

ABSTRACT

- Thesis title:** Analysis of mechanized agriculture in Tanzania. A case study of human, animal, and farm machinery power sources in Shinyanga region.
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Agricultural mechanization in Tanzania has a role to play in attaining food security, poverty alleviation, and the Sustainable Development Goals (SDGs), especially SDG 2 on zero hunger. One of the points is that human, animal, and machinery power sources are integrated in order to increase efficiency and productivity. The research paper is devoted to Shinyanga Region, a semi-arid zone in northwestern Tanzania with an area of 50,000 square kilometers where agriculture provides over 80 percent of the population and includes crops such as cotton, maize, and rice as well as livestock rearing (FAO, 2021). The livestock density of the region makes it a prime location to use draught animal power (DAP), yet the traditional human power prevails because of economic and infrastructural challenges (FAO, 2021). The paper assesses the role, effectiveness and consequences of these sources of power using a mixed methodology basing on literature and empirical evidence of 150 farmers and 20 key informants in such districts as Shinyanga Rural, Kahama and Msalala.

This paper set out to discuss the effectiveness of human energy in farming operations, the application and consequences of DAP on output, and the influence of mechanical sources on progress. There are various factors that farmers have to put into consideration when making decisions on the adoption of power sources which are costs, agro-ecological zones and sustainability. The information was aggregated to be analyzed by quantitative surveys through SPSS and qualitative interviews through NVivo. Demographics, usage percentages, yields and challenges were collected in a structured questionnaire, whereas semi-structured interviews explored perceptions and policy requirements. Findings were combined in tables with efficacy measures, effects, and comparisons. The results obtained in this exploratory study cannot be required to make firm conclusions. Thus, key aspects observed in the research are brought to the fore and may potentially inform themes to be used in future research projects.

The literature review establishes agriculture as Tanzania's economic cornerstone, contributing 28% to GDP and employing 65% of the workforce (FAO, 2021). Mechanization transitions from human to animal and mechanical power to reduce drudgery and expand cultivation (FAO & AUC, 2018). In Shinyanga, human power prevails on small farms (2-3 ha), limited by physical constraints and gender disparities (Magezi et al., 2018). DAP, historically promoted via oxenization, boosts yields by 20-30% but faces trypanosomiasis in 60% of the region (Mrema, 2016). Mechanical sources like 2WTs and 4WTs offer high efficiency, yet adoption is low at 13% due to costs and infrastructure (Lugendo et al., 2016). Policies like

ASDP emphasize mechanization, but gaps in region-specific data hinder progress (JAICAF, 2015).

Results indicate human power at 62% overall, with 70% in lowlands, efficacious for small tasks like weeding (4.0/5) but plagued by 70% drudgery and 60% labor shortages, yielding 1.2 tons/ha (TECA, 2006). Women perform 55% of manual labor, causing health issues and delays (AGRA, 2020). DAP covers 25%, expanding areas by +1.5 ha and yields by +0.6 t/ha, but 30% report disease losses (Starkey & Mutagubya, 1992). Machinery at 13% yields +1.0-1.3 tons/ha, with 40% increases in rice via 2WTs, though 60-75% cite cost barriers (Nakano & Magezi, 2019). Comparative efficacy shows machinery highest (4.5/5), animal at 3.8/5, and human lowest (3.2/5), with ANOVA confirming differences ($p < 0.05$) (Field, 2018). Zone variations highlight lowlands' human dominance, plateaus' 30% DAP, and highlands' 10% machinery.

Common themes in literature and data reflect human power's accessibility but inefficiency, DAP's transitional benefits amid ecological challenges, and machinery's modernization potential limited by access. Feedback underscores timeliness gains from alternative but persistent poverty cycles from manual reliance. Changes in mechanization are spurred by policies, but low adoption risks soil degradation and 30% post-harvest losses (Nakano & Magezi, 2019). The study highlights mixed methods' usefulness for triangulating data, with tables and figures prompting discussions on sustainable shifts.

Limitations include self-reported biases and seasonal variations (Mrema, 2016). Future studies could expand samples or incorporate participatory GIS for precise zone calibrations. Recommendations urge subsidies for machinery hiring, the use of precision agriculture, gender-inclusive training, and veterinary support for DAP to boost yields 20-30% (AGRA, 2020). Farmers should leverage extension services for informed choices, considering efficacy and costs. Policymakers can use findings to tailor ASDP for Shinyanga's semi arid context, promoting inclusive mechanization for economic and environmental sustainability.