catherine W. Kilelu, Isaiah O. Omolo and Josephat M. Okemwa
African Centre for Technology Studies (ACTS)



Introduction

According to FAO (2021), in SSA, an estimated 1.3 billion tonnes of food, which translates to between 35-50 percent of production, does not make it from farm to the table due to Post-Harvest Losses (PHL). Thus, PHL is a major threat to food and nutrition security and sustainable livelihoods in SSA. The losses are attributed to poor harvesting, insufficient storage systems, limited processing and value addition coupled with limited information and knowledge and unstructured market systems among other factors. Further, FAO (2011) estimated that PHL accounts for around 4.4 gigatonnes of greenhouse gas (GHG) emissions each year (about 8.2% of total anthropogenic GHG emissions). Reducing PHL, could therefore significantly increase food availability, stimulate inclusive agri-based processing and trade, whilst at the same time contributing to climate change mitigation action.

In many developing countries including Kenya innovations to address PHL such as various solar drying technologies are increasingly being promoted to smallholders and linked agri-enterprises where the confluence of abundance of solar resources and a thriving agricultural sector presents unique opportunities (Mujuka et al., 2020; Udomkun et al., 2020). These technologies include greenhouse dryers, tunnel solar dryers, tray dryers, roof-integrated solar dryers, inflatable solar dryers, and lately hybrid solar dryers which incorporate use of biomass furnaces to power the dryer (Aukah et al., 2018; Mohammed et al., 2020; Kimario et al., 2021). However, wide-scale adoption by farmers and small and medium enterprises (SMEs) agro-processing in Kenya remains limited. Whereas lack of knowledge

Key messages

- There is need for more training and capacity building for fabricators on design and installation techniques, material selection etc. in order to achieve quality dryers.
- In order to assure the end users of the quality of the dryers, standards must be put in place. This will be a major step as it will ensure uniformity of products available in the market.
- The financial institutions are available and willing to partner with the stakeholders at every stage of the product development: from training on business related programs to acquiring the dryers.
- The project is very key, as it not only addresses the issues of PHL and food security but also, presents a huge potential opportunity including income, job opportunities for small and medium enterprises for youths and women in agro processing.

and financial constraints are notable barriers to uptake, a key limitation is the sub-optimal performance of many of the technologies in the market, linked to gaps in performance assessments, standards and technical capacities among technology providers in design and fabrication which affects the quality of the final products and business viability of food drying SME agri-enterprises (Aukah et al., 2018; Kimario et al., 2021, Mohammed et al., 2020; Ndirangu et al., 2018; Ndukwu et al., 2023). Additionally, the lack of policies to govern solar dryers' industry further compounds the issue as there are no incentives or regulations to encourage and guard uptake (Udomkun et al., 2020).

Notably, innovation in solar drying provides an entry point for inclusive rural industrialization that can open opportunities including for women and youth to engage in value addition in the food sector.

This policy gap in Kenya related to standards and options for governing and further stimulating innovation in solar drying technology and related Agri-processing enterprise development informed the agenda of the workshop that brought together diverse stakeholders for dialogue. The stakeholders included farmers and farmer organizations, government ministries and agencies, researchers, Fabrication SMEs, Non-government organizations (NGO), and financial institutions. This policy brief summarizes the key issues and recommendations that emerged from the workshop.

Emerging issues from the stakeholder's workshop

Stakeholders reiterated that solar drying technology is a sustainable solution for addressing PHL with potential for stimulating growth in inclusive value addition and related Agri-enterprises. Solar dryers are energy efficient, environmentally friendly, and cost-effective technologies, and have reduced environmental impact. There is a growth in solar drying technology producing SMEs in the market. Nevertheless, several issues emerged that point to the challenges that are limiting the potential for uptake, and they are related to quality/standards, capacity of fabricators and finance issues.

Standard parameters for quality assurance

Stakeholders expressed concerns about varying quality and standards of the solar dryers being fabricated in the market. Notably, there are no standard parameters for performance and efficiency evaluation of the different types of dryers currently in the market. Thus, there is information asymmetry between those that fabricate the various solar dryers and their customers. In many instances, the customers do not have the technical capacity to assess whether the product that they need and what they get matches. The inconsistent quality of the solar driers has not only impacted on customer satisfaction but also the quality of dried products.

The stakeholders emphasized the need to develop standards that can assure customers of the quality when acquiring the technology, especially considering that this is a capital-intensive investment for those that consider acquiring it.

The Kenya Industrial Research and Development Institute (KIRDI) with other partners were involved in developing and optimizing a hybrid solar dryer that included performance assessments which were presented at the workshop. The approach to the performance assessment can be further refined and be included in process of development standards in solar dryers that has been initiated by the Kenya Bureau of Standards (KEBS). This process will guide in agreeing on the parameters for developing the standards in the market.



Figure 1: The hybrid solar dryer designed, fabricated, and installed by KIRDI

Capacity of fabricators

The stakeholders highlighted that although the fabricators possess key skills including fabrication, assembly and installation, business development, material selection, marketing, and customer service, they still have several gaps/limitations in technical skills and capacity leading to delays in project execution and missed opportunities for growth. These include design and installation especially of modern cost-effective dryers, automation of fabrication processes, trouble shooting, implementation of mass production lines, cost estimations, identification, and selection of material to be used in fabrication. Other identified gaps

include limited sources of funds for implementation of outreach programs.

To effectively meet the market demand for the solar drying technologies, there is need for fabricators to be supported with the relevant knowledge including engineering design, business, and financial skills as well as integration of women into the technology development but most importantly, develop solar dryer standards which will come in handy to solve challenges in the sector. Also, there is need to foster public-private partnerships for transfer of technology; assist small scale holders access finance to enable them to access these technologies and expand markets.

Finance related issues

Financing institutions play a key role both in financing the development and fabrication of solar driers and business-related capacity training programs. However, the stakeholders raised concerns about the limited access to the needed finance due to high interest rates which hinders the sector's expansion and development. The stakeholders indicated that close collaborations with financial institutions to design and tailor make products as well as development of sustainable business models that will cater the unique business in the industry is key. In supporting the farmers, Equity Bank for instance mentioned they have been actively engaging farmers to acquire several business/financial skills and access low-interest financing incentives to purchase/acquire equipment and fund the capital expenditures to boost productivity. Also, Kenya Climate Innovation Centre (KCIC) have been able to provide grants, based on proof of concept at a low interest rate with good repayment schedules.

Draft on Solar Dryers Standards in Kenya

Standardization is important in business since it helps ensure safety in the products being created. It also helps ensure consistent quality and compatibility in products. This creates uniformity and conformity in a set of practices within an industry. For solar driers, it will guarantee that all products of a similar category match the same specifications.

Currently, there is no specific national guidelines on quality and standards in Kenya on fabrication and/or marketing of solar dryers and no certification is required alongside the fabrication processes. However, there is a standard that governs the fabrication of metallic products. Following a request to develop solar dryer's standard in Kenya, a preliminary draft has already been developed by KEBS. To cascade this further, KEBS promised to constitute a technical committee (TC), which shall review the parameters and inputs from the workshop before sharing the same with other stakeholders for more insights and inputs. The proposed standards will take into consideration the different categories of products associated with solar drying technologies, i.e., materials, design, installation, solar dryers' specifications among others.



Figure 2: A section of participants during the workshop

Policy Recommendations

- KEBS to advance the process initiated to develop solar dryers' standards by spearheading the formulation of an enabling policy, legal and regulatory framework to support enforcement of these standards. This will enhance delivery of quality solar dryers and dried food products in the market.
- There is a need to foster collaborations and partnerships for transfer of technology/knowledge as well as access finance. The research institutes need to constantly engage the fabricators with new or improved designs for fabrication and implementation.

- There is need to fast-track addressing the identified capacity and skills gaps together with partners who have the capacity and can support the process.
- There is need for more sensitization to consumers on the dried food products which will enhance success for the adoption of solar dryers and market sustainability.
- There is need to stimulate demand for the dried food products, even as the industry pushes for the solar dryers' standard to enhance functionality of the standard. While there are indications of an expanding dried food products market, there is little information available regarding this market segment. There could be policy measures that can stimulate through a demand pull and push approach.
- Solar drying expansion is part of the national strategies for reducing PHL and key in stimulating value addition and Agro processing.

Conclusion

Solar drying technology is one the ways used to reduce PHL which is cost effective and sustainable.

While the uptake of the solar drying technologies is on upward trajectory, a few issues have been raised to be hindering its market penetration. These challenges are lack of solar dryer standards in the market resulting into poor designs and performances, lack of technical capabilities and skills among the fabricators and access to affordable finances is still a challenge.

Solar dryer standards play a crucial role in ensuring the quality, safety, and environmental sustainability of solar drying processes. Fabricators on the other hand needs training and capacity building in order to achieve quality dryers. Access to finances is key to the whole process of the solar dryer's industry from materials acquisition to market expansion.

Addressing the issues related to quality/standards, fabricator capacity, and finance requires is a multi-faceted approach that involves collaboration among industry players, government agencies, and relevant stakeholders. By implementing the recommendations outlined in this policy brief, we can foster a more robust and sustainable industry that meets the needs of both consumers and businesses.



Figure 3: Interior architecture of a Solar dryer

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Contact:

Dr. Catherine Kilelu
Project Lead

C.Kilelu@acts-net.org

IFT Website: <https://solardryers.acts-net.org/>