

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF AGRICULTURAL MECHANIZATION AND IRRIGATION

ENGINEERING.

DESIGN AND FABRICATION OF A SOLAR POWERED PADDY RICE WINNOWING

AND DESTONING MACHINE.

FINAL YEAR PROJECT REPORT

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A final year project report submitted to the Department of Agricultural Mechanization and Irrigation Engineering as a partial fulfillment of the requirement for the award of a Bachelor's degree of Science in Agricultural Mechanization and Irrigation Engineering.

APPROVAL

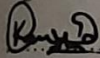
APPROVAL.

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DECLARATION

DECLARATION.

We KISAKYE ESTHER, OCHENGEL JOSEPH AND CHEPKURUI TEDDY declare that this final year project report was prepared out of our efforts and has never been presented to any institution of higher learning.

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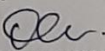
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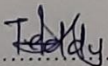
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ABSTRACT

Rice is a staple food for more than half of the global population, playing a critical role in food security worldwide (Mohidem *et al.*, 2022). In 2020, global rice production was around 500 million metric tons, with Asia producing over 90% of this output (Mohidem *et al.*, 2022). In Africa, rice is becoming increasingly important, especially in West Africa, where countries like Nigeria and Senegal lead in production. However, contamination from stones, dust, and foreign materials remains a persistent challenge, negatively affecting rice quality and market value (De Vos *et al.*, 2023). Uganda, a leading rice producer in East Africa, has experienced rapid growth in rice cultivation, expanding from 20,000 hectares in the early 2000s to over 95,000 hectares by 2020 (UBOS, 2022). The country produces a substantial volume of rice but still faces significant postharvest losses due to inadequate processing equipment, particularly for winnowing and de-stoning. Traditional or semi-mechanized methods used in rice-growing regions like Butaleja, Pallisa, and Gulu are tedious and labor-intensive, resulting in poor rice quality and economic losses for smallholder farmers (Oonyu *et al.*, 2011).

Addressing these challenges, this study presents the design and fabrication of a solar-powered paddy rice winnowing and de-stoning machine. This machine aims to improve rice processing efficiency by integrating sustainable solar energy, making it particularly suitable for rural areas where electricity access is limited and fossil fuel costs are prohibitive (Ageze *et al.*, 2024). The machine addresses the limitations of earlier designs, such as the inefficiency of 36% caused by high camshaft vibration and reliance on a single sieve size (Joseph *et al.*, 2022). It features an innovative linkage system to control vibrational energy and two interchangeable sieves: an upper, detachable sieve for larger impurities and a lower sieve for finer contaminants. This modular design accommodates different grain sizes, enhancing impurity separation and overall processing efficiency.

Energy consumption (to assess solar power usage), Payback period, exploring alternative energy sources to supplement solar power

Employ a 1.5 HP DC motor as the primary power source for driving the winnowing blower, sieving mechanisms, and the de-stoning unit. This motor should be efficiently powered by a dedicated solar energy system.

Design and integrate a system to precisely control the rate at which paddy rice enters the winnowing and destoning sections of the machine. This could involve an adjustable hopper outlet, a metering gate, or a controlled feeding mechanism (e.g., a small conveyor belt with variable speed)

Provide training and support programs for farmers on how to operate and maintain the machine effectively. Additionally, establish a support network for troubleshooting and repairs to ensure long-term usability.

By implementing these recommendations, the solar-powered paddy rice winnowing and destoning machine can become an even more effective solution for improving rice processing in Uganda and similar contexts, ultimately contributing to food security and rural development.

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